DIVISION 26. ROADSIDE DEVELOPMENT

This work consists of developing and improving the right-of-way by shaping and establishing turf, primarily for control of surface drainage and soil and wind erosion, and by installing plant materials. Comply with the requirements of the contract documents and the following sections:

2601. Erosion Control.
2602. Water Pollution Control (Soil Erosion).
2610. Furnish and Install Shrubs, Trees, and Vines.
2611. Furnish and Install Shrubs and Trees with Warranty.
2612. Mowing.

Section 2601. Erosion Control

2601.01 DESCRIPTION.
Perform the following erosion control measures on areas within and adjacent to the right-of-way according to the contract documents and this specification:

- Seeding and fertilizing,
- Overseeding and fertilizing
- Stabilizing crop seeding and fertilizing,
- Sodding,
- Special ditch control with wood excelsior mat or other specified material,
- Special ditch control over sod,
- Slope protection with the specified material,
- Fertilizing,
- Fertilizing for stabilizing crop seeding,
- Mulching for control of surface drainage, and
- Removal of temporary water pollution control measures according to Section 2602.

2601.02 MATERIALS.

A. Furnish materials meeting the requirements of Section 4169.

B. Apply materials at no less than the minimum rate specified in the contract documents. Apply seeds for native grasses on a PLS basis, as computed by the Engineer. For native grasses identified in Article 4169.02 with both purity and germination requirements, adjust application rates for grasses that exceed these minimum requirements to an equivalent computed on a PLS basis.

C. Additional compensation will not be allowed for materials in excess of that specified, unless directed by the Engineer.

D. If, after application of fertilizer, it is determined by test that the fertilizer fails to comply with minimum requirements, furnish and apply additional fertilizer to comply with minimum requirements as defined in Article 4169.03.

E. Perform work in a manner that will provide the Engineer the opportunity to verify the quantity of material furnished and the rate of application. Divide the project area into small natural areas that are to be constructed as identifiable units. Furnish a tally of the quantities of each material as it is used on each area. This may include the quantities below.

- Weights (mass) from approved scales of truck loads of bulk materials,
- Other scaled weights (mass),
- Counts of containers, bags, or bales, or estimates of partially used packages of materials, as approved by the Engineer.

F. Provide the Engineer with the opportunity to verify the quality and quantities in a manner that will allow continuous operation with minimum delays.

G. When handling inoculants, and sticking agents, follow safety precautions as specified on the product label.

2601.03 PLACEMENT OF EROSION CONTROL.

A. Equipment.
Use equipment meeting the requirements of Section 2001 and the following, except that other equipment which produces similar results will be considered for approval. Use methods and procedures consistent with equipment manufacturers' recommendations; however, do not operate ground driven equipment at speeds greater than 10 mph (15 km/h).

1. Disk.
When preparing a seedbed on ground having heavy vegetation, use a disk having cutaway blades. Provide for the addition of weight (mass) to obtain proper cutting depth.

2. Slope Harrow.
Use a rolling weight (mass) attached by heavy chain to a tractor. Use a chain of suitable length, with picks attached and a means of rotating the picks as the rolling weight (mass) is pulled in a direction parallel to the movement of the tractor.

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

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

5. Spike Tooth Harrow.
Use equipment designed to:

- Provide adjustment of the spike teeth to level the ground, or
- Be used as specified by the Engineer.

6. Compaction Equipment.

a. Cultipacker.

1) Use a pull type cultipacker with individual rollers or wheels. Cultipackers having sprocket type spacers between the wheels may be used. Ensure the cultipacker produces a corrugated surface on the area being compacted.

2) Use a cultipacker that operates separate from all other operations. Attachment of the cultipacker to the seeder or disk will not be permitted, except when the combined cultipacker seeder is manufactured to operate as a unit. Provide for the addition of weight (mass).

b. Compaction Rollers.
Apply Article 2001.05, A.

c. Hand Tamping Equipment.
Use base plate type hand tamping equipment adapted to the performance of the work. Obtain the Engineer's approval.

d. Expanded Mesh Roller.
Use open grid type equipment or the cultipacker type equipment modified by covering with expanded metal mesh.

7. Hydraulic Seeder and Mulcher.

a. Use hydraulic seeding equipment with a pump rated at no less than 100 gallons (350 L) per minute. Inoculant, seed, and fertilizer may be applied in a single operation, unless stated otherwise in the contract documents. Apply hydraulic mulch as a separate operation. Ensure the equipment has suitable working pressure and a nozzle adapted to the type of work.

b. Ensure the supply tanks have a means of mechanical agitation. Calibrate the tanks and provide a calibration stick or other approved device to indicate the volume used or remaining in the tank.

8. Gravity Seeders.

a. Ensure gravity seeders:

- Provide agitation of the seed,
- Have an adjustable gate opening, and
- Uniformly distribute seed on the prepared seedbed.

b. Use a seed hopper equipped with baffle plates spaced no more than 2 feet (0.6 m) apart. Ensure baffle plates extend from the agitator shaft to within approximately 2 inches (50 mm) of the top of the seed hopper.

c. Wind guards will be required to facilitate seeding when moderate wind conditions exist and when required by the Engineer. Place wind guards in front or in back (or both) of the seed outlet and extend to near the ground line.

d. This seeder may be used for the application of fertilizer.

9. Endgate Cyclone Seeders.
Ensure endgate cyclone seeders are:

- Suitably mounted,
- Provide movement by mechanical means, and

- Drop through an adjustable flow regulator onto a rotating, power driven, horizontal disk or fan.

10. Hand Cyclone Seeders.
Use a seeder that drops the seed through an adjustable flow regulator onto a rotating, hand driven, horizontal disk or fan.

11. Native Grass Seed Drill.
Use a 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 manufactured by the same manufacturer as the drill.

12. 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.

13. Straw Mulching Machine.
Use a type that will uniformly apply mulch material over the desired area without excessive pulverization. The Engineer may consider excessive pulverization as the general absence of straw longer than 6 inches (150 mm) after distribution.

14. Mulch Stabilizer.

a. Use a mulch stabilizer designed to anchor straw or hay mulch into soil by means of dull blades or disks. Use blades or disks that:
- Are flat,
- Have a nominal minimum diameter of 20 inches (500 mm), and
- Are spaced at approximately 8 inch (200 mm) intervals.

b. The blades may have cutaway edges. Pull the mulch stabilizer using mechanical means. Use a mulch stabilizer that weighs approximately 1,000 pounds (has a mass of approximately 450 kg). When directed by the Engineer, increase the weight (mass) by the addition of ballast.

15. Mechanical Trencher.
Use a machine designed for the specific purpose of constructing a trench for placement of check slots to the depth specified.

16. Mowers.
Use rotary, flail, disk, or sickle type mowers that do not bunch or windrow mowed material.

17. Silt Fence Machine.
Use a machine that will slice-in and place silt fence at a minimum depth of 12 inches (300 mm).

B. Seeding.

1. On various portions of the right-of-way, except the traveled portion of the roadbed:
- Prepare the seedbed,
- Furnish, sow, and cover the seed, and
- Compact the seedbed.

2. Seed other areas as may be indicated in the contract documents or directed by the Engineer. The limits of areas to be seeded will be clearly marked before the seedbed is prepared.

3. Do not disturb areas having a satisfactory growth of desirable grasses or legumes.

4. Sow seed only at times of the year when temperature, moisture, and climatic conditions will promote germination and plant growth. Normal permanent seed application dates are between March 1 and May 31, and between August 10 and September 30. Perform seeding according to the following procedures:

a. Seedbed Preparation.

1) Ensure the area to be seeded is relatively smooth. Fill washes and gullies to conform to the desired cross section. When such fills exceed 6 inches (150 mm), compact the material with a tractor wheel or other suitable field equipment. Coordinate preparation of all ditches designated for special ditch control with the seedbed preparation.

2) Thoroughly work areas accessible to field machinery to a depth of no less than 3 inches (75 mm). Use mechanical rotary tillage equipment to prepare the seedbed on earth shoulders, urban or raised medians, rest areas, and islands. Hand prepare areas inaccessible to field machinery to a depth of not less than 2 inches (50 mm). Ensure the entire width of the shoulder and areas around headwalls, wingwalls, flumes, and other structures are prepared in the manner specified.

3) Where weed growth has developed extensively, weeds 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).

4) Use crawler type or dual wheeled tractors to prepare seedbeds. Operate equipment in a manner to minimize displacement of soil and disturbance of the design cross section.

5) Prior to rolling with the cultipacker, harrow ridging in excess of 4 inches (100 mm) caused by operation of tillage equipment. Prior to permanent seeding, roll the area with no less than one pass of the cultipacker.

6) Remove ruts that develop during the sequence of operations before subsequent operations are performed.

7) After seedbed preparation has been completed, pick up and remove all debris according to Article 1104.08, including 3 inch (75 mm) diameter or larger stones, logs, stumps, cable, or

other objectionable material that will interfere with the seeding operation.

b. Application of Fertilizer.

1) Spread fertilizer over the areas at the rate designated. Unless otherwise specified in the contract documents, use a rate of 750 pounds per acre (840 kg/ha) of 13-13-13 (or equivalent) commercial fertilizer.

2) Spread fertilizer with a mechanical spreader which will secure a uniform rate of application. Do not use truck mounted spreading equipment for bulk fertilizer. On areas accessible to field machinery, spread fertilizer after the preliminary preparation of seedbed, but prior to the sowing of any seed. Disk in the fertilizer and roll the area prior to the application of permanent seed. If the roller cannot be operated satisfactorily, the Engineer may permit substituting a harrow for the roller. On areas inaccessible to field machinery, spread fertilizer after preparation of the seedbed and thoroughly rake into the soil.

3) If using a hydraulic seeder, apply fertilizer in combination with seeding as specified in Article 2601.03, B, 4, h. When the contract documents require two applications of fertilizer, perform the second application during the next permanent seeding period following initial seeding and fertilizer application.

c. Application of Seed.

1) Use the seed mixture in Table 2601.03-1 for permanent seeding of rural areas, unless otherwise specified in the contract documents:

Table 2601.03-1: Permanent Seed Mixture, Rural Areas

Fescue, Fawn	25 lbs. per acre (28 kg/ha)
Ryegrass (Perennial)	15 lbs. per acre (17 kg/ha)
Sideoats Grama (Butte or Trailway)	5 lbs PLS per acre (6 kg PLS/ha)
Switchgrass (Neb. 28, Blackwell, Pathfinder, or Cave-In-Rock)	3lbs. PLS per acre (3 kg PLS/ha)
Birdfoot Trefoil (Empire)	5lbs. per acre (5kg/ha)

2) Use the seed mixture in Table 2601.03-2 for permanent seeding of urban areas, including any areas previously maintained as a lawn. Use an application rate of 4 pounds per 1,000 square feet (2 kg per 100 m^2.)

Table 2601.03-2: Permanent Seed Mixture, Urban Areas

Bluegrass, Kentucky	70%
Ryegrass, Perennial (Fineleaf variety)	10%
Fescue, Creeping Red	20%
A commercial mixture may be used if it contains high percentage of similar bluegrasses; it may or may not contain Creeping Red Fescue.	

d. Application of Special Seed.

1) When not shown in the contract documents but directed by the Engineer, a special seed or seed mixture may be required in addition to the regular seed mixture. Apply this seed at the rate ordered as a separate operation either immediately before or immediately after sowing the regular grass mixture.

2) No additional work other than sowing of the seed will be required.

3) On limited areas, this seed may be applied by hand cyclone seeders.

e. Preparation of Seed.

1) Except when a hydraulic seeder is used, thoroughly mix all seed specified for the contract prior to placing the seed in the seed hopper. Ensure the Engineer witnesses all seed mixing. Provide 48 hour notice to the Engineer prior to mixing the seed.

2) Inoculate legumes with a standard culture at the rate as specified by the manufacturer of the inoculant, according to Article 4169.04. Use a type of inoculant specified for each legume seed and approved by the Engineer.

3) Do not allow inoculated seed to be exposed to direct sunlight for more than 30 minutes. Prior to use, reinoculate seed that is not sown within 8 hours after inoculation. Preinoculated seed with manufacturer's recommended protective coating may be used in lieu of seed with Contractor applied inoculant.

4) 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. If the hydraulic seeder is used, inoculant, in quantities specified above, may be applied directly into the supply tank with seed, water, and other material. Furnish and apply inoculant.

5) Treat seed with a commercial sticking agent. Apply prior to application of inoculant, or as a mixture when the sticking agent is compatible with other materials, except with hydraulic equipment. A sticking agent is not required if a liquid formulation of inoculant is used.

6) Use mechanical mixing equipment to apply the sticking agent and inoculant on seed quantities over 50 pounds (25 kg) per batch.

f. Sowing Grasses and Legumes.

1) On areas accessible to field machinery, grass and legume seed may be sown with:

- A gravity, cyclone, or hydraulic seeder,
- A native grass seed drill,
- Aerial equipment, or
- As specified in the contract documents.

2) On areas inaccessible to field machinery, use of hand cyclone seeders will be permitted.

3) Sowing of grass and legume seed must be performed as a split rate application (no less than two passes).

4) Hairy vetch may be seeded until September 30. Other legume and native grass seed shall not be seeded after August 31. Defer the work until spring. The spring seeding of legume and native grass seed may be performed in one operation, with a cyclone seeder, hydraulic seeder, or aerial equipment when the ground is friable from frost action.

5) Covering, compaction, rolling, dragging, or raking of the seedbed will not be required provided the friable condition exists. For spring seeding (following fall seedbed preparation) after April 1, the Contractor will be required to roll or harrow when, in the opinion of the Engineer, a friable condition does not exist.

6) Apply crownvetch seed only in the spring or as designated in the contract documents. The crownvetch seeding required is considered the final operation of seeding, fertilizing, and mulching for erosion control projects under construction during the spring seeding period.

g. Covering and Compaction of Grasses and Legumes.

1) Follow sowing of the grasses and legumes with at least one complete rolling with the cultipacker. Roll shoulders immediately to prevent loss of seed due to air currents caused by passing traffic.

2) Where compaction equipment will not operate satisfactorily, lightly drag or rake in the seeded area by hand. Roll the seedbed with a cultipacker both before and after seeding.

h. Seeding and Fertilizing with Hydraulic Seeder.

1) The Contractor may use a hydraulic seeder when the seedbed has been prepared according to Article 2601.03, B, 4, a. When a hydraulic seeder is used, apply seed or fertilizer, or both, at the rates specified in approximately 400 gallons (4000 L) of water slurry per acre (hectare).

2) Apply the mixture within 1 hour after fertilizer and seed are placed in the hydraulic seeder. Continuous agitation will be required. Seed remaining in the fertilizer solution for more than 1 hour will be unacceptable. Additional seed at the specified rate will be required.

i. Fall Seeding.

1) The normal fall seeding period is August 10 through September 30.

2) Apply crownvetch seed only in the spring seeding period or as designated in the contract documents.

3) Seeding after August 31 consists of stabilizing crop seed, hairy vetch (legume seed), and grass seed except native grass. Sow other legume seed and native grass seed the following spring as soon as possible after March 1, and before April 1, when the ground is friable from frost action, as directed by the Engineer and according to Article 2106.03, B, 4, f.

j. Urban Seeding.

1) Apply fertilizer prior to preparing the seedbed.

2) A rotary tiller will be required for the preparation of seedbed according to Article 2106.03, B, 4, a. Prior to the application of seed, ensure the seedbed is firm, smooth, and free of any material 1 1/2 inches (40 mm) in diameter or greater including clods, rocks, and other debris. Roll the seedbed both before and after the application of seed. For rolling, use either open grid type equipment or cultipacker type equipment modified by covering with expanded metal mesh.

3) Prepare, roll, seed, and fertilize areas inaccessible to field equipment by hand or using hand operated equipment, including lawn type, hand cyclone, or gravity equipment. Obtain the Engineer's approval for such equipment.

k. Pneumatic Seeding.

Includes furnishing and applying compost to a depth of 1 inch (25 mm) on all designated disturbed areas. Apply compost using a pneumatic (air blower) system with sufficient hose to reach 300 feet (100 m). Driving on the soil to apply the compost will not be allowed. Apply seed with the top 1/4 inch (6 mm) of compost material. Incorporate fertilizer into the full depth of compost material. Prepare the seedbed according to Article 2601.03, B, 4, j.

l. Spring Overseeding.

1) Seedbed preparation will not be required, provided the overseeding is applied when the ground is friable from frost action after March 1 and before April 1 or as directed by the Engineer.

2) For overseeding, when in the opinion of the Engineer a friable soil condition does not exist, the Contractor shall roll with a cultipacker or harrow.

3) Sow grass legume seed mixture as a split rate application (no less than two passes).

m. Native Grass Seeding and Wetland Grass Seeding.

1) Between April 1 and June 30 and between August 1 and August 31, use the seed mixtures of Tables 2601.03-3 and 2601.03-4 for areas designated for native grass seeding or wetland grass seeding, unless specified otherwise in the contract documents.

Table 2601.03-3: Seed Mixture, Native Grasses

Common Name	Scientific Name	PLS (per ac)	PLS (per ha)
Native Grasses and Wildflowers: Furnish seed certified as Source Identified Class (Yellow Tag) Source G0-Iowa. Grain Rye is excluded from this requirement.			
Grain rye	Secale cereale	22.5 lbs.	25 kg
Canada wild rye	Elymus canadensis	12 lbs.	13 kg
Switchgrass	Panicum virgatum	2 lbs.	2.2 kg
Big bluestem	Andropogon gerardi	8 lbs.	9 kg
Indiangrass	Sorghastrum nutans	8 lbs.	9 kg

Little bluestem	Schizachyrium scoparium	4 lbs.	4.5 kg
Sideoats grama	Bouteloua curtipendula	3 lbs.	3.4 kg
Blue grama	Bouteloua gracilis	3 lbs.	3.4 kg
Purple prairie clover	Dalea purpurea	4 oz.	280 g
Blackeyed susan	Rudbeckia hirta	4 oz.	280 g
Prairie blazing star	Liatris pycnostachya	4 oz.	280 g
Butterfly weed	Asclepias tuberosa	4 oz.	280 g
Wild bergamot	Monarda fistulosa	4 oz	280 g
Gray-headed coneflower	Ratibida pinnata	4 oz.	280 g
New England aster	Symphyotrichum novae-angliae	2 oz.	140 g

Table 2601.03-4: Seed Mixture, Wetland Grasses

Common Name	Scientific Name	PLS (per ac)	PLS (per ha)
Blue vervain	Verbena Hastata	1 oz.	70 g
Boneset	Eupatorium perfoliatum	1 oz.	70 g
Nodding bur marigold	Bidens cernua	8 oz.	560 g
Swamp milkweed	Asclepias incarnata	1 lb.	1.1 kg
Sneezeweed	Helenium autumnale	2 oz.	140 g
Water plantain	Alisma plantago-aquatica	4 oz.	280 g
Arrowhead	Sagittaria latifolia	4 oz.	280 g
New England aster	Symphyotrichum novae-angliae	2 oz.	140 g
Big Bluestem	Andropogon gerardii	1 lb.	1.1 kg
Switchgrass	Panicum virgatum	8 oz.	560 g
Prairie cordgrass	Spartina pectinata	1 lb.	1.1 kg
Virginia wild-rye	Elymus virginicus	5 lbs.	5.6 kg
Bluejoint grass	Calamagrostis	1 oz.	70 g
Rice cutgrass	Leersia oryzoides	4 oz.	280 g
Dark Green bulrush	Scirpus atrovirens	1 oz.	70 g
Fox sedge	Carex vulpinoidea	4 oz.	280 g
Softstem bulrush	Schoenoplectus tabernaemontani	8 oz.	560 g
Spike rush	Eleocharis palustris	4 oz.	280 g
Porcupine sedge	Carex hystericina	8 oz.	560 g
Broom sedge	Carex scoparia	2 oz.	140 g
Tussock sedge	Carex stricta	2 oz.	140 g

2) Uniformly apply seed to areas with the seedbed prepared as in Article 2601.03, B, 4, a. Seed areas accessible to field equipment with a native grass seed drill, gravity, or broadcast equipment. Cultipack as specified in Article 2601.03, B, 4, g. Broadcast seed other areas and follow with a light dragging or hand raking.

3) In areas with existing stabilized crop residue, apply seed with a native grass seed drill with a no till attachment. Seedbed preparation and cultipacking will not be required.

4) Perform seeding as a split rate application (no less than two passes).

n. Wildflower Seeding.

1) Apply the wildflower seed mix designated in the plans between April 15 and June 30, and between August 1 and August 31. Uniformly apply seed to areas with the seedbed prepared as in Article 2601.03, B, 4, a.

2) Seed areas accessible to field equipment using a native grass seed drill at an approximate depth of 1/8 inch (3 mm), or using gravity or broadcast equipment. Cultipack as specified in Article 2601.03, B, 4, a. Broadcast seed other areas and follow with a light dragging or hand raking.

3) In areas with existing stabilized crop seeding residue, apply seed with a native grass seed drill with a no till attachment. Seedbed preparation and cultipacking will not be required.

4) Perform wildflower seeding as a split application (no less than two passes).

o. Mowing.

1) Mowing may be required prior to permanent seeding and any time during the growing season following permanent seeding. The Engineer will notify the Contractor in writing prior to each mowing. Notification may be issued as early as 15 calendar days following the execution of the contract. The Contractor will be given 5 mowing days, plus 1 additional day for each 50 acre (20 ha) increment, that has been requested to be mowed. A mowing day is a calendar day, exclusive of Saturdays, Sundays, or recognized legal holiday, on which weather or other conditions (not under the control of the Contractor) will permit mowing operations to proceed for no less than 3/4 of a normal work day in the performance of a controlling item of work. When multiple projects are combined into a single contract, mowing days will be administered independently for each project. Mowing days will be charged starting on the day following the Contractor's notification. A price adjustment will be assessed at a rate of $200.00 per mowing day after the work was to be completed.

2) Use suitable equipment for mowing. Bunching or windrowing mowed vegetation will not be permitted. When wet soil conditions result in rutting, suspend mowing. Repair rutting damage at the direction of the Engineer at no additional expense to the Contracting Authority. Hand equipment will be required for areas inaccessible to other equipment. Set the

cutting height at approximately 6 inches (150 mm). More than one pass may be required for each mowing.

C. Stabilizing Crop Seeding and Fertilizing.
Prepare the seedbed according to Article 2601.03, B, 4, a.

1. Stabilizing Crop Seed Mixture.

a. Unless otherwise specified in the contract documents, use the stabilizing crop seed mixture rates and schedule shown in Table 2601.03-5.

Table 2601.03-5: Seeding Rates and Schedule

Spring -- March 1 to May 20	
Oat Grain rye Red clover Timothy	2 bu. per acre (75 kg/ha) 1 bu. per acre (63 kg/ha 5 lbs. per acre (6 kg/ha) 5 lbs. per acre (6 kg/ha)
Summer -- May 21 to July 20	
Oat Grain rye Red clover Timothy	3 bu. per acre (108 kg/ha) 2 bu. per acre (126 kg/ha) 5 lbs. per acre (6 kg/ha) 5 lbs. per acre (6 kg/ha)
Fall – July 21 to September 30	
Oat Grain rye Red clover Timothy	2 bu. per acre (72 kg/ha) 2 bu. per acre (126 kg/ha) 5 lbs. per acre (6 kg/ha) 5 lbs. per acre (6 kg/ha)

b. Apply stabilizing crop seeding using full seedbed preparation and incorporation.

c. Overseeding of stabilizing crop seeding will only be allowed on areas which are not accessible to field equipment.

d. Treat all legume specified for stabilizing crop seed with inoculant prior to mixing with the remainder of the seed mixture.

2. Fertilizing for Stabilizing Crop Seeding.

a. Apply commercial fertilizer to all seeded areas at the rate of 450 pounds per acre (500 kg/ha) of 13-13-13 (or equivalent) unless specified otherwise in the contract documents.

b. Apply the provisions of Article 2601.03, B, 4, b.

3. Covering and Compaction of Stabilizing Crop Seeding.

a. Cover stabilized crop seed and fertilizer with a light disking or with other tillage equipment such as a rigid harrow, spring tooth harrow, or field cultivator.

b. Follow the tillage by rolling the area with a cultipacker. If the cultipacker cannot be operated satisfactorily, the Engineer may permit the harrow to be substituted for the cultipacker.

D. Composting.
Compost may be used as a top dress application or as an incorporated soil amendment.

1. Top dress applications may be used for urban seeding or on soils that are highly erosive or sloped soils to prevent surface or rill erosion and to provide organic material and nutrients needed for vegetative establishment. Ensure areas top dressed with compost have little or no drainage onto them.

2. In highly erosive soils or sloped embankments with drainage onto the area, incorporate compost by mixing it into the top soil a minimum of 2 inches (50 mm) to prevent the compost from washing off the slope.

E. Mulching.
Mulch seeding areas unless otherwise designated in the contract documents.

1. Time of Mulching.
Apply mulch to areas requiring mulch as soon as seed is sown and final rolling completed.

2. Application of Mulch.

a. Straw Mulch.

1. Evenly and uniformly distribute mulch and anchor it into the soil. Use an application rate for reasonably dry material of approximately 1 1/2 tons per acre (3.5 Mg/ha) of dry cereal straw, native grass straw, or other approved material, depending on the type of material furnished.

2. In all accessible mulched areas, consolidate the mulch into the soil with a mulch stabilizer. Tuck slope areas on the contour. Use crawler type or dual wheel tractors for the mulching operation. Operate equipment in a manner to minimize displacement of the soil and disturbance of the design cross section.

b. Hydraulic Mulches.
Apply hydraulic mulches at no less than the manufacturer's recommended minimum rate using standard hydraulic mulching equipment.

F. Reseeding, Refertilizing, and Remulching.

1. When ordered by the Engineer reseed, refertilize, and remulch (at the contract unit prices) an area when:

- All work related to seeding on the area has been completed, but is washed out or damaged prior to final acceptance of the project by the Engineer, and
- The area involves seeding in combination with mulching or fertilizing, or both.

2. If a fertilized or seeded area is damaged by rain prior to the required mulching, refertilize or reseed, or both, that area at a rate not to exceed the specified rate as designated by the Engineer. Perform this work at no additional cost to the Contracting Authority.

G. Sodding.

1. Refer to the contract documents for areas to be sodded. The Engineer may designate other areas for sodding.

2. Prior to shaping the sodbed, the Engineer will define upon the ground the limits of areas to be sodded, and indicate the center lines of waterways. Cover the designated areas with live sod meeting requirements of Article 4169.06.

3. Closely place and properly fit the sod against structures and adjacent sod according to the following provisions:

a. Preparation of Sodbed.

1) Shape and prepare all surfaces to be sodded. Ensure areas to be sodded are firm and even surfaces. Ensure they are free of material 1 1/2 inches (40 mm) in diameter or greater including clods, rocks, and other debris. Ensure all ditch channels, slopes, and flumes to be sodded have a typical cross section as shown in the contract documents.

2) Construct the ditch channel to secure a relatively level, flat bottom ditch cross section with a minimum depth of 6 inches (150 mm), measured from the finished sodbed ground line at the edge of the ditch. Scarifying prior to shaping may be necessary to assure the minimum depth. A minimum sod ditch overall width of 7 1/2 feet (2.2 m) (sloping sides) will be required.

3) Use a soil compaction roller complying with Article 2601.03, A, for compaction and reshaping of ditches. Limit layers of fill materials to no more than 8 inches (200 mm) in depth.

4) After the surface of the layer has been smoothed and before material for the next layer is deposited upon it, compact the layer:

- With no less than one pass of a soil compaction roller per inch (25 mm) of loose thickness of the layer, and
- Until the roller is supported entirely on its tamping feet.

5) The roller will be considered entirely supported on its tamping feet when the tamping feet penetrate no more than 3 inches (75 mm) into an 8 inch (200 mm) layer being compacted. A single section roller may be necessary for this operation in some locations.

6) Extend the compacted area approximately 6 inches to 12 inches (150 mm to 300 mm) beyond the width of the ditch.

7) After compaction, shape the ditch.

b. Fertilizer for Sod.

1) Two applications are required (initial and prior to final acceptance). After sodbed preparation and prior to placing sod, fertilize the area to be sodded and the adjacent disturbed area

at a rate of 10 pounds per 1000 square feet (5 kg per 100 m^2). Use a commercial fertilizer specified for the project.

2) Place the final application of fertilizer at a rate of 10 pounds per 1000 square feet (5 kg per 100 m^2) within 5 calendar days of the end of the 30 calendar day watering period and prior to final acceptance of the project. Place the final application when the grass is dry and with a dry form of fertilizer.

3) For both of the above applications, if the type of fertilizer is not specified, apply 13-13-13 (or equivalent) commercial fertilizer. Spread the fertilizer with a mechanical spreader which will secure a uniform rate of application. Manipulation or mixing with the soil, other than that incidental to Article 2601.03, F, 3, d, will not be required.

c. Placing Sod.

1) Do not place sod between May 31 and August 10, or on frozen ground unless otherwise directed by the Engineer.

2) Place sod in rows or strips. On slopes, place the strips transverse to the flow of water over the area. On the sides and bottoms of ditches and channels, place the strips at right angles to the center line of the channel. Place sod strips tightly against each other so that no open joints are apparent.

3) Stagger joints at the ends of sod strips at least 1 foot (0.3 m) on adjacent rows or strips of sod. Cut sod to be placed in road ditch channels, intercepting ditches, or sod flumes where the total sodded width is less than 7 1/2 feet (2.2 m) into strips having lengths equal to the width of the sodded area. At the top of slope or at the edge of a channel, lay sod so water from adjacent areas will have free flow onto the sodded area. In road ditch channels and flumes, begin sodding at the outlet or lower end and progress upward. On slopes, begin sodding at the bottom and progress upward. If necessary to protect sod already laid, furnish (without extra compensation) ladders or planks for workers to use.

4) The Engineer may order sod flumes, slopes, and ditch channels to be staked to minimize erosion loss before establishment. Stake sod as shown in the contract documents and as required by the Engineer.

d. Finishing Sod.

1) Firm the soil along the edge of the sodded area. Properly shape and smooth the adjacent disturbed area to allow surface water to flow into the sod ditch. Excessive soil placed over the edge of the sod will not be permitted.

2) Prepare and seed the seedbed for all rural disturbed areas adjacent to the sod. Rake the seed in. Seed the disturbed area with the following seed mixture at the rate of 2 pounds per 1000 square feet (1 kg per 100 m^2):

Fescue, Fawn	80%
Ryegrass, Perennial	20%

3) For urban projects adjacent to sod, use the seed mixture specified for the project. Mulch the disturbed area with grass, hay, or straw at the rate of 70 pounds per 1000 square feet (35 kg per 100 m^2).

4) After sodding and seeding, water the sod, sodbed, and disturbed areas according to Article 2106.03, F, 3, e.

5) When sod ditches are constructed after October 1, overseed grasses the following spring, between March 1 and April 1, when weather and soil conditions are favorable.

6) When initial watering of the sod does not secure adequate bond between the sod and soil, the Engineer may require rolling. If sod is allowed to be placed between May 31 and August 10, and it is not to be staked, roll the sod using equipment approved by the Engineer. Remove from the project sod rejected from sod ditches. Remove from the site any other material not otherwise incorporated into the work.

7) In urban areas, islands, and rest areas, roll the sod prior to or following the initial watering using a hand operated, lawn type roller approved by the Engineer.

e. Watering Sod.

1) Provide watering equipment and an approved water supply before beginning any sodding operation. Six waterings will be required. Allow no more than 1 hour to elapse between laying and initial watering of sod. Perform the second, third, and fourth waterings at 4 calendar day intervals, and the fifth and sixth waterings at weekly intervals. Perform all waterings unless notified by the Engineer in writing at least 1 calendar day prior to the day the watering is to occur. A price adjustment will be assessed at a rate of $200.00 per day for each calendar day that the Contractor fails to complete the watering from the day watering is to commence.

2) Ensure all waterings are sufficient to thoroughly saturate the sod, sodbed, and adjacent disturbed areas to a depth of approximately 4 inches (100 mm).

3) Each watering may require a maximum of 100 gallons of water per square (40 L of water per square meter). Apply the water as a spray or dispersion to prevent damage to the sod. Complete each watering within a 4 hour period. More than one application for each watering may be necessary to provide adequate saturation without runoff.

f. Urban, Island, and Safety Rest Area Sodding.

1) Prepare areas to be sodded, except ditch channels, according to Article 2601.03, B, 4, j.

2) During the total watering period, mow the sod once to a 3 inch (75 mm) height approximately 3 weeks after placement.

H. Constructing and Reshaping Intercepting Ditches and Flumes.

1. Construct ditches to intercept the flow of surface water and conduct it into proper drainage channels, as provided in Article 2102.03, H when:

- The slope of adjacent land is toward the backslope of road excavations, and
- The extent of the area drained will result in sufficient water flowing over the backslope to cause serious erosion.

2. Ensure intercepting ditches and flumes comply with the typical cross section shown in the contract documents.

3. Form the ditch by excavating or blading earth from the area on the downhill side of the ditch location. Deposit this material in a windrow and compact it to form the ditch and provide the bank for the downhill side.

4. For reshaping of intercepting ditches, compact the earth excavated from the ditch to the bank on the lower side of the ditch.

I. Special Ditch Control, Turf Reinforcement Mat, and Slope Protection. Use material meeting the requirements of Article 4169.09. The Engineer will designate the areas for each type of work.

1. Special Ditch Control Wood Excelsior Mat or Other Material Specified.
Perform the following according to the contract documents:
- Shape channels on all ditches.
- Furnish and apply seed and fertilizer, mulch, ditch control material, and water.

2. Turf Reinforcement Mat (TRM).
Perform the following according to the contract documents:
- Shape channel, ditches, or slopes.
- Furnish and apply TRM.
- Furnish and apply a minimum of 1 inch (25mm) of soil suitable for the establishment of vegetation on the TRM.
- Furnish and apply seed and fertilizer.
- Furnish and apply special ditch control wood excelsior mat on the soil fill
- Watering.

3. Special Ditch Control over Sod.
Furnish and apply specified material, including staples, over the sodded areas.

4. Slope Protection Wood Excelsior Mat or Other Material Specified.
Furnish and apply the specified material on the slopes designated by the Engineer.

J. Preparation of Area to be Treated with Special Ditch Control, Turf Reinforcement Mat, and Slope Protection.

1. Shape the ditch channel in the same manner as preparing a ditch for sod as provided in Article 2601.03, F, 3, a.

2. During ditch shaping operations, provide a seedbed with a friable soil condition on the surface. Prepare slope areas to be protected with ditch control material as preparing a seedbed for seeding as provided in

Article 2601.03, B, 4, a, except with a depth no less than 3/4 inch (20 mm).

3. Remove all material 1 1/2 inches (40 mm) in diameter or greater, including clods, rocks, and other debris, which will prevent contact of the ditch control material with the seedbed.

4. Coordinate preparation and placement of the ditch control material or TRM with the seedbed preparation, seeding (including sticking agent and inoculant), fertilizing, and mulching of the adjacent area of right-of-way.

5. Prepare areas to be protected with slope protection materials in the same manner as provided in Article 2601.03, B, 4, a.

K. Seeding For Special Ditch Control and Slope Protection.
Sow seed prior to placement of ditch control material, unless directed otherwise by the Engineer. Treat seed with sticking agent and inoculant.

1. Special Ditch Control in Depressed Medians and Other Ditch Areas.
Seed ditches and depressed medians at a rate of 5 pounds per 1000 square feet (2.5 kg per 100 m^2), as directed by the Engineer, using the following seed mixture:

Ditches Outside Shoulder	
Fescue, Fawn	70%
Fescue, Creeping Red	10%
Ryegrass, Perennial	20%
Median Ditches	
Fescue, Fawn	77%
Birdsfoot Trefoil (Empire)	3%
Ryegrass, Perennial	20%

2. Slope Protection and Urban Seeding Areas.
Use the seed mixture specified for the project.

L. Fertilizer for Special Ditch Control and Slope Protection.

1. After the area is prepared and prior to laying the specified material, fertilize the ditch channel at the rate of 10 pounds per 1000 square feet (5 kg per 100 m^2). Use the commercial fertilizer specified for the project.

2. If the type of fertilizer is not specified for the project, apply 10 pounds per 1000 square feet (5 kg per 100 m^2) of 13-13-13 (or equivalent) commercial fertilizer. Spread the fertilizer with a mechanical spreader to secure a uniform rate of application. Manipulation or mixing with the soil other than that incidental to Article 2601.03, O, will not be required.

3. For slope protection, use the fertilizer specified for the project.

M. Application of Special Ditch Control and Turf Reinforcement Mat Materials on Seeded Areas.

The areas of special ditch control will be designated by the Engineer. Shape the ditch channel as provided in Article 2601.03, F, 3, a. Apply the provisions of Articles 2601.03, J; 2601.03, K; 2601.03, O; and 2601.03, Q.

1. Wood Excelsior Mat.

a. Space check slots on ditch channels so one check slot occurs within each 50 foot (15 m) increment on slopes of more than 4%.

b. Apply wood excelsior mat without tension and in the direction of the flow of water. Where more than one strip is required, lap the lap joint no less than 3 inches (75 mm). Bury the anchor slot on the top edge of the wood excelsior mat from 6 inches to 12 inches (150 mm to 300 mm), as designated by the Engineer.

c. On junction slots, bury the upslope end of each strip of wood excelsior mat 6 inches (150 mm). Firmly tamp the soil. Overlap the ends of the wood excelsior mat at least 12 inches (300 mm) and staple, with the upgrade section on top.

d. Staple the terminal fold at the bottom end of the wood excelsior mat.

e. Use staples meeting the requirements of Article 4169.09, A. Space staples as shown in the contract documents.

2. Other Materials.

Place TRM on channel or slope after shaping. Apply according to the manufacturer's instructions and the contract documents.

N. Special Ditch Control over Sod.

When shown in the contract documents, place plastic netting or other approved material over sod and staple it in place. Space staples 3 feet (1 m) apart in the row. Space rows no more than 2 feet (0.6 m) apart. Place staples alternately to adjacent rows. No junction slots or check slots are required. Anchor slots and terminal folds will be required.

O. Finishing Adjacent to Special Ditch Control and Turf Reinforcement Areas.

For adjacent areas disturbed outside of ditch channels, uniformly shape, fertilize, seed, and rake in the seed in the same manner required for disturbed areas adjacent to sod ditches, except use the seed specified in Article 2601.03, J. Complete this work during the normal permanent seeding period or by the date specified to complete seeding.

P. Application of Slope Control Materials over Seeded Areas.

Details for applying slope control materials over seeded areas will be shown in the contract documents.

Q. Watering of Special Ditch Control, Turn Reinforcement, and Slope Protection.

1. Provide watering equipment and an approved water supply before starting special ditch control, TRM, or slope protection work. Water the area no later than the day following placement of the materials. If the

Contractor fails to water by the second day following placement a price adjustment will be assessed at a rate of $200.00 per calendar day until the watering has been completed.

2. Apply three additional waterings at intervals of 5 to 8 calendar days. Perform all waterings unless notified by the Engineer in writing at least 1 calendar day prior to the day the watering is to occur. If the Contractor fails to complete the watering before the 8th calendar day has elapsed a price, adjustment will be assessed at a rate of $200.00 per calendar day, beginning on the 9th day, until the watering is completed.

3. Ensure all waterings are sufficient to thoroughly saturate the seedbed to a depth of approximately 2 inches (50 mm).

4. Each watering may require a maximum of 50 gallons of water per square (20 L of water per square meter). Apply the water as a spray or dispersion to prevent damage to the seedbed. Complete each watering within a 4 hour period.

5. More than one application for each watering may be necessary to provide adequate saturation without runoff.

R. Completion of the Work.

1. Give priority to medians, islands, interchange quadrants, urban areas, and rest areas, including the area between rest areas and the highway. Schedule the work so that all work, except sodding, in these areas is completed first, except as authorized by the Engineer.

2. Coordinate and complete all phases of this work, except sodding, so the operation for any phase of work will not extend more than 2 miles (3 km) from portions already completed, except with the Engineer's permission. Complete all phases of this work, excluding the 30 calendar day maintenance of sodded areas, within the specified construction schedule.

3. When any work included in the contract is washed out or damaged prior to final acceptance of the project, the Engineer may order replacement of the damaged portion. The Engineer will advise the Contractor of the approximate quantity of replacement required. Perform these repairs during the normal permanent seeding period. Maintain the work in a manner satisfactory to the Engineer.

4. The Contractor is responsible for replacement in addition to the quantity directed by the Engineer to complete the work in an acceptable condition should the Contractor fail to:

- Make this replacement when directed by the Engineer, or
- Perform necessary maintenance to the area.

2601.04 METHOD OF MEASUREMENT.

Measurement for the various items of work involving erosion control, satisfactory completed, will be as follows:

A. The Engineer will compute in acres to the nearest 0.1 acre (hectares to the nearest 0.1 hectare) the surface areas of
- Overseeding and Fertilizing,
- Seeding and Fertilizing,
- Pneumatic Seeding,
- Mulching,
- Compost,
- Native Grass Seeding,
- Wetland Grass Seeding,
- Wildflower Seeding,
- Stabilizing Crop Seeding and Fertilizing,
- Seeding Special Areas, and
- Crownvetch Seeding.

B. Surface areas of Sodding: squares of 100 square feet (square meters) calculated from measurements to the nearest foot (0.1 m).

C. Debris picked up and removed according to Article 2601.03, B, 4, a: cubic yards (cubic meters) by cross sectional measurement or in the hauling units, at the option of the Engineer.

D. Special Ditch Control, Turn Reinforcement Mat, and Slope Protection: squares of 100 square feet (square meters) calculated from measurements to the nearest foot (0.1 m). Measurement of actual area covered will be used, but will not exceed an area based on the actual measured length and design width. Materials used for anchor slots, junction slots, check slots, terminal folds, lap joints, mulch, and seed and fertilizer for Special Ditch Control are incidental.

E. Watering: by counting loads from a transporting tank of known volume or by metering.

F. Mobilization for watering: by count. Mobilization for the initial watering required at installation of the plant material will not be measured for count.

G. Mowing described in Article 2601.03, B, 4, n: acres to the nearest 0.1 acre (hectares to the nearest 0.1 hectare) of surface area.

2601.05 BASIS OF PAYMENT.

A. Payment for the various items of work involved in erosion control will be made as described below. When suitable soil for filling holes, gullies, or washes is not available adjacent to the area to be filled or when soil must be removed, payment for necessary loading and hauling directed by the Engineer will be as extra work according to Article 1109.03, B.

1. Contract unit price per acre to the nearest 0.1 acres (hectare to the nearest 0.1 hectares) for the following. Payment is full compensation for preparing the area and furnishing and applying each material.
- Overseeding and Fertilizing,

- Seeding and Fertilizing,
- Pneumatic Seeding,
- Compost
- Native Grass Seeding,
- Wetland Grass Seeding, Wildflower Seeding,
- Stabilizing Crop Seeding and Fertilizing, and
- Crownvetch Seeding.

2. Seeding Special Areas:
   a. Contract unit price per acre to the nearest 0.1 acres (hectare to the nearest 0.1 hectares).
   b. Payment is full compensation for preparing the area and furnishing and applying the seed and fertilizer as specified.

3. For sowing special seed ordered by the Engineer, but not provided for in the contract documents: delivered cost of the seed plus 10% of the contract unit price for Seeding and Fertilizing.

4. Sodding:
   a. Contract unit price per square (square meter).
   b. Payment is full compensation for:
      - Preparing the sodbed,
      - Furnishing, placing, and finishing the sod,
      - Fertilizing, and
      - Repair of adjacent areas disturbed by the sodding operation.

5. Squares (square meters) of staking of sod flumes, slopes, and ditch channels: 25% of the contract unit price for Sodding in addition to payment for Sodding.

6. Mulch furnished and placed: predetermined contract unit price per acre (hectare).

7. Debris picked up according to Article 2102.03, C, for grading work:
   a. Payment for debris pickup of additional boulders resulting from Stabilized Crop Seeding and Fertilizing will be as described in Article 2102.05 for Class 12 boulders. If there is no Class 12 item, payment will be at 10 times the contract unit price for Class 10 excavation.
   b. Payment for the number of cubic yards (cubic meters) of debris picked up and removed in conjunction with other work will be paid at 25% of the contract unit price for Stabilizing Crop Seeding or Seeding and Fertilizing, as applicable.

8. Squares (square meters) of Special Ditch Control over Sod, Wood Excelsior Mat or other material, as specified:
   a. Contract unit price per square (square meter).
   b. Payment is full compensation for the special ditch control preparation and materials. This includes reshaping intercepting ditches and flumes, seed, fertilizer, stapling, mulch, and in areas

where special ditch control is specified, for construction of intercepting ditches and flumes.

9. Squares (square meters) of Turf Reinforcement Mat:
- **a.** Contract unit price per square (square meter).
- **b.** Payment is full compensation for the Turf Reinforcement Mat, preparation and materials including shaping channels, ditches and slopes, soil fill, seed and fertilizing, wood excelsior mat and watering.

10. Squares (square meters) of Slope Protection with Wood Excelsior Mat or other material, as specified:
- **a.** Contract unit price per square (square meter).
- **b.** Payment is full compensation for the slope protection materials in addition to the amount paid for seed and fertilizer.

11. When a large area is to be watered, the contract documents will include an item for watering. For the quantity of water applied to sod, Article 2601.03, F, 3, e, and to special ditch control and slope protection, Article 2601.03, Q, payment will be the predetermined contract unit price per 1000 gallons (kiloliter). When an item for watering is not included, the cost of watering is included in the amount paid for the item to be watered.

12. Mobilization for watering: pre-determined price of $350.00 for each required watering.

13. Mowing as described in Article 2601.03, B: contract unit price per acre to the nearest 0.1 acres (hectare to the nearest 0.1 hectares).

B. Payment for these items is full compensation for furnishing all materials, equipment, tools, and labor necessary to complete the work according to the contract documents. It includes:
- Removal of rock and other debris from the area,
- Filling gullies and washes,
- Preparing the seedbed or sodbed,
- Furnishing and placing sod and staking sod,
- Furnishing and placing seed including any treatment required,
- Furnishing and placing fertilizer and mulch,
- Tucking the mulched areas,
- Furnishing and placing wood excelsior mat,
- Furnishing water, and
- Other care during the care period.

C. Payment will not be allowed for any area seeded until all seeding of the area permitted by the season is completed, including crownvetch seeding in the spring, and until the Special Ditch Control, Slope Protection, fertilizer, and mulch are placed.

D. Payment will not be allowed for the Special Ditch Control and Sod until the watering, as specified, has been completed. Replace or repair, at the

discretion of the Engineer, Special Ditch Control and Sod areas which are damaged by weather or other causes before the specified initial watering has been completed, at no additional cost to the Contracting Authority.

E. Payment for areas of completed work which are damaged by weather or other causes during the care period and which are repaired at the direction of the Engineer will be at the contract unit prices for the respective types of work involved. Should the repair work not be done with reasonable promptness, payment for repair will be limited to the work described at the time of notification.

F. Payment for furnishing extra length stakes or staples when directed by the Engineer will be as extra work according to Article 1109.03, B.

Section 2602. Water Pollution Control (Soil Erosion)

2602.01 DESCRIPTION.

A. Temporary control measures for projects to control water pollution caused by soil erosion. Additional measures are described in Section 2601..

B. Projects that are regulated by the requirements of Iowa DNR National Pollutant Discharge Elimination System (NPDES), General Permit No. 2, for Storm Water Discharge Associated with Industrial Activity for Construction Activities, will be identified in the contract documents. The Prime Contractor for these projects will be required to complete, sign, and return, along with the signed contract, a certification statement for storm water discharge associated with industrial activity for construction activities. Affected Subcontractors for the project will be required to sign and return an affidavit identifying them as co-permittees with the Contracting Authority prior to starting work.

C. Coordinate temporary water pollution control work with permanent erosion control work to ensure economical, effective, and continuous erosion control throughout the construction and post construction period.

2602.02 MATERIALS.

Use materials complying with Division 41.

2602.03 CONSTRUCTION.

A. At the preconstruction conference or prior to the start of construction, submit for acceptance the work plans and schedules for accomplishment of temporary and permanent erosion control. In addition, submit for acceptance the proposed method of erosion control on haul roads and borrow pits as well as the plan for the removal of excess materials from the project.

B. Obtain the Engineer’s approval for erosion control schedules and methods before commencing work. Schedule and perform all operations so erosion control features are placed according to the approved work plan.

C. Provide immediate, permanent or temporary, water pollution control measures to prevent contamination of adjacent watercourses and property. This work may involve:
- Constructing or installing silt fence, silt fence for ditch checks, silt ditches, silt dikes, silt basins, and slope drains, and
- Using temporary mulches, mats, seeding, or other control devices or methods, as necessary to control erosion and sediment pollution.

D. Unless otherwise specified, use compost as a filter medium in filter socks, filter berms, or filter blankets for sediment control.

E. Stabilize disturbed areas, in which construction activity will not occur for a period of 21 calendar days, no later than the 14th calendar day after no construction activity has occurred. Stabilization measures include temporary seeding, permanent seeding, mulching, sod, or other methods the Engineer approves.

F. Incorporate all erosion control features into the project at the earliest practical time, as outlined in the accepted schedule. Construct water pollution control measures:
- At locations shown in the contract documents and as determined by the Contractor,
- At locations where conditions develop during construction that were unforeseen during design, or
- Where needed to control water pollution that develops during normal construction practices.

G. Maintain water pollution control features in appropriate functional condition from initial construction through completion of the project. Restore siltation control features to their original condition where siltation has reduced their capacity by 50% or more.

H. Clean-out of Silt Fence and Clean-out of Silt Fence for Ditch Check includes excavation and disposal of silt material trapped by the silt fence or silt fence for ditch checks. Shaping of the ditch bottom to the original ditch template is incidental to this item. Dispose of the silt material off the project unless Engineer approves a suitable site within the project limits.

I. Limit clearing and grubbing, excavation, borrow, and embankment operations in progress to an area commensurate with their capability. Progress in keeping the finish grading, mulching, seeding, and other pollution control measures current according to the accepted work schedule. The Engineer may suspend operations if the Contractor fails to provide adequate erosion control measures in a timely manner.

J. In the event of conflict between these requirements and water pollution control laws, rules, or regulations of other Federal, State, or local agencies, the more restrictive laws, rules, or regulations will apply.

K. The Contractor is responsible for water pollution control for work outside the right-of-way or easement obtained by the Contracting Authority.

2602.04 METHOD OF MEASUREMENT.

Measurement for water pollution control items will be as follows:

A. Silt Ditches.
Linear feet (meters) to the nearest 0.1 foot (0.1 m).

B. Silt Fence.
Linear feet (meters) to the nearest 0.1 foot (0.1 m).

C. Silt Fence for Ditch Checks.
Linear feet (meters) to the nearest 0.1 foot (0.1 m).

D. Silt Dikes.
Linear feet (meters) to the nearest 0.1 foot (0.1 m).

E. Silt Basins.
By count for each silt basin.

F. Removal of Silt Fence.
Linear feet (meters) to the nearest foot (0.1 m).

G. Removal of Silt Fence for Ditch Checks.
Linear feet (meters) to the nearest foot (0.1 m).

H. Removal of Silt Basins.
Cubic yards (cubic meters) as Class 10 Excavation according to Article 2102.04 for material used to fill silt basins.

I. Clean-out of Silt Fence.
Linear feet (meters) to the nearest foot (meter).

J. Clean-out of Silt Fence for Ditch Check.
Linear feet (meters) to the nearest foot (meter).

K. Removal and Reinstallation of Silt Fence.
Linear feet (meters) to the nearest foot (meter).

2602.05 BASIS OF PAYMENT.

A. Payment for water pollution control items will be the contract unit price as described below. Payment for construction of water pollution control items is full compensation for labor, equipment and materials necessary to construct the items according to the contract documents.

1. Silt Ditches.
Per linear foot (meter) for the length of silt ditches properly constructed.

2. **Silt Fence.**
   Per linear foot (meter) for the length of silt fence properly installed.

3. **Silt Fence for Ditch Checks.**
   Per linear foot (meter) for the length of silt fence for ditch checks properly installed.

4. **Silt Dikes.**
   Per linear foot (meter) for the length of silt dikes properly constructed.

5. **Silt Basins.**
   Each for properly constructed silt basins.

6. **Removal of Silt Fence.**
   Per linear foot (meter) for the length of silt fence properly removed.

7. **Removal of Silt Fence for Ditch Checks.**
   Per linear foot (meter) for the length of silt fence for ditch checks properly removed.

8. **Removal of Silt Basins.**
   Per cubic yard (cubic meter) for Class 10 Excavation, according to Article 2102.05, for each silt basin properly filled.

9. **Clean-out of silt Fence.**
   Per linear foot (meter) for silt fence properly cleaned out.

10. **Clean-out of Silt Fence for Ditch Check.**
    Linear foot (meter) of silt fence for ditch check properly cleaned out.

11. **Removal and Reinstallation of Silt Fence.**
    Two times the contract unit price for the type of silt fence properly repaired for silt fence that must be replaced by removal and reinstallation, through no fault of the Contractor.

B. When it is necessary for the Contractor to clean out, repair, or reconstruct a silt ditch, dike, or basin, the additional payment will be 100% of the contract unit price for construction of that item. When applicable bid items are not in the contract documents, payment for clean out, repair, or reconstruction will be according to Article 1109.03, B.

C. If water control measures are required due to the Contractor's negligence, carelessness, or failure to install the controls as a part of the work as scheduled, and are ordered by the Engineer, perform this work at no additional cost to the Contracting Authority.

D. All water pollution control features are to be in functional condition before final acceptance of the contract.

Section 2610. Furnish and Install Shrubs, Trees, and Vines

2610.01 DESCRIPTION.

Furnish and install plants and planting material of the type, class, species, grade, and size specified in the contract documents.

2610.02 MATERIALS.

Furnish plants and planting materials for installation and incidental materials required for proper placement meeting the requirements of Section 4170. Substitutions will be permitted according to Article 4170.02, B, 6.

2610.03 INSTALLATION.

A. Handling and Temporary Storage.

1. Maintain plants in good condition during handling at point of delivery and in transportation from temporary storage. Protect all roots with moist straw, moss, or other suitable material.

2. When being transported in an open vehicle, further protect all plants with a tarpaulin.

B. Location of Plantings.

1. The Engineer will stake the location of planting of each type of material specified. Locations of trees will be staked individually before excavation for planting.

2. The outline and number of plants for shrub beds will be indicated without staking the location of individual plants.

3. Do not set plants in rows or straight lines, unless required.

C. Pruning.

1. General.
- **a.** Complete pruning prior to wrapping.
- **b.** Perform all pruning to retain the natural shape of the plant. Unless removing dead or damaged material, do not top plants. Prune back broken and damaged branches to the closest outward growing bud on healthy sound wood. Remove rubbing branches and suckers. Remove all stubs. Remove all debris resulting from pruning from the right-of-way according to Article 1104.08.

2. Deciduous Trees.
- **a.** Remove all broken, damaged, or otherwise defective branches, as well as all branches which may not develop properly. In addition, eliminate narrow crotches or competing leaders.
- **b.** Prune trees to develop an upright leader which will best promote the symmetry of the tree. Prune flowering or specimen trees to develop their natural form.

3. Evergreen Trees and Shrubs.
Remove dead and broken branches.

4. Deciduous Shrubs.
Remove dead or irregular branches.

5. Vines and Ground Cover.
Remove broken, damaged, or dead portions from vines and ground cover plants.

D. Wrapping.

1. Complete wrapping in the Fall prior to the final watering in the year the plant is planted.

2. Wrap deciduous trees (except Hawthorn, Russian Olive, and other multi-stemmed varieties) from the ground line up to and including the crotch formed by the first major branch. Self tie or secure wrapping with paper tape.

3. Remove identification ties and tags on plant material at the end of the contract period.

E. Planting.
Spring planting dates for evergreens are between March 1 and April 30, and for deciduous plants are between March 1 and May 15. Fall planting dates for evergreens are between September 1 and September 30, and for deciduous plants are between October 1 and November 30. Complete any plantings not completed by the completion date specified in the contract documents during the next planting period, unless otherwise directed by the Engineer. Plant the plant materials according to the following:

1. Area Preparation and Excavation of Planting Wells.
a. Prior to excavation, till entire area to be mulched with a rotary tiller or other method the Engineer approves.
b. Unless shown otherwise in the contract documents, perform the excavation according to Table 2610.03-1:

Table 2610.02: Planting Well Excavation

ENGLISH UNITS		
Type of plant material	**Diameter**	**Excavation depth**
Bare root trees:		
Less than 1/2 in.	Root spread +12 in.	1 1/2 ft.
1/2 in. to 1 3/4 in.	3 ft.	2 ft.
1 3/4 in. to 3 in.	4 ft.	2 ft.
3 in. to 4 in.	5 ft.	3 ft.
4 in. to 6 in.	6 ft.	3 ft.
6 in. and over	As specified	As specified
B & B trees & shrubs	Ball diameter + 16 in.	Ball height + 8 in.
Shrubs	24 in.	18 in.

Dwarf shrubs, vines, & ground cover	Root spread +12 in.	18 in.
Container grown	Cont. diameter + 16 in.	Cont. height + 8 in.
Seedlings[(a)]	Root spread +12 in.	12 in.
METRIC UNITS		
Type of plant material	**Diameter**	**Excavation depth**
Bare root trees:		
Less than 15 mm	Root spread +0.3 m	0.5 m
15 mm to 45 mm	1.0 m	0.6 m
45 mm to 80 mm	1.3 m	0.6 m
80 mm to 100 mm	1.5 m	1.0 m
100 mm to 150 mm	2.0 m	1.0 m
150 mm and over	As specified	As specified
B & B trees & shrubs	Ball diameter + 0.4 m	Ball height + 0.2 m
Shrubs	0.6 m	0.45 m
Dwarf shrubs, vines, & ground cover	Root spread +0.3 m	0.45 m
Container grown	Cont. diameter + 0.4 m	Cont. height + 0.2 m
Seedlings[(a)]	Root spread + 0.3 m	0.3 m
[(a)] Does not apply if a seedling planter is used.		

c. On slopes, measure the depth at the low point on outer edge of the planting well.

d. During excavation, further loosen the soil in the bottom of the planting well to a depth of 6 inches (150 mm). If an auger is used to excavate the planting well, use a spade or other approved method to remove the compacted, smooth surface on the sides of the well.

e. If the excavation is in an impervious soil, the planting may be relocated with the Engineer's approval.

f. For seedlings, a seedling planter may be used.

2. Backfill Material and Fertilizer.

a. Acquire backfill material for plantings from soil salvaged from the excavation of the planting well. Ensure backfill material has a uniform appearance and is loose, friable, and free of hard clods and rock 2 inches (50 mm) in diameter or larger.

b. For initial plantings and first year replacements, fertilize using 0-46-0 fertilizer thoroughly mixed with the backfill material at the following rates:

- 1 1/2 pounds (0.7 kg) of fertilizer per tree.
- 1/4 pound (0.1 kg) of fertilizer per shrub, seedling or vine.

c. Prior to the final watering, spread 20-10-10 chemically combined commercial fertilizer uniformly over the mulched area of each plant at the following rates:

- 1 pound (0.5 kg) per tree.
- 1/4 pound (0.1 kg) per shrub, seedling or vine.

3. Placing Backfill Material for Bare Root Plant Material.

- **a.** Prior to planting, prune all broken or cut roots back to sound wood with a clean cut. Prune approximately 1/2 inch (15 mm) off all roots 1/2 inch (15 mm) diameter and larger.
- **b.** Place the plant at the same grade line as it grew in the nursery. Backfill material may be firmed by tamping, but vigorous tamping will not be permitted.
- **c.** Exercise care during backfill material placement to avoid damage to the roots.
- **d.** At this point, water the plant as specified in Paragraph 6 of this article.

4. Placing Backfill Material for Balled and Burlapped Plant Material.

- **a.** Before placing the plant, place and tightly firm the backfill material until the planting well is deep enough to set the top of the ball at the existing grade line. Place the plant and firmly pack the backfill material around the base of the ball to hold the plant in an upright position.
- **b.** Ensure soil in the plant ball is moist at the time of planting. Remove any wire, twine, burlap, and so forth tied or wrapped around the stem of the plant.
- **c.** Complete all of these processes with minimum disturbance of the soil ball:
  - **1)** After placement, remove the upper half of any wire mesh.
  - **2)** Cut and fold the remaining mesh into the bottom of the well.
  - **3)** Push the burlap from the top and sides of the ball to the bottom of the planting well.
  - **4)** Continue placing backfill material to the finished grade line.
  - **5)** After placement, remove the sides of all wooden baskets.
- **d.** At this point, water the plant as specified in Article 2610.03, E, 6.

5. Placing Backfill Material for Container Grown Plant Material.

- **a.** Thoroughly water container plants the day prior to planting.
- **b.** Before placing the plant, firm the backfill material until the planting well is deep enough to allow the top of the soil in the container to match the existing grade line.
- **c.** Carefully remove the plant from the container and place the plant in the planting well with minimum disturbance to the soil ball.
- **d.** Firmly pack the backfill material around the base of the roots to hold the plant in an upright position. Continue placing backfill material to the finished grade line.
- **e.** Carefully remove plants from all containers (plantable and non-plantable) in a manner that does not disturb the potted soil or the roots.

6. Watering and Final Shaping.

- **a.** Water plants initially within 4 hours of planting unless otherwise directed by the Engineer.
- **b.** Perform the initial watering by inserting a pipe to the bottom of the planting well and filling the well with water. At all times, perform watering at an extremely low pressure to prevent washing.

c. Reposition the plant as necessary to allow proper planting depth. Take necessary precautions to minimize root damage.

d. At this time, additional backfill material may be required to compensate for any settlement. Shape the final backfill material of the planting to form a 2 inch (50 mm) deep basin at the base of the plant.

e. After allowing the water to drain into the soil, the above procedure is repeated until the required amount of water necessary to thoroughly soak the backfill material with no further settlement has been applied.

f. Perform subsequent waterings as follows:

1) Fill each plant basin completely and allow the water to drain into the soil.

2) Refill the plant basin with water. Repeat this process until the required amount of water has been applied.

3) Penetration of the backfill material with a pipe or other means will not be allowed. Adjust water pressure to ensure no damage to the plant or displacement of soil or mulch.

g. Watering schedule is as follows:

Initial Watering	within 4 hours of planting
Second Watering	7 calendar days after the initial watering
Third Watering	14 calendar days after the second watering
Fourth and subsequent Waterings	21 calendar days apart until November 1.

Second Growing Season (As applicable):
Water plants monthly from May through November.

h. Ensure replacements receive the first three waterings as listed above, and then are watered monthly with the rest of the project.

i. Notify the Engineer prior to watering. If the Contractor requests, and the Engineer concurs, deviation from the watering schedule may be allowed. Weather and soil conditions that result in adequate water being available to the plant at the time of a scheduled watering may delay, delete, or reduce that watering as directed by the Engineer. The Engineer may request additional watering when dry soil conditions exist.

F. Staking and Guying.

1. Complete staking by the end of each day for all plant material planted during the day, unless otherwise approved by the Engineer. Use two stakes placed on opposite sides of the tree to stake all deciduous trees 1 inch to 2 1/2 inches (25 mm to 60 mm) in diameter, except multi-stemmed varieties of Hawthorn, Amur Maple, Serviceberry, and Russian Olive and all upright evergreens from 4 feet to 8 feet (1.2 m to 2.5 m) in height. Place one of the stakes on the southwest side of the tree or as directed by the Engineer. Extend the stakes to approximately 50% of the height of the tree or a maximum of 7 feet (2 m) from the ground after being driven until firm. Drive the stakes parallel to the trunk of the tree and in unexcavated soil.

2. Using ties approved by the Engineer, firmly tie between the two stakes all upright evergreens from 4 feet to 8 feet (1.2 m to 2.5 m) and all deciduous trees 1 inch to 2 1/2 inches (25 mm to 60 mm) in diameter, except multi-stemmed varieties of Hawthorn, Amur Maple, Serviceberry, and Russian Olive. Fasten ties to the stakes 6 inches (150 mm) from the top.

3. Guy deciduous trees over 2 1/2 inches (60 mm) in diameter and all evergreens over 8 feet (2.5 m) in height using three guys equally spaced about the perimeter of the tree. Use a collar encased with material specified in Article 4170.09, D, to attach guys to the tree. Attach at a point approximately one-half to two-thirds of the distance from the ground to the top. Firmly attach the guys to anchors embedded in the ground.

4. Use anchors of the sizes in Table 2610.03-2:

Table 2610.03-2: Anchor Sizes

Tree Diameter	Anchor Shank		Anchor Minimum Disk Diameter
	Min. Dia.	Min. Length	
2 1/2 to 4 in. (60 to 100 mm) over 4 in. (over 100 mm)	1/2 in. (13 mm) 3/4 in. (20 mm)	24 in. (0.6 m) 36 in. (1.0 m)	4 in. (100 mm) 5 in. (125 mm)

5. Place anchors at a distance from the trunk of the tree which is approximately 50% the distance from the ground to the point where the collar is attached. Use the anchors specified in the contract documents or approved equal.

6. Approximately 1 foot (0.3 m) from the trunk of each tree not specified to be tied or guyed, drive one 5 foot (1.5 m) witness stake until firm. At shrub groups, drive a 5 foot (1.5 m) stake, until firm, 2 feet (0.6 m) outside the outermost shrubs at a frequency that defines the shape of the area. On living snow fence and seedlings, place one stake 2 feet (0.6 m) outside every tenth shrub or seedling along sides exposed to areas being mowed.

7. Use staking and guying material specified in Article 4170.09, D.

G. Mulching.

1. Furnish and place material as specified around trees, shrubs, vines, and seedlings according to the contract documents. Install mulch around the plant material within 4 calendar days after planting. Clear the following areas of all foreign material and vegetation and mulch:

- An area 6 feet by 6 feet (1.8 mm by 1.8 mm) around all trees,
- The entire area of shrub groups including 2 feet (0.6 m) outside the outermost shrubs, and
- A 9 inch (225 mm) radius around seedlings.

2. Use a temporary 6 foot x 6 foot x 4 inch (1800 mm x 1800 mm x 100 mm) form to facilitate placement of the mulch around the trees.

3. Repair mulch displaced or disturbed at no additional cost to the Contracting Authority.

H. Cleanup.

1. Remove excess soil and rocks from excavations, according to Article 1104.08, as directed by the Engineer.

2. Remove packing materials, burlap, brush, limbs and other trimmings, according to Article 1104.08.

3. Prepare disturbed areas and seed as specified in Article 2601.03, B.

4. Cleanup work will be considered incidental to construction work, and no extra compensation will be allowed.

I. Plant Establishment Period and Replacement.

1. The establishment period of one or two growing seasons as specified in the contract documents begins at the time the last plant is planted and incidental work related to the plantings is complete. If an establishment period is not specified in the contract documents, the establishment period is 1 year.

2. During the period of the contract, properly care for all plants. Water and weed them, spray with insecticides, cultivate, adjust stakes, wraps, and ties, and perform other work which is necessary to keep the plants in a live, healthy, and growing condition. Water plants as specified or as required by the Engineer.

3. Ensure the entire mulched area is free of vegetation. Vegetation in the mulch may be removed by pulling or cutting at ground level. In the 2 foot (0.6 m) area adjacent to the mulch, maintain vegetation to a height between 6 inches to 9 inches (150 mm to 225 mm). Replace plants damaged due to Contractor's carelessness at no additional cost to the Contracting Authority.

4. Obtain the Engineer’s approval for pesticide use for competing vegetation, insect, or disease control prior to application. Apply pesticides according to product label directions and current state laws and regulations.

5. Replace plants (except seedlings) that are not in a live, healthy, growing condition at the end of each growing season. Install replacement plants during the planting periods mentioned in Article 2610.03, E. If the contract is for one growing season, plant replacement plants in the fall of that year.

6. If the contract is for two growing seasons, plant replacement plants for the first growing season the following spring. Plant replacement plants for the second growing season in the fall of that year.

7. Evergreens will be checked at approximately August 15 and deciduous plants will be checked at approximately September 1. The Engineer will furnish a replacement list.

8. Supply replacement plants of the variety and size originally specified. Install as specified in Article 2610.03, E, including fertilizing and watering. The original mulch may be reused for replacement plants. An additional care period will not be required for second year replacement plants.

2610.04 METHOD OF MEASUREMENT.

Measurement for materials, satisfactorily installed will be measured as follows:

A. Plants.
By count for shrubs, trees, or vines in place.

B. Mulch.
Computed in cubic yards (cubic meters) in place by adding the volumes of each mulch area. The volume of each mulch area will be determined from the length and width measured to the nearest 0.1 foot (0.1 m) and depth to the nearest 0.05 feet (10 mm).

C. Fertilizer.
By count and weight (mass) of packages in pounds (kilograms) or by measurement at the time it is applied.

D. Water.
By units of 1000 gallons (kiloliter) at the time it is applied.

2610.05 BASIS OF PAYMENT.

A. Payment will be contract unit price as follows:

1. Plants.
Each for the number of shrubs, trees, or vines in place.

2. Mulch.
Per cubic yard (cubic meter).

3. Fertilizer.
Per pound (kilogram).

4. Watering.
Per 1000 gallon unit (kiloliter unit).

B. Payments are full compensation for furnishing all materials, equipment and labor, and for performing all work necessary according to the contract documents including:

- Excavation and placing backfill,
- Wrapping, staking, tying, guying and pruning of trees,
- Maintenance during the establishment period, and
- Replacements.

C. When excavation is made in impervious soils or the excavation of a new planting well is directed by the Engineer, payment for the work will be as extra work according to Article 1109.03, B.

D. When substitution of a plant or planting material becomes necessary, payment will be made at the contract unit price for the substitute.

Section 2611. Furnish and Install Shrubs and Trees with Warranty

2611.01 DESCRIPTION.

A. Furnish and install tree and shrub materials of the type, class, species, grade, and size specified in the contract documents. The requirements in Section 2610 do not apply to this work unless stated otherwise in this specification.

B. The Contractor has the option to use the provisions of Articles 2610.03, A; 2610.03, D; 2610.03, E; or 2610.03, F as a guideline for planting techniques to enhance survivability of plant materials, at no additional cost to the Contracting Authority.

C. The contract period for this work is two growing seasons for all plants.

2611.02 MATERIALS.
Meet the requirements of Section 4170.

2611.03 CONSTRUCTION.
Plant trees and shrubs and first year replacements between March 1 and May 15. Plant second year replacements between September 1 and September 30 for evergreens and between October 1 and November 30 for deciduous plants.

A. Plant Establishment Period and Replacement.

1. The plant establishment period will be the first two growing seasons. The establishment period will begin when the last plant of the initial installation is planted and incidental work related to the plantings is complete.

2. Use chemical methods to control competing vegetation in the entire mulched area throughout the contract period. Chemical methods to remove vegetation shall be applied by a Certified Pesticide Applicator - Category 6 (Right of Way).

3. Obtain the Engineer's approval prior to applying pesticides and herbicides used for competing vegetation, insect, or disease control. Use pesticides and herbicides according to product label directions.

4. Replace all plants that are not in a live, healthy, growing condition at the end of each of the first two growing seasons. Plant the replacement plants for the first growing season the following spring. Plant the replacement plants for the second growing season in the fall of that year. Ensure replacement plants are of the variety and size originally specified in the contract documents.

5. The Contractor may salvage and reuse the original mulch for replacement plants. If the original mulch is not available, suitable, or salvageable for reuse, place new mulch around the replacement plants. The Contractor is responsible for replacement costs.

B. Inspection of Plant Materials.

1. Verify correct species have been planted. Also verify compliance with ANSI Z60.1, American Standard for Nursery Stock.

2. The Engineer will inspect the plant materials, staking and guying, and mulch after the initial installation or on May 16, whichever comes first. This includes the inspection for:

- Size, number, location, alignment, and viability of plant materials,
- Correct depth and area of mulch, and
- Installation of stakes and guys as specified in the contract documents.

3. In August of each year of the establishment period, identify all dead plants using tie-on plastic flagging, all of one color, in a location that is easily seen.

4. By August 30 of each year, submit to the Engineer marked copies of the plant location plan sheets showing the number and species of replacement plants required for each location for that year. Submit tabulations of the total number of replacement plants of each species on each plan sheet. Indicate the total number of replacement plants for the project.

5. The Contracting Authority will inspect the plant materials in the fall of each growing season. The Contracting Authority will verify, during this inspection, the number of living plants and determine if the correct species of plants were used.

6. The Contracting Authority will also inspect and verify any replacement plant materials after installation.

2611.04 METHOD OF MEASUREMENT.

Measurement will be as follows:

A. Shrubs with the specified mulch: by count of live shrubs installed.

B. Trees with the specified mulch: by count of live trees installed.

2611.05 BASIS OF PAYMENT.

A. Payment will be the contract unit price for each Tree, Furnished and Installed according to the contract documents.

B. Payment will be the contract unit price for each Shrub, Furnished and Installed according to the contract documents.

C. For each time each species is requested for substitution, a $250.00 price reduction will be charged. When substitutions are made, the Engineer will price adjust downward. No participation in price increases will be incurred.

D. Payments will be made in increments according to the following schedule:

1. **After Initial Installation is Complete.**
   Sixty-five percent of the placed quantity will be paid for all live plants of each size and variety installed with the specified mulch, and meeting the staking and guying requirements. This payment will be made after the initial inspection by the Engineer.

2. **End of the First Growing Season.**
   a. Payment will be based on the total project's first year survival rate. Plants not in compliance with the contract documents will be considered dead.
   b. A percent of the placed quantity will be paid for each tree and shrub correctly installed according to the schedule in Table 2611.05-1:

Table 2611.05-1: Payment, End of First Growing Season

Total Project Survival Rate	% of Placed Quantity
85 - 100%	10%
60 - 84%	5%
Below 60%	0%

3. **After First Year Replacement Installation.**
   After replacement plants have been installed, 5% of the placed quantity will be paid for all plants considered alive at the end of the previous growing season including all plants replaced.

4. **End of the Second Growing Season.**
   a. Payment will be based on the total project's second year survival rate. Plants not in compliance with the contract documents will be considered dead.
   b. A percent of the placed quantity will be paid for each tree and shrub correctly installed according to the following schedule. Payment for plants requiring replacement will be after replacement is complete. Payment will be according to the schedule in Table 2611.05-2:

Table 2611.05-2: Payment, End of Second Growing Season

Total Project Survival Rate	% of Placed Quantity
85 - 100% 60 - 84% Below 60%	20% 10% 0%

E. Payments are full compensation for:
- Furnishing all materials, equipment, and labor,
- Performing all work necessary according to the contract documents including excavating, placing backfill, mulching, pruning of trees and shrubs, replacements, and
- Methods used to ensure the survivability of the planted trees and shrubs.

F. When excavation is made in impervious soils or the excavation of a new planting well is directed by the Engineer, the Contractor will be paid for this extra work according to Article 1109.03, B.

Section 2612. Mowing

2612.01 DESCRIPTION.
Mow a strip of vegetation along the edges of shoulders, in the medians, and within designated interchange areas. Perform incidental hand mowing around obstacles.

2612.02 MATERIALS.
None.

2612.03 MOWING.

A. Equipment.

1. Use tractors with sickle type mowers, underbody rotary mowers, gang type rotary mowers, or other types the Engineer approves. Equip rotary mowers with a suction type blade and safety chains or other approved protective devices. Ensure sickle bar mowers have protective shields on all sections. Replace broken sections to ensure a clean, smooth cut. Make available on the project an extra set of operable blades to fit available equipment.

2. Equip each tractor with an amber revolving light:
- Visible from the front and rear,
- Mounted at least 10 feet (3 m) high as measured to the lamp axis, and
- Flashes between 60 and 120 times per minute.

3. In lieu of an amber revolving light, an amber strobe light may be used.

4. Equip each tractor with a standard triangular slow moving vehicle emblem mounted 4 feet (1.2 m) above the ground with a dimension of

13 1/2 inches (345 mm) per side, a red or fluorescent orange flag, and a rear view mirror. Locate as shown in the contract documents. Use a flag that is 16 inches by 16 inches (400 mm by 400 mm) minimum.

5. Set mower cutting height so that, after completion of the mowing operation, the height of remaining stubble averages 6 inches ± 1 inch (150 mm ± 25 mm).

B. Types.

1. General.
- **a.** The contract documents will specify the type of mowing required. The Engineer will issue a Notice to Proceed to the Contractor for each mowing, based on the projected date when 50% of the vegetation will reach 14 inches (350 mm).
- **b.** Mow a strip of vegetation 15 feet (4.5 m) wide immediately adjacent to the edges of the shoulders and throughout the length of the project. This also includes outside and inside ramp shoulders.

2. Metro Mowing.
- **a.** Metro mowing consists of three to four mowings as stated in the contract documents. Approximate start dates are usually prior to Memorial Day, late June to early July, early to mid August (in a four mowing contract), and after Labor Day.
- **b.** Mow the entire median. In addition to mowing along the shoulder and in the median, mow all other accessible areas including foreslopes, backslopes, ditch bottoms, interchange areas, islands, and along fences.

3. Spring and Fall Mowing.
- **a.** Spring and fall mowing consists of two to four mowings, as stated in the contract documents. Approximate start dates are usually prior to Memorial Day, late June to early July, early to mid August (in a four mowing contract), and after Labor Day.
- **b.** Mow the entire median.

4. Fall Mowing.
- **a.** Fall mowing consists of one mowing, usually after Labor Day.
- **b.** Mow the entire median.

C. Requirements.

1. Prior to mowing, examine the area to be mowed for objects that may cause damage. Immediately remove objects thrown onto the roadway.

2. Advance roadway warning signs will not be required.

3. When not mowing, limit mowing equipment travel to the right hand shoulder of the main line pavement. Do not travel in the traffic lanes except to cross the pavement for purposes of mowing adjacent to the left shoulder.

4. Do not use existing median crossovers. These are for emergency operations only. Confine turnarounds to interchanges.

5. Unless specified otherwise in the contract documents, perform all work during the hours of 30 minutes after sunrise to 30 minutes before sunset.

6. When mowing along the main line and right ramp shoulders, progress in the same direction as traffic. Mowing along the left ramp shoulder in the direction opposite the flow of traffic will be permitted if it can be accomplished without equipment using the left shoulder. Conduct mowing operations so that the equipment does not encroach on the traveled way. When mowing behind guardrail, the direction of travel may be opposite that of adjacent traffic.

7. To avoid leaving a ragged appearance, set the speed of the mowing equipment not to exceed the ability of the mower to cut cleanly. Monitor the operation and maintain the cutting edges in a sharp condition or replace as necessary to prevent unmown strips (rooster tails) or damage to vegetation.

8. Perform mowing in a single pass. If any unmown strip or damage to vegetation is encountered, immediately suspend the operation and take corrective measures, at no additional cost to the Contracting Authority. The Engineer may inspect cutting edges at any time. Additional mowing widths are permissible to take advantage of wider mowing equipment which may be difficult to modify to the required width. The Contractor will not be paid for this additional mowing width.

9. The contract documents will specify the limits of mowing at interchanges and rest areas, if applicable. When more than one pass of the mowing equipment is required, lap successive passes to avoid leaving uncut vegetation. More than one pass of the mowing unit may be necessary to accomplish the mowing. Bunching or windrowing of the mowed vegetation will not be permitted.

10. Hand equipment will be required for areas inaccessible to other equipment, and for trimming around and under delineator posts, sign posts, guardrail, bridges, culverts, or other obstructions. Complete the hand trimming within 3 working days after the adjacent area is mowed with the tractor. This may include hand pulling of weeds. At the direction of the Engineer, replace all roadside trees, shrubs, or appurtenances such as delineator posts, signs, tile systems, tile outlets, etc. damaged due to the mowing operations, at no additional cost to the Contracting Authority.

11. When wet soil conditions result in rutting, suspend mowing. At the direction of the Engineer, repair rutting damage caused by the mowing operation.

12. Parking of Contractor vehicles and equipment will be permitted within the Interstate right-of-way only at locations designated by the Engineer.

In no case will they be allowed closer than 50 feet (15 m) from the shoulder. Parking of private vehicles within the Interstate right-of-way is prohibited.

2612.04 METHOD OF MEASUREMENT.

The area for Roadside Mowing, in acres (hectares), will be shown in the contract documents. The quantity will be based on main line, center line, and ramp base line stationing, with the area calculated in. The length of shoulders at bridges will be deducted when calculating the quantity. The quantity at intersections of main line and ramp shoulders will be calculated so there will not be a deduction or a duplication of quantities. Additional mowing required around guardrails, obstacles, and median crossovers will not be measured separately.

2612.05 BASIS OF PAYMENT.

A. Payment for Roadside Mowing will be the contract unit price per acre (hectare) indicated in the contract documents.

B. Payment is full compensation for mowing according to the contract documents, including:

- Mowing around guardrails, signs, delineators, drainage structures, bridges, and in islands, and
- Trimming with hand equipment.

C. When the Engineer determines mowing is not necessary due to factors such as the lack of vegetation growth during drought conditions, but hand trimming is still required, payment will be 25% of the contract unit price per acre (hectare).