

EROSION AND SEDIMENT CONTROL**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. NPDES General Permit No. 2
- B. Stormwater Pollution Prevention Plan (SWPPP)
- C. Erosion Control Measures
- D. Velocity and Flow Control Measures
- E. Sediment Control Measures
- F. Application/Installation of Measures
- G. Removal/Replacement of Measures

1.02 DESCRIPTION OF WORK

- A. Furnish all materials; install, construct, maintain, and remove specified erosion control devices; at locations specified in the contract documents, or where specified by the Engineer.
- B. Complete the required construction work on this project, while minimizing soil erosion and controlling water pollution. Maintain these features as specified, from initial construction stages to final completion of the project.

1.03 SUBMITTALS

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

Upon request, provide copies of all records and documentation related to compliance with the Iowa DNR NPDES Permit.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

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

- A. Implement erosion and sediment control measures at the appropriate time(s).
- B. Coordinate construction to minimize damage to erosion and sediment control devices.

1.07 SPECIAL REQUIREMENTS**A. Permit:**

1. When applicable, comply with the requirements of the Iowa Department of Natural Resources, *NPDES (National Pollutant Discharge Elimination System) General Permit No. 2 for Stormwater Discharge Associated with Industrial Activity for Construction Activities*, and the Stormwater Pollution Prevention Plan.
2. For projects covered under the Iowa DNR General Permit No. 2, sign on as a co-permittee with the owner and any other contractors or subcontractors.
3. When applicable, comply with the local jurisdiction's permitting requirements.

B. Protection of Property: Prevent accumulation of soil, sediment, or debris from project site onto adjoining public or private property. Remove any accumulation of soil or debris immediately, and take remedial actions for prevention.

C. Permit Compliance: When applicable, conduct all operations in compliance with the Iowa DNR NPDES General Permit No. 2. Labor, equipment, or materials not included as a bid item, but necessary to prevent stormwater contamination from construction related sources, are considered incidental. Incidental work related to compliance with the permit may include, but is not limited to: hazardous materials protection, fuel containment, waste disposal, and providing employee sanitary facilities.

D. Project Staging: Replacing erosion and sediment control practices that are damaged or removed by the contractor in a manner that is inconsistent with the current project staging or SWPPP is the Contractor's responsibility and will be at the Contractor's expense.

1.08 MEASUREMENT AND PAYMENT**A. Stormwater Pollution Prevention Plan (SWPPP):****1. Preparation:**

- a. **Measurement:** Lump sum item; no measurement will be made.
- b. **Payment:** Payment will be at the lump sum price for SWPPP preparation.
- c. **Includes:** Lump sum price includes, but is not limited to, development of a SWPPP by the Contractor meeting local and state agency requirements, filing the required public notices, filing a Notice of Intent for coverage of the project under the Iowa DNR NPDES General Permit No. 2, and payment of associated NPDES permit fees.
- d. **Other:** Item will be paid for upon approval of the SWPPP by the Engineer, and after the Notice of Intent has been filed by the Contractor.

2. Management:

- a. **Measurement:** Lump sum item; no measurement will be made.
- b. **Payment:** Payment will be at the lump sum price for SWPPP management.
- c. **Includes:** Lump sum price includes all work required to comply with the administrative provisions of the Iowa DNR NPDES General Permit No. 2; including record keeping, documentation, updating the SWPPP, filing the Notice of Discontinuation, etc. Item also includes weekly inspections required to satisfy the provisions of General Permit No. 2, unless otherwise specified in the contract documents.
- d. **Does Not Include:** Unit price does not include installation or maintenance of erosion and sediment control practices, or inspection after 1/2 inch or greater rainfall events.
- e. **Other:** The Engineer may make partial payments based on estimates of the project completion. Final payment will be made when the site reaches final stabilization and the Notice of Discontinuation is filed.

1.08 MEASUREMENT AND PAYMENT (Continued)**3. Qualifying Rainfall Event Inspection:**

- a. **Measurement:** Based on inspection records, each individual inspection required and performed after a 1/2 inch or greater rainfall event will be counted.
- b. **Payment:** Payment will be at the unit price for each inspection.

B. Compost Blankets:

1. **Measurement:** Measurement will be in square feet for each thickness of compost blanket.
2. **Payment:** Payment will be at the unit price per square foot for each thickness of compost blanket.

C. Filter Berms:

1. **Measurement:** Measurement will be in linear feet for each size of filter berm, measured longitudinally along the top of the berm.
2. **Payment:** Payment will be at the unit price per linear foot for each size of berm.

D. Filter Socks:

1. **Installation:**
 - a. **Measurement:** Measurement will be in linear feet for each size of filter sock.
 - b. **Payment:** Payment will be at the unit price per linear foot for each size of filter sock.
 - c. **Includes:** Unit price includes, but is not limited to, anchoring stakes.
2. **Removal:**
 - a. **Measurement:** Measurement will be in linear feet of filter sock removed.
 - b. **Payment:** Payment will be at the unit price per linear foot of filter sock removed.
 - c. **Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of filter socks and accumulated sediment.

E. Temporary Rolled Erosion Control Products (RECP):

1. **Measurement:** Measurement will be in square yards, based on the width specified in the contract documents and actual measured length, for each type of temporary RECP.
2. **Payment:** Payment will be at the unit price per square yard for each type of temporary RECP.
3. **Includes:** Unit price includes, but is not limited to, excavation, staples, anchoring devices, and material for anchoring slots.

F. Wattles:

1. **Installation:**
 - a. **Measurement:** Measurement will be in linear feet for each type and size of wattle.
 - b. **Payment:** Payment will be at the unit price per linear foot for each type and size of wattle.
 - c. **Includes:** Unit price includes, but is not limited to, anchoring stakes.
2. **Removal:**
 - a. **Measurement:** Measurement will be in linear feet of wattle removed.
 - b. **Payment:** Payment will be at the unit price per linear foot of wattle removed.
 - c. **Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of wattle and accumulated sediment.

1.08 MEASUREMENT AND PAYMENT (Continued)**G. Check Dams:****1. Rock Check Dams:**

- a. **Measurement:** Measurement will be in ton of stone installed.
- b. **Payment:** Payment will be at the unit price per ton of stone installed.
- c. **Includes:** Unit price includes, but is not limited to, engineering fabric.

2. Manufactured Check Dams:**a. Installation:**

- 1) **Measurement:** Measurement will be in linear feet for each type and size of manufactured check dam.
- 2) **Payment:** Payment will be at the unit price per linear foot for each type and size of manufactured check dam.
- 3) **Includes:** Unit price includes, but is not limited to, anchoring stakes.

b. Removal:

- 1) **Measurement:** Measurement will be in linear feet for each type of manufactured check dam removed.
- 2) **Payment:** Payment will be at the unit price per linear foot for each type of manufactured check dam removed.
- 3) **Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of manufactured check dam and accumulated sediment.

H. Temporary Earth Diversion Structures:

1. **Measurement:** Measurement will be in linear feet for each type and size of temporary earth diversion structure.
2. **Payment:** Payment will be at the unit price per linear foot of temporary earth diversion structure.
3. **Includes:** Unit price includes, but is not limited to, removal of the structure upon completion of the project.

I. Level Spreaders:

1. **Measurement:** Measurement will be in linear feet of level spreaders.
2. **Payment:** Payment will be at the unit price per linear foot of level spreader.
3. **Includes:** Unit price includes, but is not limited to, maintaining the spreader during the period of construction and removal upon completion of the project, unless otherwise specified in the contract documents.

J. Rip Rap:

1. **Measurement:** Measurement will be in tons for each type of rip rap.
2. **Payment:** Payment will be at the unit price per ton of rip rap.
3. **Includes:** Unit price includes, but is not limited to, engineering fabric.

1.08 MEASUREMENT AND PAYMENT (Continued)**K. Temporary Pipe Slope Drains:**

1. **Measurement:** Measurement will be in linear feet for each type and size of temporary pipe slope drain, measured from end of apron to end of apron.
2. **Payment:** Payment will be at the unit price per linear foot for each type and size of pipe.
3. **Includes:** Unit price includes, but is not limited to, excavation, furnishing and installing pipe and pipe aprons, grading, and removal of the slope drain upon completion of the project.

L. Sediment Basin:

1. **Outlet Structure:**
 - a. **Measurement:** Each size of sediment basin outlet structure will be counted.
 - b. **Payment:** Payment will be at the unit price for each sediment basin outlet structure.
 - c. **Includes:** Unit price includes, but is not limited to, concrete base, dewatering device, anti-vortex device, outlet pipe, and anti-seep collars (if specified).
 - d. **Does Not Include:** Unit price does not include earthwork required for construction of the sediment basin.
2. **Removal of Sediment:**
 - a. **Measurement:** Each occurrence of sediment removal will be counted.
 - b. **Payment:** Payment will be at the unit price for each occurrence of sediment removal.
 - c. **Includes:** Unit price includes, but is not limited to, dewatering and removal and off-site disposal of accumulated sediment.
3. **Removal of Outlet Structure:**
 - a. **Measurement:** Each sediment basin outlet structure removed will be counted.
 - b. **Payment:** Payment will be at the unit price for each sediment basin outlet structure removed.
 - c. **Includes:** Unit price includes, but is not limited to, dewatering and off-site disposal of the outlet structure, concrete base, emergency spillway, and accumulated sediment.
 - d. **Does Not Include:** Unit price does not include earthwork required to remove the sediment basin and restoration of the area to finished grade.

M. Sediment Trap Outlet:

1. **Installation:**
 - a. **Measurement:** Measurement will be in tons of crushed stone placed.
 - b. **Payment:** Payment will be at the unit price per ton of crushed stone.
 - c. **Includes:** Unit price includes, but is not limited to, engineering fabric.
 - d. **Does Not Include:** Unit price does not include earthwork required for construction of the sediment trap.
2. **Removal of Sediment:**
 - a. **Measurement:** Each occurrence of sediment removal will be counted.
 - b. **Payment:** Payment will be at the unit price for each occurrence of sediment removal.
 - c. **Includes:** Unit price includes, but is not limited to, dewatering and removal and off-site disposal of accumulated sediment.

1.08 MEASUREMENT AND PAYMENT (Continued)**3. Removal of Device:**

- a. **Measurement:** Each sediment trap outlet removed will be counted.
- b. **Payment:** Payment will be at the unit price for each sediment trap outlet removed.
- c. **Includes:** Unit price includes, but is not limited to, dewatering and off-site disposal of sediment trap outlet and accumulated sediment.
- d. **Does Not Include:** Unit price does not include earthwork required to remove the sediment trap outlet and restoration of the area to finished grade.

N. Silt Fence or Silt Fence Ditch Check:**1. Installation:**

- a. **Measurement:** Measurement will be in linear feet of silt fence or silt fence ditch check.
- b. **Payment:** Payment will be at the unit price per linear foot of silt fence or silt fence ditch check.
- c. **Includes:** Unit price includes, but is not limited to, anchoring posts.

2. Removal of Sediment:

- a. **Measurement:** Measurement will be in linear feet of silt fence or silt fence ditch check.
- b. **Payment:** Payment will be at the unit price per linear foot of silt fence or silt fence ditch check.
- c. **Includes:** Unit price includes, but is not limited to, anchoring posts.

3. Removal of Device:

- a. **Measurement:** Measurement will be in linear feet of silt fence removed.
- b. **Payment:** Payment will be at the unit price per linear foot of silt fence removed.
- c. **Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of fence, posts, and accumulated sediment.

O. Stabilized Construction Entrance:**1. Stabilized Construction Entrance by Square Yard:**

- a. **Measurement:** Measurement will be in square yards of material placed.
- b. **Payment:** Payment will be at the unit price per square yard of material placed.
- c. **Includes:** Unit price includes, but is not limited to, subgrade stabilization fabric.

2. Stabilized Construction Entrance by Ton:

- a. **Measurement:** Measurement will be in tons of material placed.
- b. **Payment:** Payment will be at the unit price per ton of material placed.
- c. **Includes:** Unit price includes, but is not limited to, subgrade stabilization fabric.

P. Dust Control:**1. Water for Dust Control:**

- a. **Measurement:** Measurement will be by metering of water applied to haul roads and other areas to control dust. If metering is not available, measurement will be by counting the loads from a transporting tank of known volume and gauging the contents of the transporting truck for partial loads.
- b. **Payment:** Payment will be at the unit price per 1,000 gallons of water used.
- c. **Includes:** Unit price includes, but is not limited to, furnishing, transporting, and distributing water to the haul road.

2. Dust Control Product:

- a. **Measurement:** Measurement will be in square yards of the treated area.
- b. **Payment:** Payment will be at the unit price per square yard of product applied.

1.08 MEASUREMENT AND PAYMENT (Continued)**Q. Erosion Control Mulching:****1. Conventional Mulching:**

- a. **Measurement:** Measurement will be in acres of conventional mulch.
- b. **Payment:** Payment will be at the unit price per acre of conventional mulch.

2. Hydromulching:

- a. **Measurement:** Measurement will be in acres for each type of hydromulch.
- b. **Payment:** Payment will be at the unit price per acre for each type of hydromulch.

R. Turf Reinforcement Mats (TRM):

1. **Measurement:** Measurement will be in squares for each type of turf reinforcement mat, each square containing 100 square feet.
2. **Payment:** Payment will be at the unit price per square for each type of turf reinforcement mat.
3. **Includes:** Unit price includes, but is not limited to, excavation, staples, anchoring devices, and material for anchoring slots.

S. Surface Roughening:

1. **Measurement:** Measurement will be in square feet of surface roughening, including directional tracking or grooving/furrowing.
2. **Payment:** Payment will be at the unit price per square foot of surface roughening.

T. Inlet Protection Device:**1. Installation:**

- a. **Measurement:** Each type of inlet protection device will be counted.
- b. **Payment:** Payment will be at the unit price for each inlet protection device.
- c. **Includes:** Unit price includes, but is not limited to, removal of the device upon completion of the project.

2. Maintenance:

- a. **Measurement:** Each inlet protection device maintenance occurrence will be counted.
- b. **Payment:** Payment will be at the unit price for each inlet protection device maintenance occurrence.
- c. **Includes:** Unit price includes, but is not limited to, removal and off-site disposal of accumulated sediment.

U. Flow Transition Mat:

1. **Measurement:** Measurement will be in square feet of flow transition mat.
2. **Payment:** Payment will be at the unit price per square foot of flow transition mat.
3. **Includes:** Unit price includes, but is not limited to, anchoring devices.

PART 2 - PRODUCTS**2.01 COMPOST BLANKETS**

Comply with [Section 9010, 2.07, C](#) for compost material requirements for compost blankets.

2.02 COMPOST BLANKET AND FILTER BERM TACKIFIER

- A. Use a biodegradable, organic binding agent or polyacrylamide that can be mixed with, or injected into, compost or filter material as it is placed, which is not detrimental to the establishment of vegetation.
- B. Use in filter berms or compost blankets when specified in the contract documents.
- C. Apply at the rate recommended by the manufacturer.

2.03 FILTER MATERIAL

Material for use in filter socks, filter berms, and other areas, as specified in the contract documents.

- A. Use material derived from wood, bark, or other, non-toxic vegetative feedstocks.
- B. Use material with no visible admixture of refuse or other physical contaminants, nor any material toxic to plant growth.
- C. Use material meeting the following particle sizes:

Sieve Size	Percent Passing ¹
2"	100
1"	90-100
3/8"	0-30

¹The target flow rate of in-place material is 10 gal/min/lf. The Engineer may approve use of alternate materials meeting the target flow rate.

2.04 FILTER SOCK

- A. For slope and sediment control applications, use a continuous, tubular, knitted, mesh netting with 3/8 inch openings, constructed of 5 mil thickness, photodegradable HDPE.
- B. For inlet protection, use a continuous, tubular, knitted, mesh netting with 3/8 inch openings, constructed of 500 denier polypropylene.
- C. Use 1 inch by 2 inch (minimum) hardwood stakes or stakes of equivalent strength.

2.05 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP)

Use temporary rolled erosion control products that are classified and have material properties according to the Erosion Control Technology Council's (ECTC) guidelines as follows:

A. Material Classification:

1. **RECP Type 1 (Ultra Short-term):** Functional longevity of 3 months or less and classified as follows:
 - a. **RECP Type 1.A:** Mulch control net, consisting of a photodegradable synthetic mesh or woven biodegradable natural fiber netting.
 - b. **RECP Type 1.B:** Netless rolled erosion control blankets, consisting of natural and/or polymer fibers, mechanically interlocked and/or chemically adhered together to form a RECP.

2.05 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP) (Continued)

2. Material properties meeting the Erosion Control Technology Council's (ECTC) Standard Specifications for Rolled Erosion Control Products as follows:

Classification	Slope Application	Channel Application	Min. Tensile Strength
	Max. Grade*	Permissible Shear Stress	
RECP Type 1.A	5:1 (H:V)	0.25 lb/ft ²	5 lb/ft
RECP Type 1.B	4:1 (H:V)	0.50 lb/ft ²	5 lb/ft
RECP Type 1.C	3:1 (H:V)	1.50 lb/ft ²	50 lb/ft
RECP Type 1.D	2:1 (H:V)	1.75 lb/ft ²	75 lb/ft
RECP Type 2.A	5:1 (H:V)	0.25 lb/ft ²	5 lb/ft
RECP Type 2.B	4:1 (H:V)	0.50 lb/ft ²	5 lb/ft
RECP Type 2.C	3:1 (H:V)	1.50 lb/ft ²	50 lb/ft
RECP Type 2.D	2:1 (H:V)	1.75 lb/ft ²	75 lb/ft
RECP Type 3.A	5:1 (H:V)	0.25 lb/ft ²	25 lb/ft
RECP Type 3.B	1.5:1 (H:V)	2.00 lb/ft ²	100 lb/ft
RECP Type 4	1:1 (H:V)	2.25 lb/ft ²	125 lb/ft

*Product tested according to ECTC Test Method No. 2 and meeting the ECTC Standard Specifications for "C" factor.

- C. RECP Anchors:** Stakes or staples as recommended by manufacturer, with a minimum length of 6 inches.

2.06 WATTLES

- A. Netting:** Open weave, degradable netting. Nominal diameter of 9 inches, or as specified.
- B. Fill Material:** Straw, wood excelsior, coir, or other natural materials approved by the Engineer.
- C. Stakes:** 1 inch by 1 inch (minimum) wooden stakes, or stakes of equivalent strength.

2.07 CHECK DAMS**A. Synthetic Permeable Check Dam (HDPE):**

1. **Ditch Berm:**
 - a. Installed height of 9 to 10 inches.
 - b. Manufactured check dam constructed from sheets of perforated, UV-stabilized High Density Polyethylene (HDPE).
 - c. Perforations of 30 to 40% open area.
2. **RECP for Permeable Check Dam (when specified):** RECP Type 4, 4 feet wide.
3. **Anchors:** As recommended by the manufacturer.

B. Triangular Foam Check Dam: Triangular-shaped device with a height of 8 to 10 inches and a base of 16 to 20 inches.

1. **Inner Support Material:** Urethane foam.
2. **Outer Cover:** Woven geotextile material shaped to fit around the inner support material, extending 2 to 3 feet beyond the bottom edge of the triangular-shaped inner support.
3. **Length:** 7 feet.

2.07 CHECK DAMS (Continued)**C. Rock Check Dam:**

1. **Aggregate:** Erosion stone complying with [Iowa DOT Article 4130.04](#).
2. **Engineering Fabric:** Comply with [Section 9040, 2.18](#).

2.08 LEVEL SPREADERS

- A. Provide 2 inch by 8 inch (minimum) pressure-treated timber of the length specified.
- B. Use timbers that are relatively straight and have a minimum length of 5 feet each.

2.09 RIP RAP

- A. **Class A Revetment:** Comply with [Iowa DOT Section 4130](#).
- B. **Class B Revetment:** Comply with [Iowa DOT Section 4130](#).
- C. **Class D and E Revetment:** Comply with [Iowa DOT Section 4130](#).
- D. **Erosion Stone:** Comply with [Iowa DOT Section 4130](#).

2.10 TEMPORARY PIPE SLOPE DRAINS

- A. PVC, HDPE, and metal pipes as specified in [Section 4020, 2.01](#).
- B. HDPE, Type C (corrugated interior).
- C. All pipes listed are allowed for use within the right-of-way.

2.11 SEDIMENT BASIN OUTLET STRUCTURES

- A. **Base:** Class C concrete unless otherwise specified in the contract documents.
- B. **Riser:** CMP complying with [Section 4020](#); diameter as specified in the contract documents.
- C. **Dewatering Device:**
 1. Drill holes in the riser of the number, diameter, and at the elevation specified in the contract documents.
 2. 1/4 inch by 1/4 inch or 1/2 inch by 1/2 inch wire mesh for hardware cloth.
- D. **Barrel:** CMP complying with [Section 4020](#); diameter as specified in the contract documents.
- E. **Anti-Vortex Device:** CMP complying with [Section 4020](#); diameter according to [Figure 9040.16](#) and riser diameter as specified in the contract documents.
- F. **Anti-Seep Collar:**
 1. Corrugated metal sheet of same material and gage as barrel section.
 2. Size according to [Figure 9040.17](#).

2.12 SEDIMENT TRAPS

- A. Erosion Stone:** Comply with [Section 9040, 2.19](#).
- B. Engineering Fabric:** Comply with [Section 9040, 2.18](#).

2.13 SILT FENCE

- A. Fabric:** Comply with [Iowa DOT Article 4196.01](#).
- B. Posts:** 4 foot minimum steel (T-section) weighing at least 1.25 pounds per foot, exclusive of anchor plate. Painted posts are not required.
- C. Fastener:** Wire or plastic ties with a minimum tensile strength of 50 pounds.

2.14 STABILIZED CONSTRUCTION ENTRANCE

- A. Entrance Stone:** Comply with [Iowa DOT Section 4122, Gradation 13](#), Macadam crushed stone.
- B. Subgrade Stabilization Material:** Use woven, UV-stabilized geotextile with a minimum tensile strength of 135 lb/ft.

2.15 DUST CONTROL

- A. Water:** Use potable water or water from a source approved by the engineer.
- B. Calcium Chloride:** Comply with [Iowa DOT Article 4194.01](#).
- C. Lignosulfonate (Tree Sap):** Use a commercially-available product with known lignin content.
- D. Soapstock (Soybean Oil):**
 - 1. Use a commercially-available, undiluted, soybean oil soapstock emulsion.
 - 2. Comply with manufacturer's recommendations for storage, transportation, temperature, and application equipment requirements.

2.16 EROSION CONTROL MULCH

- A. Conventional Mulch:**
 - 1. Use dry cereal straw (oats, wheat, barley, or rye) or native grass straw.
 - 2. Use material that is free of noxious weeds, seed-bearing stalks, or roots, and will be inspected and approved by the Engineer prior to use.
 - 3. Other materials, subject to the approval of the Engineer, may be used.
- B. Hydromulch:**
 - 1. **Wood Cellulose Mulch:** Comply with [Section 9010, 2.07](#).
 - 2. **Bonded Fiber Matrix (BFM):** Comply with [Section 9010, 2.07](#).
 - 3. **Mechanically Bonded Fiber Matrix (MBFM):** See [Section 9010, 2.07](#).

2.17 TURF REINFORCEMENT MATS (TRM)**A. Material Classification:**

1. **TRM Type 1:** Use a TRM that is constructed of a web of mechanically or melt-bonded polymer netting, monofilaments, or fibers that are entangled to form a strong and dimensionally stable mat. Bonding methods include polymer welding, thermal or polymer fusion, or the placement of synthetic fibers between two high-strength, biaxially-oriented nets, mechanically bound by parallel stitching with polyolefin thread. Products may contain a degradable component.
2. **TRM Type 2 and 3:** Use a TRM that is constructed of a web of mechanically or melt-bonded polymer netting, monofilaments, or fibers that are entangled or woven to form a strong and dimensionally stable mat. Non-woven bonding methods include polymer welding, thermal or polymer fusion, or the placement of fibers between two high-strength, biaxially oriented nets, mechanically bound by parallel stitching with polyolefin thread. Use only components that are 100% synthetic and resistant to biological, chemical, and ultraviolet degradation.
3. **TRM Type 4:** Use a high performance/survivability TRM that is composed of monofilament yarns woven into a resilient uniform configuration. Use a mat that has a matrix that exhibits very high interlock and reinforcement capacities with both soil and root systems and demonstrate a high tensile modulus. TRMs manufactured from discontinuous or loosely held together by stitched or glued, netting, or composites are not allowed in this category. Use only components that are 100% synthetic and resistant to biological, chemical, and ultraviolet degradation. Use this category when field conditions exist with high loading and/or high survivability requirements.

B. Properties and Performance: Meet the minimum material and performance requirements contained in the following table:

Property ¹		Test Method	Type 1	Type 2	Type 3	Type 4
Material	Thickness	ASTM D 6525	0.25 in	0.25 in	0.25 in	0.25 in
	Tensile Strength ²	ASTM D 6818	125 lb/ft	240 lb/ft	750 lb/ft	3,000 lb/ft
	UV Resistance ³	ASTM D 4355	80% @ 500 hrs	80% @ 1,000 hrs	80% @ 1,000 hrs	90% @ 3,000 hrs
Performance	Maximum Shear Stress ⁴ (Channel Applications)	ASTM D 6460	7 lb/ft ²	10 lb/ft ²	12 lb/ft ²	15 lb/ft ²
	Maximum Slope Gradient (Slope Applications)	N/A	1:1 (H:V) or flatter	1:1 (H:V) or flatter	1:1 (H:V) or greater	1:1 (H:V) or greater

1 For TRMs containing degradable components, all values must be obtained on the non-degradable portion of the matting.

2 Minimum Average Roll Values, machine direction only.

3 Tensile strength of structural components retained after UV exposure.

4 Minimum shear stress that fully-vegetated TRM can sustain without physical damage or excess erosion (0.5 in soil loss) during a 30 minute flow event in large scale testing. Acceptable large scale testing protocol includes ASTM D 6460 or independent testing conducted by the Texas Transportation Institute, Colorado State University, Utah State University, or other approved testing facility. Bench scale testing is not acceptable.

2.18 INLET PROTECTION**A. Drop-in Intake Protection:**

1. Use a manufactured device that is inserted into the intake and is capable of trapping or filtering sediment from runoff prior to entering the storm sewer.
2. All components must be contained entirely below the surface of the intake grate.
3. Incorporate means of emergency outflow to prevent flooding if plugged with sediment.

B. Surface-applied Intake Protection:

1. Use devices or filter socks, placed around or over the intake, that are capable of trapping or filtering sediment from runoff prior to entering the storm sewer.
2. Do not allow the device to completely block or plug the intake, preventing inflow.

2.19 FLOW TRANSITION MATS

- A. UV-stabilized HDPE plastic sheet with openings for vegetation growth and energy dissipation.
- B. Use a nominal sheet size of 4 feet by 4 feet by 1/2 inch.
- C. Use duckbill style anchors, as specified by the mat manufacturer.

2.20 ENGINEERING FABRIC

Comply with [Iowa DOT Article 4196.01, B](#) (Embankment Erosion Control) and [Iowa DOT Materials I.M. 496.01, Appendix G](#).

PART 3 - EXECUTION**3.01 SWPPP PREPARATION**

- A. Prepare a SWPPP according to the requirements of the Iowa DNR NPDES General Permit No. 2.
- B. Have the SWPPP prepared by an individual experienced in erosion and sediment control.
- C. Ensure that controls utilized in the SWPPP conform to the type and quantity of erosion and sediment controls specified in the contract documents.
- D. Submit the completed SWPPP to the Engineer for review and approval prior to filing the Notice of Intent.
- E. Upon approval of the Engineer, file public notices, as required by the NPDES General Permit No. 2.
- F. File the Notice of Intent and fee, as required by the NPDES General Permit No. 2.

3.02 SWPPP MANAGEMENT

Coordinate and carry out all requirements of Iowa DNR NPDES General Permit No. 2 and any local ordinance requirements, including:

- A. Update the SWPPP according to the requirements of the NPDES General Permit No. 2.
- B. Revise the SWPPP and implement changes, as necessary, to prevent sediment or hazardous materials from being transported off the site.
- C. Submit all SWPPP revisions to the Engineer for review and approval.
- D. Perform and maintain records of weekly erosion and sediment control site inspections, unless otherwise specified in the contract documents.
- E. Maintain records of transfer of responsibility under the NPDES General Permit No. 2.
- F. Retain all records on-site, or as required by the NPDES General Permit No. 2.
- G. After final stabilization, file a Notice of Discontinuation, according to the NPDES General Permit No. 2.
- H. Provide all records and documentation to the Engineer upon completion of the project. Retain a copy of all records for the period required under the Permit.
- I. Continue to perform the work required under this item throughout the duration of the project, and until final stabilization is achieved and a Notice of Discontinuation is filed.

3.03 EROSION AND SEDIMENT CONTROL INSPECTION

- A. Perform inspections according to and at frequency required by the Iowa DNR NPDES General Permit No. 2.
- B. Schedule necessary maintenance or improvements for items that are included in the contract documents.
- C. Notify the Engineer immediately of situations requiring attention beyond that provided for in the contract documents.

3.03 EROSION AND SEDIMENT CONTROL INSPECTION (Continued)

D. Provide copies of the inspection reports to the Engineer.

3.04 EQUIPMENT

Comply with [Iowa DOT Article 2601.03](#).

3.05 COMPOST BLANKETS (Figure 9040.1)

- A. Loosen the ground surface to a minimum depth of 1 inch.
- B. Evenly spread compost, as specified in the contract documents, or as directed by the Engineer.
- C. Divert concentrated flows away from the slope.
- D. Do not operate heavy equipment over the compost blanket after placement, or throughout the required period of protection.
- E. Inspect the ground under the blanket at regular intervals for signs of erosion.

3.06 FILTER BERMS (Figure 9040.2)

- A. Install filter berm along the contour as specified in the contract documents, or as directed by the Engineer.
- B. Turn the ends of the filter berm uphill to prevent runoff from flowing around the end of the berm.
- C. When a vegetated berm is specified, apply seed to the surface of the berm.
- D. Replace the berm when sediment accumulation reaches one-half of the height of the berm.

3.07 FILTER SOCKS (Figure 9040.2)**A. Installation:**

1. Pneumatically fill mesh filter sock of size and length specified in the contract documents, or as directed by the Engineer. Alternative methods of filling the sock may be allowed upon approval of the Engineer.
2. Fill socks with filter material.
3. Place the filter sock along the contour as specified in the contract documents, or as directed by the Engineer.
4. Place additional filter material or soil from the site, on the upstream side of the sock, in the seam between the tube and the ground.
5. Construct a "J-hook" at each end of a continuous run of filter sock, by turning the end of the sock uphill, as necessary to prevent runoff from flowing around the ends when water behind the sock ponds up to a level even with the top of the sock.
6. Drive stakes into the ground at a maximum spacing of 10 feet, and as required to secure the sock and prevent movement.

3.07 FILTER SOCKS (Continued)

7. Repair or replace non-functioning filter socks that allow water to flow under the sock, are torn, or are otherwise damaged, due to inadequate installation.
8. Remove filter material from damaged socks that are located along streambanks, around intakes, in ditches, or in other locations where the material may be carried to surface waters.

C. Removal: When specified in the contract documents, or as directed by the Engineer; remove the filter sock upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.

1. Upon completion of the project, completely remove socks and filter material that are located along streambanks, around intakes, in ditches, or in other locations where the filter material may be carried to surface waters if the sock degrades and/or tears.
2. Slice the sock longitudinally. Remove and dispose of the filter sock material and stakes.
3. Spread the filter material and accumulated sediment to match finished grade and to ensure proper drainage.
4. If the site has been brought to finished grade and prepared for permanent seeding, spread and incorporate the filter material into the surface by tilling, or as required to break up any large particles and provide a finished surface suitable for permanent seeding.

D. Replacement:

1. When accumulated sediment reaches a level one-half the height of the sock, or when the sock becomes clogged with sediment and no longer allows runoff to flow through, remove the sock as described above, and replace according to the installation instructions above.
2. At the Engineer's option, the existing filter sock and accumulated sediment may be left in place, and a new filter sock installed up-slope from the existing filter sock.

3.08 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP) (Figures 9040.3 and 9040.4)

Install temporary RECPs according to the manufacturer's published installation recommendations, subject to the following minimum requirements:

A. Slope Application:

1. Grade and smooth surface. Remove all rocks, clods, vegetation, or other obstructions that will prevent direct contact between the RECP and the soil surface.
2. When specified, prepare seedbed and place seed and fertilizer according to [Section 9010](#) prior to placing RECP.
3. Install anchor trench at top of slope. Seed and fertilize trench after backfill and compaction, if seeding is specified.
4. Unroll the RECP down or horizontally across the slope.
5. Place consecutive blankets down the slope end-over-end, shingle style.
6. Overlap ends of consecutive rolls a minimum of 3 inches, and install anchors at a maximum spacing of 18 inches along all overlaps.

3.08 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP) (Continued)

7. Overlap edges of adjacent rolls a minimum of 2 inches.
8. Install anchors at edge seams between rows.

B. Channel/Ditch Application:

1. When specified, prepare seedbed and place seed and fertilizer according to [Section 9010](#), prior to placing RECP.
2. Place end of first roll in the anchor slot at the center of the upstream channel and secure with anchors.
3. Position adjacent rolls in the anchor slot, overlapping adjacent rolls a minimum of 3 inches.
4. Place backfill material in anchor slot and compact. Unroll RECP over compacted slot and secure with anchors.
5. Unroll RECP downstream. Maintain a minimum 3 inch overlap between adjacent rolls. Secure edge lap with anchors.
6. Install intermittent staple check slots every 30 feet.
7. Construct end lap at end of roll and beginning of new roll. Overlap roll ends with upstream RECP on top.
8. Excavate longitudinal trench along both sides of the channel at the outside edges of installation. Place outer edges of RECP into longitudinal slot. Install anchors, place backfill material, and compact.
9. Terminate installation at downstream end with staple check.
10. Install anchors in a regular pattern over entire area covered according to manufacturer's published recommendations (minimum three anchors per square yard).

3.09 WATTLES ([Figure 9040.5](#))**A. Installation:**

1. Construct a shallow trench, 2 to 4 inches deep, matching the width and contour of the wattle.
2. Install wattle along contour of slope.
3. Turn ends of wattle uphill to prevent water from flowing around ends.
4. Place and compact excavated soil against the wattle, on the uphill side.
5. Drive stakes through the center of the wattle, into the ground at a maximum spacing of 4 feet along the length of the wattle, and as needed to secure the wattle and prevent movement.
6. Abut ends of adjacent wattles tightly. Wrap joint with a 36 inch wide section of silt fence and secure with stakes.

3.09 WATTLES (Continued)

B. Removal: When specified in the contract documents, or as directed by the Engineer, remove the wattle upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.

1. Completely remove the wattle netting, filler material, and stakes.
2. Spread the accumulated sediment to match finished grade and to ensure proper drainage.
3. When allowed by the Engineer, the wattle netting may be sliced open and the filler material spread out over the ground. Removal of netting and stakes and spreading of sediment is still required.

C. Replacement:

1. When accumulated sediment reaches a level one-half the height of the wattle, or when the wattle becomes clogged with sediment and no longer allows runoff to flow through, remove the wattle as described above, and replace according to the installation instructions above.
2. At the Engineer's option, the existing wattle and accumulated sediment may be left in place, and a new wattle installed up-slope from the existing wattle.

3.10 CHECK DAMS (Figure 9040.6)

A. Synthetic Permeable Check Dam (HDPE):

1. Install according to the manufacturer's recommendations.
2. When specified, provide an RECP under the check dam, installed according to the manufacturer's recommendations.

B. Triangular Foam Check Dam: Install according to the manufacturer's recommendations.

C. Rock Check Dam: Construct according to [Figure 9040.7](#).

D. Removal: When specified in the contract documents, or as directed by the Engineer, remove check dams upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.

1. Remove the check dam and dispose of materials, or salvage to the contractor.
2. Remove the accumulated sediment or spread to match finished grade; ensure proper drainage.
3. Stabilize the area disturbed by removal operations.

3.11 TEMPORARY EARTH DIVERSION STRUCTURES (Figure 9040.8)

- A. Ensure positive drainage along the diversion toward the outlet area.
- B. Adequately compact fill to prevent failures or seepage.
- C. Outlet the diversion to undisturbed and/or stabilized areas only.
- D. Stabilize the surface of the earth diversion with temporary erosion control seeding, as specified in [Section 9010](#).

3.12 LEVEL SPREADERS ([Figure 9040.9](#))

- A. Butt multiple timbers together, as necessary to provide the required length.
- B. Ensure the spreader is installed level in all directions. Adjust as necessary during construction to maintain spreader in a level condition.
- C. Excavate a depression behind the spreader to the depth specified in the contract documents. The depression may be over-excavated up to 1 foot to provide an area for sediment accumulation.
- D. Grade as required to prevent flow around the ends of spreader.
- E. Remove the accumulated sediment from the depression when the depth is reduced below that specified in the contract documents.

3.13 RIP RAP ([Figures 9040.10](#) and [9040.11](#))

Install the quantity of rip rap (revetment stone or erosion stone) as specified in the contract documents.

3.14 TEMPORARY PIPE SLOPE DRAINS ([Figure 9040.12](#))

- A. Place slope drain on undisturbed soil or well compacted fill.
- B. Carefully compact cohesive soils around inlet ends of the drain in 6 inch lifts.
- C. Discharge slope drain to a stable outlet or to a sediment retention device.

3.15 SEDIMENT BASIN OUTLET STRUCTURES ([Figures 9040.13](#) and [9040.14](#))

- A. Concrete Base:** Construct the concrete base and anchor riser section, as shown on [Figure 9040.15](#).
- B. Dewatering Device:**
 - 1. Drill holes in the riser section. The number, diameter, and configuration will be specified in the contract documents.
 - 2. Wrap the perforated section of the riser pipe with metal hardware cloth.
- C. Anti-vortex Device:** If required by the contract documents, firmly attach the cylinder to the top of the riser by welding or other means. Comply with [Figure 9040.16](#).

3.16 ANTI-SEEP COLLAR ([Figure 9040.17](#))

- A. General:** Place backfill material and compact overexcavation areas to a minimum of 95% Standard Proctor Density per [Section 3010](#).
- B. Concrete Collar:**
 - 1. Place collars a minimum of 2 feet from pipe joints.
 - 2. Provide Class C concrete per [Section 6010](#).

3.16 ANTI-SEEP COLLAR (Continued)**C. CMP Collar:**

1. Provide collar of same gage as the pipe barrel on which it is used.
2. Paint or tag unassembled collars to identify matching pairs.
3. Furnish each collar with two 1/2 inch diameter rods with tank lugs for connecting collars to pipe.
4. Install collar with corrugations vertical.
5. Seal the tap between the two half sections and between the pipe and connecting band with a bituminous jointing compound at the time of installation.

3.17 SEDIMENT TRAPS (Figure 9040.18)

Construct the storage area to the size and elevations specified in the contract documents.

3.18 SILT FENCES (Figure 9040.19)**A. Installation:**

1. Install material along the contour of the ground, as specified in the contract documents, or as directed by the Engineer.
2. Install silt fence with a mechanical soil slicing machine that creates a slit in the ground while simultaneously installing the fabric. The trenching method may be used when situations will not allow soil slicing, as determined by the Engineer.
3. Construct a "J-hook" at each end of a continuous run of silt fence, by turning the end of the silt fence uphill, as necessary to prevent runoff from flowing around ends when water behind the fence ponds to a level even with the top of the fence.
4. Insert 12 inches of fabric to a minimum depth of 6 inches (fabric may be folded below the ground line).
5. Compact installation by driving along each side of the silt fence, or by other means, as necessary to adequately secure the fabric in the ground, to prevent pullout and water flow under the fence.
6. Drive steel posts into the ground alongside the silt fence, to a minimum depth of 20 inches, unless otherwise specified by the Engineer. Space posts as shown on [Figure 9040.19](#) or as required to adequately support silt fence.

B. Maintenance: Repair or replace non-functioning silt fence that allows water to flow under the fence, is torn, or is otherwise damaged, due to inadequate installation, at no additional cost to the Contracting Authority.

C. Removal:

1. Remove the silt fence upon final stabilization of the project area, or according to the staging indicated in the SWPPP.
2. Remove and dispose of silt fence and posts.
3. Remove sediment or spread to match finished grade; ensure proper drainage.
4. Stabilize the area disturbed by removal operations.

3.18 SILT FENCES (Continued)**D. Replacement:**

1. When accumulated sediment reaches a level one-half the height of the fence, remove the silt fence as described above, and replace according to the installation instructions above.
2. At the Engineer's option, the existing silt fence and accumulated sediment may be left in place, and a new silt fence installed up-slope from the existing silt fence.
3. When allowed by the Engineer, the existing silt fence may be left in place and the accumulated sediment removed to the original ground line and within 6 inches of the silt fence. Carefully inspect the existing silt fence for structural integrity and signs of undermining. Make any necessary repairs.

3.19 STABILIZED CONSTRUCTION ENTRANCE (Figure 9040.20)

- A. Install a stabilized construction entrance at all locations where construction traffic leaving the site presents the potential for sediment track-out.
- B. Remove vegetation and excavate soft soils from entrance area. Thoroughly compact subgrade prior to placing stone.
- C. Install culvert under entrance if necessary to maintain drainage.
- D. Grade entrance to prevent runoff from flowing onto street. Direct all runoff from entrance to a sediment retention device.
- E. When specified, install subgrade stabilization fabric prior to placing crushed stone.
- F. Install layer of crushed stone to the thickness (6 inches minimum) and dimensions specified in the contract documents.
- G. Remove the accumulated sediment and install new stone, as required to prevent track-out.

3.20 DUST CONTROL

- A. **Water:** Apply frequent light watering to ground surface, as required to control dust.
- B. **Calcium Chloride:** Apply according to [Iowa DOT Section 2314](#).
- C. **Lignosulfonate (Tree Sap):**
 1. Loosen the top 1 to 2 inches of the roadway surface.
 2. Apply solution with a 50% residual concentration, at a rate of 0.50 gal/yd², to deliver a 25% residual. For diluted solutions, increase the application rate, as required, to deliver an equivalent 25% residual.
 3. Allow product to penetrate through the loosened material.
 4. Tight-blade road surface.
- D. **Soapstock (Soybean Oil):**
 1. Loosen the top 1 to 2 inches of the roadway surface.
 2. Apply undiluted soapstock at a rate of 0.70 gal/yd².

3.20 DUST CONTROL (Continued)

3. Allow product to penetrate through the loosened material.
4. Tight-blade road surface.

3.21 EROSION CONTROL MULCHING**A. Conventional Mulching:**

1. Use conventional mulching when the surface cannot be stabilized by seeding, due to season or ground conditions.
2. Uniformly distribute mulch over the required areas, at a rate of 2 tons/acre for dry cereal straw, or 2.5 tons/acre for prairie hay.
3. Work the mulch into the soil with a mulch tucker, designed to anchor the mulch into the soil, by means of dull blades or disks.

B. Hydromulching:

1. Place mulch and tackifier (if applicable) in equipment specifically manufactured for hydraulic mulching.
2. Mix materials with fresh, potable water using a combination of re-circulation through the equipment's pump and mechanical agitation to form a homogeneous slurry.
3. If necessary, dampen any dry, dusty soil as required to prevent balling of the material during application.
4. Apply hydromulch in multiple layers from opposing directions, where possible.
5. Apply the slurry evenly over all specified areas, at the minimum component material rates specified:
 - a. Wood Cellulose Mulch:
 - 1) Mulch: 2,600 lb/acre dry weight.
 - 2) Tackifier: 50 lb/acre.
 - b. Bonded Fiber Matrix: 3,600 lb/acre dry weight.
 - c. Mechanically Bonded Fiber Matrix: 3,600 lb/acre dry weight.
6. Retain and count empty bags of mulch to ensure final application rate.

3.22 TURF REINFORCEMENT MATS

Install according to the manufacturer's published installation literature for the product specified and application (slope or channel).

3.23 SURFACE ROUGHENING**A. Directional Tracking:**

1. Do not use on slopes steeper than 3:1.
2. Operate tracked equipment up and down exposed slope to create ridges perpendicular to the slope.
3. Continue operation until the entire surface has been tracked.

3.23 SURFACE ROUGHENING (Continued)**B. Grooving/Furrowing:**

1. May be used on all slopes.
2. Use rippers, disks, harrows, chisel plows, or other equipment capable of operating on the slope and creating grooves a maximum of 15 inches apart and 3 inches deep.
3. Operate equipment along the contour of the slope to create grooves that are perpendicular to the slope.
4. Perform over all exposed slopes as specified.

3.24 INLET PROTECTION

- A. Install inlet protection devices according to the manufacturer's recommendations.
- B. Remove the accumulated sediment, as required to maintain the inlet protection device in working order. Remove any accumulated sediment from streets open to traffic if it encroaches into the traveled roadway.

3.25 FLOW TRANSITION MATS

Install according to the manufacturer's published recommendations.

3.26 TEMPORARY EROSION CONTROL SEEDING

Comply with [Section 9010](#).

END OF SECTION