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3835
Pedestrian Signal Faces

3835.1 SCOPE

This Specification covers pedestrian signal faces to direct pedestrian movements as part of a traffic control signal system.

3835.2 REQUIREMENTS

A General

Pedestrian signal faces shall be furnished where specified in the Contract. Pedestrian signal faces shall be constructed in accordance with the current ITE Pedestrian Traffic Control Signal Indication standard.

Pedestrian signal faces shall utilize light emitting diode (LED) module. The LED module shall meet or exceed ITE Pedestrian Traffic Control Signal Indications - Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules. Components shall be compatible with standard signal hardware and shall be interchangeable with other units of similar construction.

The electrical and optical system of each pedestrian signal indication shall be designed for operation on a nominal 120 VAC, single phase power supply.

Each pedestrian signal indication shall consist of a housing, housing door, visor, lens, optical unit, and wiring.

Each pedestrian signal face shall be a single unit housing with the signal indication size a nominal 406 mm x 457 mm (**16 inch x 18 inch**) with side by side or overlapping symbol messages. Each symbol message ("WALKING PERSON" and "UPRAISED HAND") shall be illuminated by the use of light-emitting diodes (LED's).

Each pedestrian signal face shall be of the adjustable type permitting rotation of 360 degrees about a vertical axis.

Arrangement of pedestrian signal indications in a pedestrian signal face shall be in accordance with Part IV, "SIGNALS", of the MN MUTCD.

Pedestrian signal faces shall be installed at the locations and mounted in the manner as required by the Contract.

B Housing

The housing material of each pedestrian signal indication shall be a one-piece, corrosion-resistant, aluminum alloy die casting with all sides, top, and bottom integrally cast. All parts of the housing shall be clean, smooth, and free from cracks, sharp burrs, and other imperfections. Four mounting lugs shall be integrally cast into the top and bottom area at equal distances permitting the housing door to hinge from either side. All interior mounting locations shall be symmetrically positioned.

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The housing shall have an integral 72-teeth serrated boss as part of the top and as part of the bottom of the housing for use with standard signal mounting hardware. Each boss shall have reinforcing ribs projecting the load bearing stress to the entire housing.

C Housing Door

The housing door of each pedestrian signal indication shall be a one-piece, corrosion-resistant, aluminum alloy die casting.

The door shall be suitably hinged and shall be forced tightly against the housing by stainless steel locking devices. All other door hardware shall be of stainless steel material.

The door shall be designed to be easily removed from the housing without the use of tools.

The housing door shall accommodate the pedestrian signal LED module.

The outer face of the housing door shall have four tapped holes equally spaced about the lens opening to accommodate four screws for securing the pedestrian signal indication visor.

D Gasketing

Gasketing shall be provided between the housing and the housing door to exclude dust and moisture and ensure a weather-tight enclosure when closed.

E Visor

The pedestrian signal face shall have a removable tunnel type visor attached to the housing door by four stainless steel screws. The visor shall be a minimum of 178 mm (7 inches) in length with all sides of the visor approximately the same length.

The visor shall be fabricated from sheet aluminum and shall encompass the entire top and sides (bottom open) of the pedestrian signal indication and shall be designed to fit tightly against the housing door so as to prevent any perceptible filtration of light between the door and the visor. The top of the visor shall have a minimum downward tilt of approximately 3.5 degrees. The visor shall be secured to the housing door by stainless steel screws.

F Optical Unit

The optical unit of each pedestrian signal indication shall consist of an LED module for the "Upraised Hand" symbol and the "Walking Person" symbol.

The LED module for the "Upraised Hand" symbol and the "Walking Person" symbol shall be in accordance with the latest issue of ITE Pedestrian Traffic Control Signal Indications - "Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules" Both the Walking Person and "Upraised Hand" symbols shall be LED filled.

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G Wiring

The LED module of a pedestrian signal face shall be provided with three color coded copper conductors. The conductors shall be securely fastened to the lamp receptacle and with sufficient length to reach the terminal block with the reflector fully open. A terminal block shall be provided and securely fastened to the inside of one of the housings of a pedestrian signal face for connection of the conductors from each pedestrian signal indication lamp receptacle and the field conductors. The conductors from each lamp receptacle of a pedestrian signal face shall be run independently to the terminal block and shall not be bound together into a cable.

H Painting

All surfaces of the housing, aluminum housing door, and aluminum visor of each pedestrian signal indication shall be treated with a metal primer suitable for the material.

All surfaces of the housing shall be finish painted yellow in accordance with 3532, or approved equivalent.

All surfaces of the aluminum housing door and aluminum visor shall be finish painted dull non-reflective black.

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J Signal Brackets and Pipe Fittings..... 3834.2C

3835.3 INSPECTION AND TESTING 3833

The pedestrian signal faces shall be approved by the Engineer prior to procurement. Prior to Engineer acceptance of the LED indications, the manufacturer shall supply to the Engineer independent test results performed on the product for color and intensity. The Contractor shall submit to the Engineer, for approval, four sets of manufacturer's drawings, specifications of the pedestrian signal face, all warranty information, a Manufacturer's Certificate of Conformance to this specification, and all other pertinent manufacturer data. As part of the pertinent manufacturer data, the Contractor shall include the product invoice.

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Electrical Service Equipment

3837.1 SCOPE

This Specification covers electrical service equipment for controlling and distributing electrical power, providing over-current protection, and providing a means to cut off power to items of electrical equipment, as part of a traffic control signal system, roadway lighting system, automatic traffic recorder system, or other electrical system.

3837.2 REQUIREMENTS**A Service Equipment****A1 General**

The Contractor shall furnish and install a meter socket, disconnecting means, ground rod, grounding and bonding materials, conduit, conduit fittings, power conductors, and, for installations on wood poles, conduit risers and weatherhead, for electrical service for the traffic control signal system, roadway lighting system, automatic traffic recorder system, or other electrical system, where required by Contract.

For installation on a wood pole, the power conductors above the disconnecting means, through the meter socket to the weatherhead, shall be sized appropriately for the rating of the service disconnect, shall meet the requirements of the power company, and shall extend beyond the weatherhead for connection to the power conductors from the source of power; which connection will be made by others at no cost to the Contractor.

All parts of the service equipment shall utilize copper wire and shall have connections that are UL listed for use with copper wire.

A2 Meter Socket

The meter socket shall contain a positive bypass mechanism, shall have lugs that will allow the power conductors to be stripped and laid into the lugs without being cut, and shall be approved by the power company. The meter will be furnished and installed by others.

A3 Circuit Breaker Load Center

Unless otherwise indicated in the Contract, the disconnecting means shall be a 3-wire, solid neutral, 100 A, 120/240 VAC, NEMA 3R rain-tight enclosure for outdoor use, circuit breaker load center, UL listed for use as service equipment.

The load center shall have a front cover and inner dead front cover.

The front cover shall be hinged at the top (with a slip hinge arrangement that permits leaving the cover in an open position) and snap closes at the bottom. Both covers shall be easily removable for installation, maintenance, and wiring.

Any lugs that are required for power conductor connections in the load center shall be UL listed for use with copper wire, shall be solderless (set screw type), and shall be the appropriate size for the conductors with which they are used.

The circuit breaker load center shall be provided with an isolated, bondable neutral bar with capacity to accept the number and size of neutral and grounding conductors as indicated in the Contract or required by the NEC. Bonding of the neutral shall be in accordance with the NEC.

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Unless otherwise specified in the Contract, the Contractor shall furnish and install circuit breakers in the load center as follows:

- (a) -one 2-pole, 100 A main circuit breaker.
- (b) -one 1-pole, 60 A circuit breaker for signal system.
- (c) -two 1-pole, 15 A circuit breakers for roadway lighting.

Circuit breakers shall be 120/240 VAC, and shall be clearly marked with the "ON" and "OFF" positions and identified with the load that it is carrying, such as "SIGNALS" or "LIGHTING". The circuit breakers and the load center enclosure shall be of the same manufacturer.

A4 General Duty Safety Switch

When specified in the Contract, the disconnecting means shall be a 3-wire, fusible, 2-pole, solid neutral, single throw, 60 A, 120/240 VAC, NEMA 3R (rain-tight enclosure for outdoor use), general duty safety switch, UL listed as suitable for use as service equipment. Any lugs contained in the safety switch shall be appropriate for the material and size of the conductors with which they are used. The Contractor shall furnish the required fuses.

The general duty safety switch shall be provided with an isolated, bondable neutral bar with capacity to accept the number and size of neutral and grounding conductors as indicated in the Contract or required by the NEC. Bonding of the neutral shall be in accordance with the NEC.

A5 Heavy Duty Safety Switch

The safety switch shall be provided to turn off power to the sign lights. The safety switch shall be:

1. A NEMA 3R rain tight enclosure for outdoor use.
2. 30 ampere, heavy duty, single throw, fusible with an insulated solid neutral.
3. Rated 240 volts AC for a 120/240 volt sign lighting system and 600 volts AC for a 240/480 volt sign lighting system.
4. Provided with two 20 ampere cartridge type fuses, and
5. 3-wire, 2-pole. For the 600 volt AC switch, 4 wire, 3 pole is acceptable.

The rain tight enclosure shall be fabricated from sheet metal, zinc coated and have a gray finish coat.

The safety switch shall be installed in a vertical upright position.

A6 Enclosed Circuit Breaker

When specified in the Contract, an enclosed circuit breaker shall be furnished and installed where indicated in the Plans for cutting power to the electrical system or systems.

The circuit breaker shall be mounted in a NEMA 3R rain-tight enclosure for outdoor use. The circuit breaker shall be a 2-pole, 100 A, 120/240 VAC, thermo-magnetic breaker, UL listed as suitable for use as

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service equipment, and shall be clearly marked with "ON" and "OFF" positions and identified with the load it is carrying, such as EQUIPMENT PAD. If lugs are required for power conductor connections to the breaker, they shall be UL listed for use with copper wire and shall be solderless (set screw type). The rain-tight enclosure shall have provisions for a padlock (furnished by others).

A7 Signal Service Cabinet

The signal service cabinet shall consist of an external meter socket, main and branch circuit breakers, luminaire test switch, enclosed photoelectric control, and provisions for a battery back-up system. The signal service cabinet shall be as detailed in the Contract.

B Transformer and Circuit Breaker Assembly

B1 Transformer

The transformer shall be an outdoor, general purpose, dry type transformer. Transformer Specifications shall be as follows:

- (a) Primary - 480 V, two 5-percent taps below 480 V.
- (b) Secondary- 120/240 VAC.
- (c) Rating - 7.5 KVA, single phase
- (d) Size - Approximately 400 mm (**16 inches**) high, 300 mm (**12 inches**) wide, and 270 mm (**10 ½ inches**) deep.

The transformer and related wiring compartment shall be UL listed for indoor-outdoor applications and shall meet applicable NEMA and IEEE standards. The transformer shall be mounted on the equipment pad as detailed in the Contract to the satisfaction of the Engineer.

B2 Enclosed Circuit Breaker

The transformer shall be protected by a circuit breaker mounted in a NEMA 3R rain-tight enclosure for outdoor use. The circuit breaker shall be a 2-pole, 20 A, 480 VAC, thermo-magnetic breaker. If lugs are required for power conductor connections to the breaker, they shall be UL listed for use with copper wire and shall be solderless (set screw type). The rain-tight enclosure shall have provisions for a padlock (furnished by others). The circuit breaker enclosure shall be mounted as detailed in the Contract to the satisfaction of the Engineer.

3837.3 INSPECTION AND TESTING

The Contractor shall submit to the Engineer, for approval, six sets of manufacturer's drawings and specifications for the transformer and circuit breaker assembly proposed for installation.

The drawings shall be distributed, after approval, to the following:

- (a) Contractor
- (b) Contractor's Fabricator
- (c) Engineer
- (d) Traffic Electrical Systems Engineer
- (e) District Traffic Engineer

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(f) Traffic Signal Cabinet or other pad mount cabinet

All items of electrical service equipment shall be approved before installation.

3838

Electrical Junction Boxes

3838.1 SCOPE

This Specification covers junction boxes for providing access to electrical wiring, facilitating the installation of electrical wiring, and for changing from field cable wiring to individual conductors as part of a traffic control signal system, freeway ramp control signal, automatic traffic recorder system, roadway lighting system, or other electrical system.

3838.2 REQUIREMENTS

A Metal Junction Boxes Attached to a Bridge

Metal junction boxes required to be mounted to a bridge shall be NEMA Type 4 galvanized cast iron boxes with covers.

The junction boxes shall have four mounting lugs.

Junction boxes shall meet the minimum size requirements of the NEC and shall be adequately sized to permit easy installation of all electrical cables and conductors routed through the junction box. The cover shall be of the same material as the box, fastened with stainless steel hex-head screws or bolts and nuts, and equipped with a neoprene gasket around the entire perimeter of the cover.

Each conduit entrance shall accommodate the nominal outside diameter of the conduit specified and shall be bossed and threaded to provide five full threads.

Junction boxes shall be attached using two unit threaded bolt anchorages conforming to the Contract or, if not specified, approved by the Engineer, with the required hardware to permit removal of the junction box.

B Metal Junction Boxes on Wood Poles

The Contractor shall furnish and install a metal junction box with terminal blocks whenever installing temporary traffic control signal systems; flashing beacon systems; advance warning flashers; or vehicle, pedestrian signal faces, or flashing signal indications on wood poles.

Each metal junction box shall conform to NEC requirements, shall be NEMA Type 3R, shall be at least 300 mm (**12 inches**) square by 150 mm (**6 inches**) deep with a 6 mm (**¼ inch**) drain hole on the bottom side, and shall have a cover with a gasket around the entire perimeter of the cover. The cover shall be attached by stainless steel screws.

Each metal junction box shall have terminal blocks for terminating field conductors and traffic signal conductors. Terminal blocks shall be

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as described in 2565.3J, shall be firmly attached to the back of the junction box in such a manner that the terminal screws of the terminal block face the box opening, and shall be covered with an electrical insulating coating after all conductor terminations on the terminal block.

Liquid-tight flexible metal conduit and conduit fittings as required shall be furnished and installed between the metal junction box and each type wood pole mounted signal bracketing.

C Junction Boxes in Non-Metallic (NMC) Conduit Runs Attached to a Bridge

Junction boxes required to be mounted to the bridge shall be NMC junction boxes with a cover attached by stainless steel screws. Each NMC junction box shall be sized at least 150 mm (**6 inches**) square by 150 mm (**6 inches**) deep and shall be attached to the bridge in a manner approved by the Engineer. Each NMC junction box shall conform to NEC requirements.

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E Junction Boxes for Roadway Lighting Systems

Junction boxes specified for roadway lighting systems shall be NEMA Type 4, hot dip galvanized cast iron with interchangeable cover and side hub plates, brass cap screws, gaskets for cover and hub plates, suitable for use with rigid steel conduit.

The junction box shall have inside dimensions of 216 x 216 x 100 mm (**8 ½ x 8 ½ x 4 inches**) unless otherwise specified in the Contract. The junction boxes shall have four mounting lugs.

The cover shall be of the same material as the box, fastened with stainless steel hex-head screws or bolts and nuts, and equipped with a neoprene gasket around the perimeter of the cover.

Each conduit entrance shall accommodate the nominal outside diameter of the conduit specified and shall be bossed and threaded to provide five full threads.

Junction boxes shall be attached to concrete using masonry anchorages or power activated studs with the required hardware to permit removal of the junction box.

3838.3 INSPECTION AND TESTING

Three sets of shop drawings of the metal junction boxes and mounting details that the Contractor proposes to install shall be submitted to the Engineer for approval.

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Conduit Expansion Fittings

3839.1 SCOPE

This Specification covers conduit expansion fittings for use in conduit runs attached to bridges.

3839.2 REQUIREMENTS

Each expansion fitting shall be a weatherproof manufactured unit providing for conduit movement as specified in the Contract. A fitting providing for a minimum movement of 25 mm (**1 inch**) may be furnished if no movement is specified in the Contract.

Expansion fittings for use with RMC or IMC shall be iron or steel protected by galvanizing or plating and shall be UL listed.

Expansion fittings for use with NMC shall be intended for use with the particular type of conduit.

3839.3 INSPECTION AND TESTING

The expansion fittings shall be approved by the Engineer before installation.

3840

Wood Poles

3840.1 SCOPE

This Specification covers wood poles for use in traffic control signal systems, electric lighting systems, and mounting service equipment.

3840.2 REQUIREMENTS

The Contractor shall furnish wood poles:

- (a) Conforming to the American Standard Specifications and Dimensions for Wood Poles (ANSI 2051).
- (b) Of the length specified in the Plans.
- (c) Of Class II unless otherwise specified in the Contract.
- (d) Of the species in Table 3491-1.
- (e) Treated with preservative in accordance with 3491, lighting poles.
Creosote shall not be used.

3840.3 INSPECTION AND TESTING 3491

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Lighting Service Cabinet

3850.1 SCOPE

This Specification covers electrical service cabinets used for distributing electrical power, providing overcurrent protection and providing a means to cut off power to all or part of a roadway lighting system.

3850.2 REQUIREMENTS**A General**

The Contractor shall furnish a complete and operational lighting service cabinet as specified in the Contract. The lighting service cabinet shall be a single phase, 3 wire, weatherproof cabinet, and shall contain circuit breakers, lighting contactor(s), photoelectric control with test switch(es), power distribution blocks when specified, and neutral/ground bonding bar(s).

The cabinet shall be located such that the door is orientated 90 to 180 degrees to the roadway, away from traffic.

The cabinet and its contents shall comply with the requirements of the Underwriters Laboratory Inc. (UL) standards UL-508 and UL-508A. The enclosure shall have a NEMA 3R rating.

For lighting circuits serving luminaires rated at 120 V, the lighting service cabinet shall have circuit breakers and lighting contactor contacts rated for 120/240 VAC. The lighting contactor coil shall be rated for 120 VAC.

For lighting circuits serving luminaires rated at 240 V, the lighting service cabinet shall have circuit breakers and lighting contactor contacts rated for 240/480 VAC. The lighting contactor coil shall be rated for 240 VAC.

B Electrical Equipment and Wiring**B1 Circuit Breakers**

Circuit breakers shall be thermo-magnetic type. Main circuit breakers shall be located on the line side of the lighting contactor(s).

The lighting contactor(s) shall be located on the line side of the branch circuit breakers. Each branch circuit breaker shall be bolted onto a copper bus and shall be labeled as specified in 2545. Spacers shall cover empty circuit breaker spaces for circuits that are not used.

The branch circuit breakers shall be sized to accommodate a No. 4 AWG wire.

B2 Lighting Contactors

The lighting contactor(s) shall be 2-pole, normally open, electrically held, open type, and shall be rated for tungsten filament and ballast lighting loads. The control coil shall be actuated by a photocell and protected by a 15 A circuit breaker on the line side of the photocell and test switch.

The lighting contactor shall be as specified in the Contract.

B3 Test Switches

The test switch shall be a heavy duty, single pole, double throw, two position, rotary switch. One switch position shall be labeled "AUTOMATIC" and the other switch position shall be labeled "TEST". In the "AUTOMATIC" position, the test switch shall connect the coil of

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the lighting contactor to the AC+ (SWITCHED) from the photoelectric control, providing photoelectric control of the lighting circuit. In the "TEST" position, the test switch shall connect the coil of the lighting contactor to the AC+ (UNSWITCHED) from the photoelectric control, providing power to the lighting circuit regardless of the state of the photoelectric control.

B4 Component Arrangement

The main circuit breaker, lighting contactor, photoelectric control with test switch, power distribution blocks when specified, and branch circuit breakers shall be arranged and wired as indicated in the Contract.

The main breaker, lighting contactor(s), power distribution blocks, and branch circuit breaker(s) shall be mounted on a removable panel. A separate dead front shall cover the panel and shall be hinged on one side and held in place with quick release captive fasteners.

All neutral/ground bonding bars and bus bars shall be copper.

All terminals/connectors shall be UL listed for copper wire.

All wiring inside the cabinet shall be sufficient length to allow for contraction.

Three single conductors in accordance with 3815.2B1 shall be provided from the cabinet to the source of power and shall be the size indicated in the Contract.

C Photoelectric Control

A photoelectric control mounting receptacle (EEI/NEMA standard 3-terminal twist-lock type), photoelectric control, and photoelectric control shield when specified shall be mounted within the cabinet near the two lexan windows or 3 m (**10 feet**) above the ground on top of a rigid steel conduit rising vertically and entering the side of the cabinet. When specified, the conduit shall be 41 mm (**1 ½ inch**) nominal diameter for a pad mounted cabinet and 21 mm (**¾ inch**) nominal diameter for a pole mounted cabinet. The wires to the photoelectric control mounting receptacle shall be single conductor No. 14 stranded copper conductors in accordance with 3815. The photoelectric control shall be in accordance with 3812.

D Type L1 and L2 Service Cabinet

In addition to meeting the general requirements above, the Type L1 and Type L2 lighting service cabinet shall meet the following requirements:

D1 Cabinet Enclosure Construction

The lighting service cabinet shall be constructed from a minimum 3 mm (**0.125 inch**) thick aluminum conforming to the requirements of ASTM B 209 for 5052-H32 aluminum sheet. The Aluminum cabinet shall be anodized to match the Duranodic finish #311 after all machining has been completed.

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The cabinet shall be pad mounted with dimensions of 1525 mm (**60 inches**) high, 835 mm (**33 inches**) wide and 355 mm (**14 inches**) deep. The cabinet shall be secured to a concrete pad by four 19 mm ($\frac{3}{4}$ **inch**) diameter, 150 mm (**6 inch**) long, high strength anchor bolts in a 660 mm x 280 mm (**26 inch x 11 inch**) center to center rectangular bolt pattern.

The cabinet flanges shall have slotted holes for mounting the cabinet to anchor rods. The holes shall be reinforced on the top side of the flange with a piece of 3 mm (**0.125 inch**) aluminum 150 mm (**6 inches**) long and same width as the mounting flange.

A gasket shall be provided for mounting the cabinet on a concrete pad. The gasket shall consist of a four piece 13 mm ($\frac{1}{2}$ **inch**) thick x 64 mm (**2 ½ inch**) wide solid butyl rubber gasket with drilled holes, shaped to match the mounting flange and slots on the bottom of the cabinet. The Contractor shall leave one 13 mm ($\frac{1}{2}$ **inch**) gap in the gasket to ensure proper water drainage.

The cabinet shall have two compartments. The right compartment shall be 1525 mm (**60 inches**) high, 685 mm (**27 inches**) wide and 355 mm (**14 inches**) deep, providing space for the lighting service panel and the photoelectric control circuit. The service panel shall be installed 150 mm (**6 inches**) from the bottom of the cabinet to provide access to the anchor bolts when mounting the cabinet. The cabinet shall have an enclosed left compartment to provide space for the 50 mm (**2 inch**) conduit containing the power conductors to the meter. This compartment shall be 760 mm (**30 inches**) high, 150 mm (**6 inches**) deep and 355 mm (**14 inches**) wide. An opening and a hub shall be provided on the top of this compartment to facilitate wiring to the meter socket. The edge of the opening shall be properly protected. This compartment shall have a 610 mm x 355 mm (**24 inch x 14 inch**) removable front panel 180 mm (**7 inches**) from the bottom of the cabinet. The panel fasteners shall be of stainless steel or other non-corroding material.

The cabinet shall have a weathertight hinged door opening to the right (right-handed door). The door shall be equipped with a three-point locking mechanism that operates from a single easy-turning handle. The upper and lower locking points of the locking mechanism shall each have a pair of nylon rollers. The shaft size of the handle shall be a minimum of 16 mm (**5/8 inch**) diameter or 13 mm ($\frac{1}{2}$ **inch**) square. The cabinet door shall lock with a standard police lock and key (1 key shall be furnished).

The hinges, hinge pins, locks and lock covers shall be of stainless steel or other non-corroding material. Hinges may be welded on or fastened with stainless steel tamperproof bolts.

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The cabinet door shall have two sets of 100 mm x 255 mm (**4 inch x 10 inch**) louvered vents, with screening or perforated metal, installed approximately 255 mm (**10 inches**) from the bottom. The two sets of vents shall be separated by approximately 50 mm (**2 inches**).

Two circular windows shall be at the right upper back corner of the cabinet for the photocell. One window shall be on the back cabinet wall and the other shall be on the right cabinet wall. The windows shall have a diameter of 90 mm (**3.5 inches**).

The windows shall be of 3 mm (**0.125 inch**) thick lexan and be installed in a manner that does not sacrifice the weather-tightness or the security of the cabinet.

The cabinet top shall be crowned or slanted to the rear to prevent standing water, and shall provide a 50 mm (**2 inch**) overhang above the door beyond the front of the cabinet. The overhang shall provide venting for the entire cabinet.

The cabinet lifting provisions shall meet the UL requirements for the NEMA 3R. The lifting provisions shall consist of two aluminum lifting ears mounted to the enclosure, allowing a bar or hooks to be inserted through both ears for lifting the cabinet.

The lifting ears shall have a lifting capacity equal to the weight of the completely wired cabinet plus 25 percent, a 227 kg (**500 pound**) capacity minimum. Each lifting ear shall have a 25 mm (**1 inch**) hole, the bottom of which shall be flush with the top of the cabinet or within 3 mm (**1/8 inch**) of the cabinet. The top of the lifting ears shall be between 50 mm (**2 inches**) and 55 mm (**2 1/8 inches**) above the cabinet. The lifting ears shall be secured to the cabinet by corrosion resistant bolts.

The cabinet enclosure shall be of good workmanship. All seams and joints shall be smooth and even, without cracks or pinholes. There shall be no sharp corners or jagged edges.

The exterior seams for cabinet and doors shall be continuously welded or sealed with silicon sealant. All exterior welds shall be ground smooth. All sharp edges shall be filed.

D2 Electrical Equipment and Wiring

A self contained meter socket, rated for 200 Ampere, 480 volts, commercial type with a lever actuated positive bypass mechanism in accordance with 3837.2A2 shall be mounted to the left cabinet wall facing to the left. The meter socket shall be listed as approved for commercial use by the power company. The top of the meter socket shall be right under the left lifting ear. A chase nipple (minimum 50.8 mm (**minimum 2 inches**)) shall be installed at the bottom of the meter socket to provide connection to the left compartment of the cabinet.

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For metered feed points, meters will be furnished and installed by others.

The lighting service cabinet shall have two copper power distribution blocks to provide tapping from the primary feeds to the 100 amp circuit breaker. The power distribution block shall have lugs suitable for use with 75°C (167°F) conductors; shall be rated for 600 volt; and shall have a flammability rating of UL 94V-0.

The Type L1 lighting service cabinet shall be provided with one 2-pole, 100 A main circuit breaker; one 2-pole, 100 A lighting contactor; two 20-A single pole branch circuit breakers for each three-wire lighting branch circuit indicated in the Plans or Special Provisions; and capacity for a total of eight single pole branch circuit breakers.

The Type L2 lighting service cabinet shall be provided with one 2-pole, 100 A main circuit breaker; one 2-pole, 100 A lighting contactor; one 20-A single pole branch circuit breaker for each three-wire lighting branch circuit indicated in the Plans or Special Provisions; and capacity for a total of sixteen single pole branch circuit breakers.

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G Type A Service Cabinet

In addition to meeting the general requirements above, the Type A lighting service cabinet shall meet the following requirements:

G1 Cabinet Enclosure Construction

The Type A lighting service cabinet shall be a wood pole mounted cabinet, or as otherwise specified in the Contract, with approximate dimensions 1270 mm (**50 inches**) high, 419 mm (**16 ½ inches**) wide, and 203 mm (**8 inches**) deep. The cabinet shall have provisions for being secured to the wood pole by means of two iron straps and two 13 mm (**½ inch**) diameter by 153 mm (**6 inch**) long lag screws.

G2 Electrical Equipment and Wiring

The cabinet shall be provided with one 2-pole, 100 A main circuit breaker; one 2-pole, 100 A lighting contactor; two 20-A single pole branch circuit breakers for each three-wire lighting branch circuit indicated in the Plans or Special Provisions; and capacity for a total of eight single pole branch circuit breakers.

The Contractor shall furnish and install a 53 mm (**2 inch**) RSC riser and weatherhead above the Type A lighting service cabinet to a point 600 mm (**2 feet**) below the secondary terminal taps of the feed point

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transformer, or to a point designated by the power company. The service entrance conductors above the cabinet shall be No. 2 in accordance with 3815. The conductors shall extend up the conduit riser, through the weatherhead, and terminate a minimum of 1525 mm (**5 feet**) beyond the weatherhead for connection to the power conductors from the source of power; which connection will be made by others at no cost to the Contractor.

A 53 mm (**2 inch**) RSC stubout with insulating bushing shall be provided below the cabinet to a point a minimum of 610 mm (**24 inches**) below the ground line for the each armored cable entering the cabinet.

H Type B Service Cabinet

In addition to meeting the general requirements above, the Type B lighting service cabinet shall meet the following requirements.

H1 Cabinet Enclosure Construction

The Type B lighting service cabinet shall be a wood pole mounted cabinet, or as otherwise specified in the Contract, with approximate dimensions 762 mm (**30 inches**) high, 610 mm (**24 inches**) wide, and 203 mm (**8 inches**) deep. The cabinet shall have provisions for being secured to the wood pole by means of two iron straps and two 13 mm (**½ inch**) diameter by 153 mm (**6 inch**) long lag screws.

H2 Electrical Equipment and Wiring

The cabinet shall be provided with one 2-pole, 30 A main circuit breaker; two single pole, 30 A branch circuit breakers; and one 2-pole, 30 A lighting contractor.

The Contractor shall furnish and install a 53 mm (**2 inch**) RSC riser and weatherhead above the Type B lighting service cabinet to a point 600 mm (**2 feet**) below the secondary terminal taps of the feed point transformer, or to a point designated by the power company. The service entrance conductors above the cabinet shall be No. 6, in accordance with 3815. The conductors shall extend up the conduit riser, through the weatherhead, and terminate a minimum of 1525 mm (**5 feet**) beyond the weatherhead for connection to the power conductors from the source of power; which connection will be made by others at no cost to the Contractor.

A 53 mm (**2 inch**) RSC stubout with insulating bushing shall be provided below the cabinet to a point a minimum of 610 mm (**24 inches**) below the ground line for the each armored cable entering the cabinet.

3850.3 INSPECTION AND TESTING

The lighting service cabinets are subject to final inspection and acceptance at the project site. Such inspection will include but is not limited to the identification of the item, type, size and manufacturer's

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marking, and documentation of these data. When required by the Engineer, random samples will be selected from the material delivered to the Project site or at the source before delivery.

The Contractor shall submit to the Engineer, for approval by the Department's Lighting Engineer, five complete sets of shop detail drawings of the lighting service cabinets and anchor rods, in accordance with 2471.3B1 and 2471.3B3. The drawings shall be distributed, after approval, to the following:

- (a) Contractor
- (b) Contractor's Fabricator
- (c) Engineer
- (d) Traffic Electrical Systems Engineer
- (e) District or Division Traffic Engineer

All light service cabinets shall be approved before installation.

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**3861
Plant Stock**

3861.1 SCOPE

This Specification covers trees, shrubs, vines, and perennials of various species and varieties suitable for roadside landscape planting. The term "plant" shall mean any or all trees, shrubs, vines or perennials specified.

3861.2 REQUIREMENTS

Unless otherwise specified as collected stock (wild or grown in other than nursery conditions) or Department-furnished transplants, all plants furnished shall be from nursery grown stock and shall bear evidence of proper nursery care during growth. Plants will not be considered to be nursery grown unless they have been growing in a nursery for at least 2 years.

The Contractor shall comply with the current edition of "Inspection and Contract Administration Guidelines for Mn/DOT Landscape Projects," published by the Mn/DOT Landscape Architecture Unit, as the minimum and maximum criteria and standard for grading and accepting plant stock.

A Classification of Plants

Trees, shrubs, vines and perennials commonly used for landscaping purposes will be classified by species, variety, and size or age as indicated in the Contract.

When a dimensional size is specified in the Contract, it shall indicate the minimum range of height, stem caliper (diameter), or spread acceptable, as measured in accordance with standards in the current edition of "Inspection and Contract Administration Guidelines for Mn/DOT Landscape Projects."

B Blank

C Plant Names

All botanical and common names of plant materials specified shall be based on descriptions by Bailey in the latest edition of "Hortus Third."

D Plant Hardiness

All plant stock shall be deemed acceptable for hardiness if it is hardy to the Minnesota zone where the project site is located and:

- 1) Plant stock can be documented as continuously grown for at least the last two years within the acceptable limits shown on the Acceptable Plant Stock Growing Range Limits map in the Plan or
- 2) Plant stock, if grown outside the acceptable growing range limits, can be documented as having the seed source or root and graft stock originating from within the acceptable growing range limits.

Any questions regarding plant stock hardiness or botanical identification will be resolved by the Engineer.

E Previous Transplanting

All plants with the exception of seedlings, perennials, machine-transplants, and collected stock if specified, must bear evidence of previous transplanting or root pruning at least once during growth at the nursery. Trees from forest plantations are not acceptable, unless proper transplanting and root pruning has been practiced to develop compact and fibrous root systems suitable for transplanting success.

F Quality and Condition

A Certificate of Nursery Inspection by the Department of Agriculture of the State or origin, or valid copy thereof, shall be supplied as specified in 2571.2A2 (Plant Stock Documentation).

All plants shall be first-class representatives of their normal species or variety, and shall be free of disease, disfiguring knots, sun scald, insect infestations, dead or broken branches, bark abrasions, and other objectionable conditions.

All trees shall have reasonably straight trunks and shall be fully branched and symmetrical on all sides as characterized by natural habits of growth and proper nursery care. Shrubs shall be of strong bushy stock with well developed and formed stems, canes, or branches. Vines and perennials shall be strong healthy plants of the size or age specified.

All plants shall have strongly developed root systems of sufficient size to permit successful establishment and good growth, typical of the species or variety specified. The root systems of container grown plants shall be sufficiently developed to hold the soil intact upon removal from the container. Large root stubs and/or large circling or girdling roots shall be considered evidence of lack of proper care and root pruning, and shall be sufficient cause for rejection of nursery grown plants.

G Digging and Handling

All plants shall be dug and handled with reasonable care and skill as necessary to prevent damage to stems, roots, branches, and trunk.

Plants that are balled and burlapped (B & B) shall be dug in a manner that preserves a firm ball of undisturbed soil around the root system. Plants shall conform to the recommended balling and burlapping specifications set forth in the current edition of "Inspection and Contract Administration Guidelines for Mn/DOT Landscape Projects."

Balled and burlapped plants shall be wrapped and bound so that the soil ball will remain intact and solid while being handled, shipped, and planted. Handling shall always be by the soil ball and not by the plant's branches or trunk. The use of wire baskets in conjunction with furnishing, loading, or planting balled and burlapped plants will be

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permitted; however, restrictions of 2571.3F (Installation of Plants) shall apply.

H Packing and Shipping

All plant material shipments shall comply with the nursery inspection and plant quarantine regulations of the States of origin and destination as well as with Federal regulations governing interstate movement of nursery stock.

All plants shall be true to name, and each bundle, bale or individual plant shall be legibly and securely labeled with the names and sizes of each species or variety and with the quantity contained in the individual bundles, boxes or bales.

All plants shall be packed and shipped as necessary to ensure arrival at the planting site in good condition. From the time plants are dug and until delivered to the planting site, the roots shall be protected at all times against drying-out, by covering the root systems with a suitable moisture-holding material. They shall also be adequately protected against other damaging climatic conditions such as sun, wind, and freezing temperatures. When transported in closed vehicles, the plants shall have adequate ventilation to prevent unwanted sweating.

3861.3 SAMPLING AND INSPECTION

The plants shall be subject to inspection by the Engineer prior to planting, but such inspection shall not be considered as final acceptance. Final inspection and acceptance or rejection of plant stock shall be at the Project planting site.

All plants shall be in good condition upon delivery. Plants delivered with broken or bruised branches, stems, or canes will be rejected unless the damaged growth can be removed through pruning and without losing their symmetry or being trimmed to an unacceptable size. Balled and burlapped plants delivered with broken or disturbed balls, indicating the soil has been so loosened as to cause stripping of the small and fine feeding roots, will be rejected. Bare root plants shall be delivered in a dormant condition and should be installed while in a dormant condition. The Engineer may authorize installing plants that have broken dormancy, however, if authorized, the installation will be at the Contractor's own risk, and the initial planting operations payment for these plants will be withheld until they are determined to be initially acceptable after the first year of plant establishment.

The Engineer may inspect up to three balled and burlapped or container plants, of each variety delivered to the planting site, at random and inspect for condition and size of the root system. This may include pulling back the burlap and wire basket or removing containers. Any plants that become unsuitable for planting due to inspection shall be replaced by the contractor without any compensation.

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During the spring planting season, coniferous plants that have candled out (put out new growth) while being stored in a holding bin may be planted, however, coniferous plants that are dug after candling out will be rejected. Coniferous trees not fully branched from bottom to top and those that have been heavily sheared or pruned will be rejected. Only unsheared or lightly sheared conifers (those that have not been sheared within the last growing season and display buds or growth at the terminal ends of branches) shall be accepted. Pine trees shall have a terminal leader bud and terminal leaders shorter than 500 mm (**18 inches**) in length. A new central leader must be trained in conifers delivered with multiple or missing leaders.

Plants not conforming to dimensional requirements will be rejected. In measuring the height of coniferous trees of the pine, spruce and fir species, the upper limits shall be the midpoint of the terminal leader.

All rejected plants shall be removed from the Project by the Contractor and shall be replaced with acceptable plants of the required species and variety, unless otherwise directed by the Engineer.

3876 Seed

3876.1 SCOPE

This Specification covers introduced grass/legume and native grass and forb seeds used for planting to provide vegetative cover.

Pure live seed (PLS) is the percent of seed germination plus dormant and/or hard seed times the percent of seed purity of each species.

3876.2 REQUIREMENTS

A General Requirements

All seed shall conform to the latest seed law of the State, including those governing labeling and weed seed tolerances. Tolerances for Germination and Purity, as determined by the Department of Agriculture, shall only apply to seed that has been previously tested and approved by the Department of Agriculture as a seed lot. Test for germination and viability shall have been made within 9 months of the date of installation.

All legume seed, including native legumes, shall have been pre-inoculated with the proper bacterial culture for the species being inoculated and with the bacteria culture designed for this purpose (pre-inoculation), in the manner and within the time specified by the manufacturer.

All native grass and forb seed shall be of current production seed or harvested from the previous two growing seasons.

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All sedge, rush and forb seed that requires special pregermination treatment such as cold moist stratification shall be so treated prior to installation.

All wild-type native grass and forb seed shall have a source of origin within Minnesota, eastern North Dakota, eastern South Dakota, northern Iowa, or western Wisconsin.

Origin certified seed shall have originated within the regions specified above and shall be accompanied by the appropriate Quality Mark documentation from the Minnesota Crop Improvement Association to verify this.

Wild-type is defined as seed that is derived directly from native, wild stock; including seed that was collected in the wild and placed into production or that which has been harvested directly from native stands. Wild-type varieties are regional or local ecotypes that have not undergone a selection process. Wild-type refers to all native seed referred to as "common" in the industry. Origin certified seed that is "yellow tag" is by definition wild type that has originated within a specified geographic region.

Native species requiring certification for origin shall have their origin documented by the Minnesota Crop Improvement Association (MCIA). This level of certification is at the "yellow tag" (YT) level according to the MCIA Quality Control program. Documentation for origin certification of native seeds shall accompany all shipments and shall be identified on the tags as well.

All native grass, sedge, rush and forb seed shall be either origin certified or wild-type. Origin shall be clearly identified on the seed label for all seed, including native forbs.

Use of varieties not listed herein will be considered unacceptable and will be subject to 1503.

B Requirements for Native Grasses, Sedges, Rushes

The Contractor shall supply and plant native grass as pure live seed (PLS). If the listed varieties are not available from the Approved Vendor or Source list on file with the Mn/DOT Erosion Control unit, other varieties may be substituted only by obtaining approval of the Engineer and the Erosion Control unit. The Contractor shall provide documentation of substitutions prior to acceptance. Germination values shall include not more than 20 percent dormant seed, except for wetland sedges, rushes and grasses for which up to 80% dormancy shall be allowed.

All native grass seeds that contain awns or excessive hairs shall be cleaned and de-bearded prior to their inclusion into mixtures.

TABLE 3876-1 NATIVE GRASS REQUIREMENTS GERMINATION, PURITY, AND ACCEPTABLE VARIETIES				
Trade Name	Scientific Name	Acceptable Origin & Varieties	Purity Min. %	Germ. Min. %
Bluestem, big	<i>Andropogon gerardi</i>	MN Certified (YT), Bison	85	70
Gramma, sideoats	<i>Bouteloua curtipendula</i>	MN Certified (YT)	85	70
Gramma, blue	<i>Bouteloua gracilis</i>	MN Certified (YT), SD, ND wild-type	80	70
Brome, fringed	<i>Bromus ciliata</i>	MN Certified (YT), MN, MT, Canada wild-type	85	70
Brome, Kalm's	<i>Bromus kalmii</i>	MN Certified (YT), MN wild-type	85	70
Hairy wood chess	<i>Bromus purgans</i>	MN Certified (YT)	85	70
Buffalo grass	<i>Buchloe dactyloides</i>	MN Certified (YT), MN, ND, SD, NE wild-type	85	70
Blue-joint grass	<i>Calamagrostis Canadensis</i>	MN Certified (YT), MN wild-type	85	70
Sedge, bottle-brush	<i>Carex comosa</i>	MN wild-type	85	60
Sedge, tussock	<i>Carex stricta</i>	MN wild-type	85	60
Sedge, fox	<i>Carex vulpinoidea</i>	MN wild-type	85	60
Wild rye, Canadian	<i>Elymus canadensis</i>	MN Certified (YT)	85	70
Bottle brush grass	<i>Elymus hystrix</i>	MN wild-type	85	70
Wheat grass, slender	<i>Elymus trachycaulus</i>	MN Certified (YT), MN, ND, SD, Canada wild-type, Revenue	85	70
Wild rye, Virginia	<i>Elymus virginicus</i>	MN Certified (YT), MN, WI, IA wild-type	85	70
Wheat grass, western	<i>Elytrigia smithii</i>	MN Certified (YT), MN, ND, SD wild-type	85	70
Manna grass, reed	<i>Glyceria grandis</i>	MN Certified (YT), MN wild-type	85	70
Manna grass, fowl	<i>Glyceria striata</i>	MN Certified (YT), MN wild-type	85	70
Common rush	<i>Juncus effusus</i>	MN Certified (YT), MN wild-type	85	60
June grass	<i>Koeleria macrantha</i>	MN Certified (YT), MN, ND, SD wild-type	85	70

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TABLE 3876-1 NATIVE GRASS REQUIREMENTS GERMINATION, PURITY, AND ACCEPTABLE VARIETIES				
Trade Name	Scientific Name	Acceptable Origin & Varieties	Purity Min. %	Germ. Min.%
Switch grass	<i>Panicum virgatum</i>	MN Certified (YT), Dakota	95	70
Bluegrass, fowl	<i>Poa palustris</i>	MN Certified (YT), MN, ND, Canada wild-type	90	70
Bluestem, little	<i>Schizachyrium scoparium</i>	MN Certified (YT)	85	70
Bulrush, green	<i>Scirpus atrovirens</i>	MN Certified (YT), MN wild-type	85	60
Wool grass	<i>Scirpus cyperinus</i>	MN Certified (YT), MN wild-type	85	60
Bulrush, soft-stem	<i>Scirpus validus</i>	MN Certified (YT), MN wild-type	85	60
Indian grass	<i>Sorghastrum nutans</i>	MN Certified (YT)	85	70
Cordgrass, prairie	<i>Spartina pectinata</i>	MN Certified (YT), MN wild-type	85	70
Dropseed, rough	<i>Sporobolus asper</i>	MN Certified (YT), MN wild-type	90	70
Dropseed, sand	<i>Sporobolus cryptandrus</i>	MN Certified (YT), MN, ND, SD wild-type	95	70
Dropseed, prairie	<i>Sporobolus heterolepis</i>	MN Certified (YT)	90	70
Needle grass, green	<i>Stipa viridula</i>	MN Certified (YT), MN, ND, SD wild-type	90	80

C Requirements for Introduced Grasses....Table 3876-2

TABLE 3876-2 INTRODUCED GRASS REQUIREMENTS GERMINATION, PURITY, AND ACCEPTABLE VARIETIES				
Trade Name	Scientific Name	Acceptable Varieties	Purity Minimum %	Germination Minimum %
Bentgrass, seaside	<i>Agrostis palustris</i>	--	98	90
Redtop	<i>Agrostis stolonifera</i>	--	92	85
Oats	<i>Avena sativa</i>	--	99	85
Brome, smooth	<i>Bromus inermis</i>	Lincoln, Carlton, Sac, Signal, Manchar	90	85

TABLE 3876-2 INTRODUCED GRASS REQUIREMENTS GERMINATION, PURITY, AND ACCEPTABLE VARIETIES				
Trade Name	Scientific Name	Acceptable Varieties	Purity Minimum %	Germination Minimum %
Fescue, hard	<i>Festuca ovina</i> <i>var. duriuscula</i>	Durar, Scaldis, Reliant II, Warwick, Aurora	95	85
Fescue, red	<i>Festuca rubra</i>	Wintergreen, Dawson, Pen Lawn, Cindy	97	85
Fescue, sheep's	<i>Festuca sp.</i>	--	95	85
Ryegrass, perennial	<i>Lolium perene</i>	--	99	90
Ryegrass, annual	<i>Lolium italicum</i>	--	99	90
Timothy	<i>Phleum pratense</i>	--	99	85
Bluegrass, Canada	<i>Poa compressa</i>	Common, Reubens, Talon	95	82
Bluegrass, Kentucky-Elite	<i>Poa pratensis</i>	Adelphi, Aspen, Glade, Columbia, Estate, Eclipse, Jefferson, Midnight, Midnight II, NuGlade, Touchdown, Merit, Parade, Rambo, Fylking, Victa, Monopoly	95	82
Bluegrass, Kentucky-Improved	<i>Poa pratensis</i>	Baron, Odyssey, Rugby II, Shamrock	95	82
Bluegrass, Kentucky-Low Maintenance	<i>Poa pratensis</i>	America, Aquila, Caliber, Certified Park, Challenger, Impact, Kenblue, Nassau, Newport, Ram I, Nugget, Sydsport, South Dakota	95	82
Bluegrass, Kentucky-Park	<i>Poa pratensis</i>	Certified Park only	95	82

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TABLE 3876-2 INTRODUCED GRASS REQUIREMENTS GERMINATION, PURITY, AND ACCEPTABLE VARIETIES				
Trade Name	Scientific Name	Acceptable Varieties	Purity Minimum %	Germination Minimum %
Bluegrass SD Common	<i>Poa pratensis</i>		98	85
Alkali grass	<i>Puccinella distans</i>	Fult's, Salty	95	85
Wheat, winter	<i>Triticum aestivum</i>	--	99	85

D Requirements for Introduced Legumes....Table 3876-3

Germination values determined by test shall include dormant seed for legumes.

TABLE 3876-3 INTRODUCED LEGUMES REQUIREMENTS GERMINATION, PURITY, AND ACCEPTABLE VARIETIES				
Trade Name	Scientific Name	Acceptable Varieties	Purity Minimum %	Germination Minimum %
Alfalfa, creeping	<i>Medicago sativa</i>	Rambler, Victoria, Teton, Travois, Spredor 2	99	85
Alfalfa, perennial	<i>Medicago sativa</i>	Vernal	99	85
Alfalfa, annual	<i>Medicago sativa</i>	Nitro, Condor, El Grande, Maricopa, Mesa, Prestige, Tulane, Westar, Beacon, Coronado, Mecca, Sundor	99	85
Clover, alslike	<i>Trifolium hybridum</i>	--	99	85
Clover, red	<i>Trifolium pratense</i>	Lakeland, Arlington	99	85
Clover, white	<i>Trifolium repens</i>	----	99	85

E Requirements for Native Forbs (Wildflowers).....

..... Table 3876-4

All forb seed shall be of wild-type as defined in 3876.2A.

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The Contractor shall supply and plant native forb seed as a bulk rate. Native forb seed shall be tested for viability with a standard germination test performed according to 3876.3. If the test meets or exceeds the minimum percent germination requirement for each respective species, the Engineer will accept the seed for viability. If a species is called for that is not listed in Table 3876-4, its purity shall be no less than 50 percent and its viability no less than 20 percent.

**TABLE 3876-4
NATIVE FORB SPECIES (WILDFLOWERS)
GERMINATION, PURITY, AND ACCEPTABLE VARIETIES**

Trade Name	Scientific Name	Purity Min. %	Germ. Min. %
Yarrow	<i>Achillea millefolium</i>	80	40
Hyssop, fragrant- giant	<i>Agastache foeniculum</i>	80	50
Water Plantain	<i>Alisma subcordatum</i>	80	40
Meadow garlic	<i>Allium canadense</i>	80	40
Onion, prairie	<i>Allium stellatum</i>	80	40
Anemone, Canada	<i>Anemone canadensis</i>	80	40
Milkweed, marsh	<i>Asclepias incarnata</i>	80	60
Milkweed, butterfly	<i>Asclepias tuberosa</i>	80	60
Aster, sky-blue	<i>Aster azureus</i>	80	50
Aster, heath	<i>Aster ericoides</i>	80	50
Aster, smooth-blue	<i>Aster laevis</i>	80	50
Aster, large-leaved	<i>Aster macrophyllus</i>	60	40
Aster, New England	<i>Aster novae-angliae</i>	80	50
Aster, upland-white	<i>Aster ptarmicoides</i>	80	50
Aster, swamp	<i>Aster puniceus</i>	60	40
Aster, silky	<i>Aster sericeus</i>	80	50
Aster, panicled	<i>Aster simplex</i>	80	40
Aster, flat-topped	<i>Aster Unbellatus</i>	80	40
Milkvetch, Canada	<i>Astragalus canadensis</i>	90	70
Partridge pea	<i>Chamaecrista fasciculata</i>	90	70
Tic-seed, stiff	<i>Coreopsis palmata</i>	80	40
Prairie clover, white	<i>Dalea candidum</i>	90	70
Prairie clover, purple	<i>Dalea purpureum</i>	90	70
Tick-trefoil, showy	<i>Desmodium canadense</i>	90	70
Coneflower, narrow-leaved	<i>Echinacea angustifolia</i>	80	50
Joe-pye weed	<i>Eupatorium maculatum</i>	60	50
Boneset	<i>Eupatorium perfoliatum</i>	60	50
Long-leaved bluets	<i>Hedyotis longifolia</i>	80	40
Sneezeweed	<i>Helenium autumnale</i>	80	40
Giant sunflower	<i>Helianthus giganteus</i>	80	40
Ox-eye, common	<i>Heliopsis helianthoides</i>	80	60

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**TABLE 3876-4
NATIVE FORB SPECIES (WILDFLOWERS)
GERMINATION, PURITY, AND ACCEPTABLE VARIETIES**

Trade Name	Scientific Name	Purity Min. %	Germ. Min. %
Great St. John's wort	<i>Hypericum pyramidalatum</i>	80	40
Iris, wild	<i>Iris versicolor</i>	80	40
Iris, blue-flag	<i>Iris virginica-shrevii</i>	80	60
Bushclover, round-headed	<i>Lespedeza capitata</i>	80	50
Blazingstar, rough	<i>Liatris aspera</i>	80	50
Blazingstar, dotted	<i>Liatris punctata</i>	80	50
Blazingstar, tall	<i>Liatris pycnostachya</i>	80	50
Lobelia, great-blue	<i>Lobelia siphilitica</i>	80	40
Lupine, wild	<i>Lupinus perennis</i>	80	40
Monkey flower	<i>Mimulus ringens</i>	80	40
Bergamot, wild	<i>Monarda fistulosa</i>	80	40
Bee balm, spotted	<i>Monarda punctata</i>	70	40
Beardtongue, foxglove	<i>Penstemon digitalis</i>	80	40
Penstemon showy	<i>Penstemon grandiflorum</i>	80	40
Mountain mint	<i>Pycnathemum</i>	80	40
Coneflower, columnar	<i>Ratibida columnifera</i>	80	50
Coneflower, grey-headed	<i>Ratibida pinnata</i>	80	50
Prairie rose	<i>Rosa arkansana</i>	80	40
Black-eyed Susan's	<i>Rudbeckia hirta</i>	80	60
Golden-glow, wild	<i>Rudbeckia laciniata</i>	80	40
Brown-eyed Susan	<i>Rudbeckia triloba</i>	80	40
Goldenrod, grass-leaved	<i>Solidago graminifolia</i>	70	40
Goldenrod, gray	<i>Solidago nemoralis</i>	80	40
Goldenrod, upland	<i>Solidago ptarmicoides</i>	80	40
Goldenrod, stiff	<i>Solidago rigida</i>	80	50
Goldenrod, showy	<i>Solidago speciosa</i>	80	40
Tall meadow rue	<i>Thalictrum dasycarpum</i>	80	40
Spiderwort, prairie	<i>Tradescantia bracteata</i>	80	50
Spiderwort, Ohio	<i>Tradescantia ohioensis</i>	80	50
Vervain, blue	<i>Verbena hastata</i>	80	50
Vervain, hoary	<i>Verbena stricta</i>	80	50
Ironweed	<i>Veronia fasciculata</i>	80	50
Culver's root	<i>Veronicastrum virginianum</i>	80	40
Vetch, American	<i>Vicia americana</i>	80	60
Alexander's, heart-leaved	<i>Zizea aptera</i>	80	50
Alexander's, golden	<i>Zizea aurea</i>	80	50

F Seed Mixture Designations

The seed mixture or species to be furnished and used shall be as indicated in the Contract. The mixtures shall be a uniform blend of the designated seeds, proportioned as specified in Table 3876-5.

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Mixtures in the 300 series shall be blended according to size and texture so that they can be installed from the appropriate seed box. The fine seed shall be installed from the fine seed box and the fluffy seed from the fluffy seed box. Forbs are added to mixtures by blending fine and fluffy seeds with the corresponding grass seed components using the mixtures provided in Table 3876-6. The inclusion of forbs is indicated in Table 3876-5.

F1 Native Harvest

Unless otherwise specified, native harvest shall consist of seed that has been harvested directly from wild stands within 80 km (**25 miles**) of the Project. Seed originating from outside the specified area will not be acceptable. Approximately 70 percent of the mixture shall consist of big bluestem and Indian grass, each with a minimum germination percent of 70 percent. The minimum percent PLS of the big bluestem and Indian grass portion of the native harvest mix shall be no less than 50 percent. In addition, the native harvest shall contain a minimum of five species of native grasses and shall also consist of no less than 3 percent (by mass) of native forbs. All species contained in the native harvest mix shall be listed with their relative percentages on the packing slip. Components comprising less than 1 percent of the mix may be listed as "trace". Germination results for the species tested shall be contained on the label. In addition, the native harvest mix shall contain no more than 25 percent non-viable matter. Non-viable matter includes but is not limited to chaff, non-viable seed, hulls, trash, and straw.

**TABLE 3876-5
SEED MIXTURE DESIGNATIONS**

Temporary Mixes		
Mixture	Plant Species	% of Total
100	Winter wheat	100.0
110	Oats	100.0
130	Oats	40.0
	Winter wheat	40.0
	Rye grass	10.0
	Alfalfa, annual	10.0
Total:		100.0

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Mixture: 150			
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Rye-grass, perennial	16.8	15	37.5
Wheat-grass, slender	5.6	5	12.5
Red clover	11.2	10	25.0
Alfalfa, vernal	11.2	10	25.0
GRAND TOTALS:	44.8	40	100.0
<i>Purpose: 1-2 Year Temporary Stabilization</i>			

Mixture: 190			
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Red Clover	6.7	6	10.0
Alsike Clover	4.7	4.2	7.0
Alfalfa, creeping	10.7	9.6	16.0
Brome grass, smooth	8.1	7.2	12.0
Rye-grass, perennial	16.8	15	25.0
Wheat-grass, slender	3.4	3	5.0
Vetch, hairy	16.8	15	25.0
GRAND TOTALS:	67.2	60	100.0
<i>Purpose: 2-5 Years Roadside Stabilization</i>			

Mixture: 240			
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Brome grass, smooth	10.9	9.7	13.0
Bluegrass, Kentucky "Certified Park"	22.6	20.2	27.0
Bluegrass, Canada	10.9	9.7	13.0
Switch grass	2.1	1.9	2.5
Wheat-grass, slender	3.4	3.0	4.0
Fescue, Hard "Reliant II"	5.9	5.3	7.0
Rye-grass, perennial	16.8	15.0	20.0
Dropseed, sand	2.1	1.9	2.5
Bluestem, little *	2.9*	2.6*	3.5*
Red clover	5.9	5.3	7.0
Prairie clover, purple	0.5	0.4	0.5
GRAND TOTALS:	84	75	100.0
* Bulk with 50% PLS minimum			
<i>Purpose: Sandy-Roadside</i>			

Mixture: 250			
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Brome grass, smooth	11.0	9.8	14.0
Bluegrass, Kentucky "Certified Park"	22.7	20.3	29.0
Bluegrass, Canada	11.0	9.8	14.0
Switch grass	2.4	2.1	3.0
Wheat-grass, slender	3.1	2.8	4.0
Rye-grass, perennial	16.5	14.7	21.0
Timothy	2.4	2.1	3.0
Redtop	2.4	2.1	3.0
Alfalfa, creeping	4.7	4.2	6.0
White Clover	2.4	2.1	3.0
GRAND TOTALS:	78.6	70	100.0
<i>Purpose: General Roadside excluding sandy sites</i>			

3876.2

Mixture: 260			
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Bluegrass, Kentucky "Certified Park"	35.8	32	32.0
Bluegrass, Canada	11.2	10	10.0
Bluegrass, Kentucky - Low Maintenance ¹	33.6	30	30.0
Fescue, hard	9.0	8	8.0
Rye-grass, perennial	22.4	20	20.0
GRAND TOTALS:	112	100	100.0

¹ Any accepted low maintenance Kentucky Bluegrass Except "Park"

Purpose: Commercial Turf

Mixture: 270			
Common Name	Bulk Rate		% of Mix Component
	kg/ac	lb/ac	
Bluegrass, Kentucky - Elite	33.6	30	25.0
Bluegrass, Kentucky - Improved	33.6	30	25.0
Bluegrass, Kentucky - Low Maintenance	33.6	30	25.0
Red fescue, creeping	10.8	9.6	8.0
Rye-grass, perennial	22.8	20.4	17.0
GRAND TOTALS:	134.4	120	100.0

Purpose: Residential Turf

Mixture: 280			
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Alfalfa, creeping	16.8	15	30.0
Brome grass, smooth	11.2	10	20.0
Redtop	3.4	3	6.0
Rye-grass, perennial	16.8	15	30.0
Switch grass	2.2	2	4.0
Timothy	2.2	2	4.0
Wheat-grass, slender	3.4	3	6.0
GRAND TOTALS:	56	50	100.0

Purpose: Agricultural Roadsides

3876.2

Mixture: 310			
Common Name	PLS Rate		% of Mix Component
	kg/ha	lb/ac	
Bluestem, big	2.8	2.5	25.0
Indian grass	2.8	2.5	25.0
Wild-rye, Virginia	2.2	2.0	20.0
Switch grass	0.6	0.5	5.0
Blue-joint grass	0.3	0.25	2.5
Green bulrush	0.3	0.25	2.5
Wool grass	0.3	0.25	2.5
Giant bur reed	0.3	0.25	2.5
Cordgrass, prairie	1.7	1.5	15.0
Grass Totals:	11.3	10.0	100.0
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Winter Wheat*	62.7	56.0	80.0
Rye-grass, annual	12.5	11.2	16.0
Wheatgrass, slender	3.1	2.8	4.0
Cover Crop Totals:	78.3	70	100.0
Wet Forbs Mixture (Table 3876-6)	2.2	2.0	100.0
GRAND TOTALS:	91.8	82.0	100.0
*Oats to be substituted for spring plantings			
<i>Purpose: Native mix for wetter areas. Infiltration ponds, dry ponds, wet ditches. Tall height.</i>			

3876.2

Mixture: 325			
Common Name	PLS Rate		% of Mix Component
	kg/ha	lb/ac	
Bluestem, big	1.7	1.5	15.0
Fringed brome	1.7	1.5	15.0
Wheat grass, slender	1.7	1.5	15.0
Virginia wild-rye	1.7	1.5	15.0
Switch grass	0.6	0.5	5.0
Fowl bluegrass	1.7	1.5	15.0
Indian grass	1.7	1.5	15.0
Prairie cord grass	0.6	0.5	5.0
Grass Totals:	11.4	10.0	100.0
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Blue-joint grass	0.22	0.2	10.0
Bottlebrush sedge	0.34	0.3	15.0
Tussock sedge	0.22	0.2	10.0
Fox sedge	0.22	0.2	10.0
Reed manna grass	0.22	0.2	10.0
Fowl manna grass	0.22	0.2	10.0
Green bulrush	0.22	0.2	10.0
Wool grass	0.22	0.2	10.0
Soft-stem bulrush	0.34	0.3	15.0
Sedge Totals:	2.22	2.0	100.0
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Winter Wheat*	61.6	56	80.0
Rye-grass, annual	12.3	11.2	16.0
Wheatgrass, slender	3.1	2.8	4.0
Cover Crop Totals:	77	70	100.0
Wet Forbs Mixture (Table 3876-6)	2.2	2.0	100.0
GRAND TOTALS:	92.8	84.0	100.0
*Oats to be substituted for spring plantings			
Purpose: Native sedge/prairie meadow mix. Reaches a height of 915 mm to 1220 mm (36 to 48 inches). Developed for use on hydric soils and for wetland restoration.			

3876.2

Mixture: 328			
Common Name	PLS Rate		% of Mix Component
	kg/ha	lb/ac	
Bluestem, big	2.2	2	12.5
Brome, fringed	2.2	2	12.5
Wild-rye, Virginia	4.4	4	25.0
Switchgrass	1.1	1	6.3
Bluegrass, fowl	5.5	5	31.3
Indian grass	2.2	2	12.5
Grass Totals:	17.6	16.0	100.0
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Winter Wheat*	61.6	56.0	80.0
Rye-grass, annual	12.3	11.2	16.0
Wheatgrass, slender	3.1	2.8	4.0
Cover Crop Totals:	77	70	100.0
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Milkweed, marsh	0.33	0.3	15.0
Prairie clover, purple	0.33	0.3	15.0
Tic-trefoil, showy	0.33	0.3	15.0
Sunflower, early	0.33	0.3	15.0
Black-eyed Susan	0.55	0.5	25.0
Vervain, blue	0.33	0.3	15.0
Economy Forbs Totals:	2.2	2.0	100.0
GRAND TOTALS:	96.8	88.0	100.0
*Oats to be substituted for spring plantings			
<i>Purpose: Native mix for infiltration ponds, dry ponds, temporary wet ditches. Tall height.</i>			

3876.2

Mixture: 330			
Common Name	PLS Rate		% of Mix Component
	kg/ha	lb/ac	
Gramma, sideoats	3.4	3.0	21.5
Gramma, blue	2.8	2.5	18.0
Bluestem, little	3.9	3.5	25.0
June grass	1.1	1.0	7.0
Dropseed, sand	1.1	1.0	7.0
Wild-rye, Canadian	3.4	3.0	21.5
Grass Totals:	15.7	14.0	100.0
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Winter Wheat*	62.7	56.0	80.0
Rye-grass, annual	12.5	11.2	16.0
Wheatgrass, slender	3.1	2.8	4.0
Cover Crop Totals:	78.3	70	100.0
Dry Forbs Mixture (Table 3876-6)	0.6	0.5	100.0
GRAND TOTALS:	94.6	84.5	100.0
*Oats to be substituted for spring plantings			
<i>Application: Native mix for Sandy/dry areas. Short height.</i>			

Mixture: 340			
Common Name	PLS Rate		% of Mix Component
	kg/ha	lb/ac	
Bluestem, big	3.3	3.0	21.5
Bluestem, little	2.8	2.5	18.0
Wild-rye, Canadian	2.2	2.0	14.0
Grama, sideoats	2.2	2.0	14.0
Switch grass	0.6	0.5	4.0
Dropseed, sand	0.6	0.5	3.5
Bluegrass, Canada	3.4	3.0	21.5
June grass	0.6	0.5	3.5
Grass Totals:	15.7	14.0	100.0
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Winter Wheat*	62.7	56.0	80.0
Rye-grass, annual	12.5	11.2	16.0
Wheatgrass, slender	3.1	2.8	4.0
Cover Crop Totals:	78.3	70	100.0
Dry Forbs Mixture (Table 3876-6)	0.6	0.5	100.0
GRAND TOTALS:	94.6	84.5	100.0
*Oats to be substituted for spring plantings			
<i>Purpose: Native mix for Sandy/Dry areas. Mid-height.</i>			

3876.2

Mixture: 350			
Common Name	PLS Rate		% of Mix Component
	kg/ha	lb/ac	
Bluestem, big	3.4	3.0	21.5
Indian grass	2.8	2.5	18.0
Bluestem, little	2.8	2.5	18.0
Gramma, sideoats	3.4	3.0	21.5
Wild-rye, Canadian	2.2	2.0	14.0
Switch grass	1.1	1.0	7.0
<i>Grass Totals:</i>	<i>15.7</i>	<i>14.0</i>	<i>100.0</i>
Common Name	Bulk Rate		% of Mix Component
	kg/ha	lb/ac	
Winter Wheat*	62.7	56.0	80.0
Rye-grass, annual	12.5	11.2	16.0
Wheatgrass, slender	3.1	2.8	4.0
<i>Cover Crop Totals:</i>	<i>78.3</i>	<i>70</i>	<i>100.0</i>
Mesic Forbs Mixture (Table 3876-6)	0.6	0.5	100.0
GRAND TOTALS:	94.6	84.5	100.0
*Oats to be substituted for spring plantings			
<i>Application: Native mix for general roadside areas.</i>			

3876.2

TABLE 3876-6
FORBS

Mixture: Mesic Forbs		
Common Name	Botanical Name	% of Mix
Aster, smooth-blue	<i>Aster laevis</i>	5.0
Milkvetch, Canada	<i>Astragalus canadensis</i>	5.0
Prairie clover, white	<i>Dalea candidum</i>	5.0
Prairie clover, purple	<i>Dalea purpureum</i>	5.0
Tick-trefoil, Showy	<i>Desmodium canadense</i>	5.0
Coneflower, narrow-leaved	<i>Echinacea angustifolia</i>	5.0
Ox-eye, common	<i>Heliopsis helianthoides</i>	5.0
Coneflower, grey-headed	<i>Ratibida pinnata</i>	5.0
Blazingstar, rough	<i>Liatris aspera</i>	5.0
Blazingstar, tall	<i>Liatris pycnostachya</i>	5.0
Bergamot, wild	<i>Monarda fistulosa</i>	5.0
Penstemon, showy	<i>Penstemon grandiflorum</i>	5.0
Mint, mountain	<i>Pycnathemum virginianum</i>	5.0
Coneflower, columnar	<i>Ratibida columnifera</i>	5.0
Black-eyed Susan	<i>Rudbeckia hirta</i>	5.0
Goldenrod, stiff	<i>Solidago rigida</i>	5.0
Vervain, blue	<i>Verbena hastata</i>	5.0
Vervain, hoary	<i>Verbena stricta</i>	5.0
Alexanders, heart-leaved	<i>Zizia aptera</i>	5.0
Alexanders, golden	<i>Zizia aurea</i>	5.0
	Total:	100.0

Rate: 0.6 kg/ha (½ pounds per acre) Bulk.

3876.2

Mixture: Dry Forbs		
Common Name	Botanical Name	% of Mix
Leadplant	<i>Amorpha canescens</i>	10.0
Milkweed, butterfly	<i>Asclepias tuberosa</i>	2.0
Aster, heath	<i>Aster ericoides</i>	4.0
Tic-seed, stiff	<i>Coreopsis palmate</i>	2.0
Yarrow	<i>Achillea millefolium</i>	2.0
Long-leaved bluets	<i>Hedyotis longifolia</i>	1.0
Bushclover, round-headed	<i>Lespedeza capitata</i>	3.0
Blazingstar, rough	<i>Liatris aspera</i>	4.0
Blazingstar, dotted	<i>Liatris punctata</i>	3.0
Lupine, wild	<i>Lupinus perennis</i>	5.0
Prairie clover, white	<i>Dalea candidum</i>	5.0
Prairie clover, purple	<i>Dalea purpureum</i>	16.0
Prairie rose	<i>Rosa arkansana</i>	1.0
Black-eyed susan	<i>Rudbeckia hirta</i>	18.0
Goldenrod, gray	<i>Solidago nemoralis</i>	3.0
Goldenrod, upland	<i>Solidago ptarmicoides</i>	1.0
Goldenrod, stiff	<i>Solidago rigida</i>	2.0
Goldenrod, showy	<i>Solidago speciosa</i>	2.0
Vervain, hoary	<i>Verbena stricta</i>	14.0
Alexander's, golden	<i>Zizia aurea</i>	2.0
	Total:	100.0
Rate: 0.6 kg/ha (½ pounds per acre) bulk		

3876.2

Mixture: Wet Forbs		
Common Name	Botanical Name	% of Mix
Hyssop, fragrant giant	<i>Agastache foeniculum</i>	2.0
Water plantain	<i>Alisma subcordatum</i>	4.0
Meadow garlic	<i>Allium canadense</i>	1.0
Anemone, Canada	<i>Anemone Canadensis</i>	1.0
Milkweed, marsh	<i>Asclepias incarnata</i>	2.0
Aster, panicled	<i>Aster simplex</i>	3.0
Aster, New England	<i>Aster novaeangliae</i>	3.0
Aster, red-stalked	<i>Aster puniceus</i>	3.0
Aster, flat-topped	<i>Aster umbellatus</i>	1.0
Tick trefoil, Canada	<i>Desmodium glutinosum</i>	1.0
Joe-pye weed	<i>Eupatorium maculatum</i>	17.0
Boneset	<i>Eupatorium perfoliatum</i>	10.0
Goldenrod, grass-leaved	<i>Solidago graminifolia</i>	2.0
Sneezeweed	<i>Helenium autumnale</i>	1.0
Giant sunflower	<i>Helianthus giganteus</i>	2.0
Ox-eye, common	<i>Heliopsis helianthoides</i>	1.0
Great St. John's wort	<i>Hypericum pyramidalatum</i>	2.0
Iris, wild	<i>Iris versicolor</i>	1.0
Blazingstar, tall	<i>Liatris pycnostachya</i>	8.0
Bergamot, wild	<i>Monarda fistulosa</i>	1.0
Prairie clover, white	<i>Dalea candidum</i>	1.0
Prairie clover, purple	<i>Dalea purpureum</i>	2.0
Mountain mint	<i>Pycnathemum virginianum</i>	1.0
Black-eyed susan	<i>Rudbeckia hirta</i>	6.0
Goldenrod, stiff	<i>Solidago rigida</i>	2.0
Tall meadow rue	<i>Thalictrum dasycarpum</i>	2.0
Vervain, blue	<i>Verbena hastata</i>	14.0
Ironweed	<i>Veronia fasciculata</i>	1.0
Culver's root	<i>Veronicastrum virginicum</i>	3.0
Alexander's, golden	<i>Zizea aurea</i>	2.0
	Total:	100.0
Rate: 2.2 kg/ha (2 pounds/acre) bulk		

3876.3

3876.3 INSPECTION AND ACCEPTANCE

Certified Source - Sources with established quality control and so approved by the Erosion Control unit may supply seed in accordance with the Guaranteed Analysis method on file with the Mn/DOT Erosion Control unit. Seed guaranteed as meeting the pertinent requirements of this Specification shall be identified by official guaranteed analysis labels affixed to each container of seed in addition to the customary seed tag. For each lot of each type of seed, test reports from the Minnesota Department of Agriculture Seed Laboratory or a certified commercial seed analyst shall be available.

Noncertified source – All seed shall be sampled and tested prior to use. The Contractor shall submit to the Engineer the proposed source at least 6 weeks prior to time of use to allow adequate time for testing and approving the material. Current test results as conducted by a certified seed analyst or by a state Seed Laboratory may be accepted in lieu of Department testing.

As an alternate to the above testing or the Guaranteed Analysis method, Certified Seed bearing the Quality Mark of the Minnesota Crop Improvement Association will be acceptable. Certified Seed bearing the Quality Mark of agencies so authorized in other states will be acceptable providing that their germination and purity requirements equal or exceed those established by the Minnesota Crop Improvement Association.

The Department reserves the right to conduct its own inspection of seed either at the supplier's warehouse or at the Project site. Should the results of the Department's inspection disagree with those obtained at the origin, the Department's findings shall be conclusive and binding.

All bags of seed shall be labeled with the mixture number and the vendor from which it was obtained. All Seed not planted within 9 months after it has been tested for germination shall be sampled and retested before use, at no cost to the Department. Seed testing shall be in accordance with the methods on file with the Mn/DOT Erosion Control unit.

The Contractor shall obtain all native grass and forb seeds from an Approved Vendor or Source for native seeds as listed with the Mn/DOT Erosion Control unit or listed in the Contract. A Certification of Compliance shall be furnished for all native seed mixes supplied to the project in accordance with 1603. The Certificate of Compliance shall state the amount of origin certified seed if any in the mix and the conversion of PLS to bulk weight. Each native seed mixture shall have a separate Certificate of Compliance.

3877
Topsoil Borrow

3877.1 SCOPE

This Specification covers topsoil material used as a medium for establishing and sustaining healthy plant growth.

3877.2 REQUIREMENTS

Topsoil material furnished under this Specification shall be obtained from the soil horizons normally designated as "A" or "B" as defined by the Soil Science Society of America, or shall be obtained from alluvial deposits. The material shall meet the requirements given herein for the several classifications defined.

A Topsoil Borrow

Topsoil borrow for general use as a turf growing medium shall meet the requirements of Table 3877-1:

TABLE 3877-1
TOPSOIL BORROW REQUIREMENTS

	Minimum	Maximum
Material Passing 2.00 mm (#10) Sieve	85%	--
Clay	5%	30%
Silt	10%	70%
Sand & Gravel	10%	70%
Organic Matter	3%	20%
pH	6.1	7.8

B Select Topsoil Borrow

Select topsoil borrow for use as a plant growing medium in designated areas, such as landscape beds, shall meet the requirements of Table 3877-2:

3877.2

**TABLE 3877-2
SELECT TOPSOIL BORROW REQUIREMENTS**

	Minimum	Maximum
Material Passing 2.00 mm (#10) Sieve	90%	--
Clay	5%	30%
Silt	10%	70%
Sand & Gravel	20%	70%
Organic Matter	3%	20%
pH	6.1	7.5
Extractible Phosphorous	30 kg per hectare (26.8 pounds/acre)	--
Exchangeable Potassium	150 kg per hectare (133.8 pounds/acre)	--
Soluble Salts	--	0.15 siemens per meter (1.5 mmho/cm)

C Premium Topsoil Borrow

Premium topsoil borrow for use as a plant growing medium in critical areas and top dressing erosion stabilization mats shall be screened and pulverized and meet the requirements of Table 3877-3:

**TABLE 3877-3
PREMIUM TOPSOIL BORROW REQUIREMENT**

	Minimum	Maximum
Material Passing 2.0 mm (#10) Sieve	95%	--
Clay	10%	25%
Silt	25%	60%
Sand & Gravel	25%	60%
Organic Matter	5%	15%
pH	6.0	7.1
Soluble Salts	--	0.15 siemens/m (1.5 mmho/cm)

3878.2

3877.3 SAMPLING AND TESTING

The Contractor shall submit to the Engineer a list of prospective sources for topsoil borrow at least 1 month prior to time of use to allow adequate time for inspecting, testing, and approving the sources.

Texture of the topsoil shall be classified according to the Engineering definition of particle size. Texture shall be determined by the method described in AASHTO T 88.

The current standard testing procedure of the University of Minnesota, Soil Science Department, Soils Testing Laboratory shall be used for determining pH, percent of organic matter, extractable phosphorous, exchangeable potassium, and soluble salts.

3878 Sod

3878.1 SCOPE

This Specification covers sod used for landscaping and erosion control.

3878.2 REQUIREMENTS

Sod shall consist of densely-rooted bluegrass or other permanent turf grasses as approved by the Engineer.

The sod shall be cut in uniform strips of not less than 300 mm (**12 inches**) in width and to a uniform thickness of 20 mm (**¾ inch**) or more as necessary so that practically all of the dense root system will be retained and be exposed in the bottom side of the sod.

When the sod is cut, it shall be sufficiently moist to withstand exposure and handling during the transplant operations. The sod shall have been raked free of debris and the top growth trimmed to a height of 25 to 75 mm (**1-3 inches**).

All sod furnished shall be in acceptable condition upon delivery to the work site. The sod strips shall not have dry or dead edges upon delivery. Between June 1 and September 15, sod shall not be cut more than 24 hours in advance of delivery.

A Lawn Sod

Lawn sod shall have a lush appearance, be dense, have a uniform texture, and bright in color throughout. The sod shall not contain grass with blade widths of 5 mm (**0.2 inch**) or greater. The sod shall be weed-free and shall contain no more than 5 mm (**0.2 inch**) of thatch over the base soil. The sod shall consist of a blend of 4 or 5 fine leaved turf grasses. At least two-thirds of the grasses, as determined by initial seeding proportions, shall be of improved and elite type Kentucky bluegrass varieties as defined in 3876.2C.

3878.2

B Erosion Control Sod

Sod used for general road side purposes and for erosion control shall be a low maintenance type, dense, and of uniform texture. The sod shall be free of noxious weeds and shall contain less than 3 percent grassy weeds, sedges, broadleaf weeds, or coarse grasses. The sod shall consist of a blend of 4 or 5 fine leafed turf grasses. At least two-thirds of the grasses, as determined by initial seeding proportions shall be of acceptable low maintenance Kentucky bluegrass varieties as defined in 3876.2C.

B1 Netting

The netting required in ditch bottoms in accordance with 2575.312, at a minimum, will meet the erosion control netting 3883 specifications with respect to material type, mesh openings, weight, and tensile strength.

B2 Anchors

On slope applications, or in ditch bottoms with intermittent flow less than 1.5 m/sec. (**5 feet/second**), or in ditch bottoms where the sod is allowed to root before carrying water, the staples used to anchor the sod shall be U shaped 3 mm (**0.12 inch**) diameter or heavier steel wire having a span width of 25 mm (**1 inch**) and a length of 200 mm (**8 inches**) from top to bottom after bending.

In ditch bottom applications with flow velocities greater than 1.5 m/sec. (**5 feet/second**), or in ditch bottoms susceptible to continuous flow before the sod can root into the ground, the shingled sod shall be overlaid with snow fence, chain link fence, jute, or a biodegradable netting with a minimum life span of 3 months over the top of the sod and securing it to the sod with anchors. The method of anchoring the overlaid material and sod to the ground shall be in accordance with 3888.2C, or wood stakes as appropriate. Unless directed otherwise by the Engineer, the chain link fence, jute or biodegradable netting does not need to be removed. Snow fence or other plastic non-biodegradable material shall be removed after the maintenance period or effective use period as determined by the Engineer.

C Salt Resistant Sod

Salt resistant sod for use along boulevards or in a potential salt environment shall be a low maintenance type, fine leafed, and of uniform texture. The sod shall be free of noxious, broadleafed, and grassy weeds and shall contain less than 3 percent coarse grasses. The sod shall have originated from the blend of grass seed shown in Table 3878-1.

**TABLE 3878-1
SALT RESISTANT SOD**

Grass Type	Acceptable Varieties	Minimum Percent by Mass	Maximum Percent by Mass
Alkali grass	Fults, Salty	15	20
Red fescue	Dawson, Cindy	15	20
Park Kentucky bluegrass	Park	10	15
Improved Kentucky bluegrass	(A)	20	30
Low Maintenance Kentucky bluegrass	(B)	20	30

(A) Listed in 3876.2C

(B) Listed in 3876.2C excluding Park Kentucky bluegrass

D Mineral Sod

Mineral sod shall be commercially produced on or harvested from mineral based soils. The soil upon which mineral sod is produced or harvested from shall consist of less than 10 percent organic matter by mass. The sod shall be dense, fine leafed, and of uniform texture. The sod shall be free of noxious, broadleafed, or grassy weeds and shall contain less than 3 percent coarse grasses. The sod shall consist of a blend of 4 or 5 fine leafed turf grasses. At least 35 percent of the grasses, as determined by initial seeding proportions, shall consist of improved type Kentucky bluegrass varieties defined in 3876.2C.

3878.3 SAMPLING AND TESTING

Prior to delivery to the Project, the Contractor shall furnish the Engineer a certification from the grower stating the grass varieties contained in the sod. No sod shall be placed until the certification of varieties contained in the sod has been reviewed and accepted by the Engineer.

Test samples for determination of soil organic matter content of mineral sod will be obtained from the soil exposed in the bottom side of the sod rolls. Testing for organic matter content will be in accordance with ASTM D 2974.

The Department reserves the right to conduct its own inspection at any time of sod in the production fields or at the Project site. Representative samples of the sod shall be furnished upon request, in which case no sod shall be delivered until the samples have been approved.

3879

3879
Agricultural Lime

3879.1 SCOPE

This Specification covers Agricultural Liming Material (ALM) containing calcium and/or magnesium compounds that are capable of neutralizing soil acidity and also providing a reasonable increase in soil pH within 6 months of soil incorporation.

3879.2 REQUIREMENTS

The ALM includes the following forms: limestone (calcitic or dolomitic), burned lime, slaked lime and marl. Gypsum is not a liming product. The lime product shall contain at least 80 percent Total Neutralizing Power (TNP). It shall be ground sufficiently fine so that 90 percent, including all the fine particles obtained in the grinding process, will pass through a 2.36 mm (# 8) sieve; at least 60 percent will pass through a 850 µm (#20) sieve; and at least 50 percent will pass through a 250 µm (# 60) mesh sieve. The maximum water content of the lime material shall be 10%. The ALM shall have a minimum rating of 1120 kg ENP per metric ton (**1000 lbs of ENP per ton**) of ALM.

The ALM must be obtained from a Minnesota Department of Agriculture's (MDA) licensed distributor or producer. For ALM supplied in bulk, the ALM must be delivered to the Project with the following information on a billing, delivery invoice or scale ticket label: 1) Distributor or producer's name, address, telephone number, and source of production or stockpile location; 2) Customer's name; 3) Date of sale or transfer; 4) Type of ALM; 5) Minimum kg of ENP per metric ton (**lbs of ENP per ton**), accurate within 3 percent; and 6) Weight or cubic meters (**cubic yards**) of ALM distributed and approximate weight per cubic meter (**cubic yard**). For ALM supplied in bags or other container types the following information must be affixed to the bag or container: 1) Distributor or producer's name and address; 2) Minimum kg ENP per metric ton (**lbs ENP per ton**), accurate to within 3 percent; and 3) the net weight.

3879.3 SAMPLING AND TESTING

Samples shall be collected in accordance with the Minnesota Department of Agriculture's (MDA) Agricultural Lime Official Sampling Methods. Samples must be submitted to either MDA or the University of Minnesota testing lab for analysis of %TNP, % passing the 2.36 mm, 850 µm and 250 µm (# 8, 20 and 60) sieves, % Dry Matter, and the kg ENP per metric ton (**lbs ENP per ton**) of Agricultural Lime Material (ALM) rating. Sampling and testing must take place within 90 days before applying the lime material to the land. The kg ENP per metric ton (**lbs ENP per ton**) of ALM is defined as

3880.3

the product of 1000 kg ALM per Metric ton (**2000 lbs ALM per ton**) x (% ENP/100) x (% of Dry Matter/100). Material furnished under this Specification may be accepted on the basis of the Distributor's or Producer's guaranteed analysis. However, the Department reserves the right to sample, test, inspect and accept or reject the material bases on its own tests.

3880
Peat Moss

3880.1 SCOPE

This Specification covers peat moss used as a soil amendment for landscape plantings.

3880.2 REQUIREMENTS

Peat moss shall be of the hypnum, sphagnum, or reed sedge types as defined in ASTM D 2607. Other peaty soils will not be acceptable. The peat moss shall be a processed product reasonably free of wood and other extraneous matter and shall contain no weed seed or bacterium that may affect plant growth. The peat moss shall be uniform throughout meeting the requirements of Table 3880-1:

TABLE 3880-1
PEAT MOSS REQUIREMENTS

	Minimum	Maximum
Moisture Content, % by mass	25	70
Ash Content, % by mass	--	25
pH	3.0	7.5
Fiber Content, %	33	--

At the time of delivery the peat moss shall be in an air-dried condition.

Quantity shall be expressed as loose volume. Package contents shall be determined by measuring loose material in a 0.03 m³ (**1 cubic foot**) measure.

3880.3 SAMPLING AND TESTING

Test samples shall be provided upon request and at a rate designated by the Engineer. Testing will be in accordance with the methods prescribed in ASTM D 2974. Testing for fiber content shall be as described in ASTM D 2607.

When delivered in package form, the material may be accepted on the basis of the manufacturer's guaranteed analysis.

3881

3881
Fertilizer

3881.1 SCOPE

This Specification covers fertilizer used for establishing vegetative cover and landscape plantings.

3881.2 REQUIREMENTS

A General

Fertilizer furnished under this Specification shall be a manufactured grade of the inorganic or organic type, produced in granular or granulated form. The fertilizer shall contain at least the minimum analysis specified, and shall be furnished as a blend or homogeneous form containing the specified percentages of total nitrogen, available phosphoric acid (or phosphorous), and water soluble potash (or potassium), in that order.

When the fertilizer is furnished in closed containers, they shall be clearly marked with the mass, type of nutrients, and the producer's guaranteed analysis, all in accordance with State and Federal regulations.

When the fertilizer is furnished in bulk, each shipment shall be accompanied by a suitable bill-of-lading giving the mass, type of nutrients and a certificate of the producer's guaranteed analysis.

B Types

Fertilizer shall conform to one of the following types, as specified in the Plan.

B1 Type 1- Commercial Fertilizer

Commercial fertilizer shall consist of dry granulated nutrients produced by mining and manufacturing processes and commonly used in the agricultural or lawn care industries. It shall contain the three major plant nutrients of nitrogen, phosphorous, and potassium. Commercial fertilizer may be furnished as a homogenous or blended form.

B2 Type 2- Phosphorous Free Fertilizer

Phosphorous free fertilizer shall meet the requirements of Type 1 commercial fertilizer except that it shall contain no phosphorous.

B3 Type 3- Slow Release Fertilizer

Slow release fertilizer shall be specifically processed to release nitrogen at a slow rate over a growing season. It shall contain the three major plant nutrients of nitrogen, phosphorous and potassium. Primary nitrogen sources shall be a coated prilled urea form. A minimum of 70% of the nitrogen component shall be a slow release water insoluble nitrogen.

B4 Type 4- Natural Based Fertilizer

Natural based fertilizer shall have a minimum of 50% of the mass and 50% of the macronutrients derived from natural or organic material. The product shall be a dry granulated product with a moisture content of less than 10%. The approximate size of the granules shall be between 2.8 – 0.6 mm (**# 7 and 30 sieve**). Primary plant food sources are derived from aerobically composted turkey litter, hydrolyzed feathermeal, ammonium sulfate, ferrous sulfate and sulfate of potash. The product shall be free of any sewage sludge, raw manure or uncomposted organic matter.

3881.3 SAMPLING AND TESTING

Fertilizer may be accepted on the basis of the manufacturer's guaranteed analysis, but the Department reserves the right to sample and test the material at any time. Chemical analysis will be in accordance with methods established by the Association of Official Agricultural Chemists.

3882**Mulch Material****3882.1 SCOPE**

This Specification covers mulch material for controlling erosion and establishing vegetative cover.

3882.2 REQUIREMENTS

Mulch material shall conform to the requirements for one of the following types, as specified in the Contract.

TYPE 1

Type 1 mulch shall consist of grain straw, hay, cuttings of agricultural grasses and legumes. When Type 1 is used in conjunction with native grasses (300 series Mixtures), it shall consist of grain straw only. The material shall be free of seed bearing stalks of noxious grasses or weeds as defined by the rules and regulations of the Minnesota Department of Agriculture.

Mulch containing Canada thistle or leafy spurge fragments or seeds shall be rejected. In addition, Type 1 mulch shall not contain the following species: cattail (*Typha sp*), reed canary grass (*Phalaris arundinacea*), birds-foot trefoil (*Lotus corniculatus*) or crown vetch (*Coronilla varia*). At the time of delivery the mulch shall be in an air dried condition. Bales used for bale barriers shall be densely packed rectangular shaped 350 x 450 x 850 mm (**14 x 18 x 36 inches**) minimum nominal size. Bales shall be tightly wrapped with two strands of twine or wire.

3882.2

TYPE 2

Blank

TYPE 3

Type 3 mulch shall consist of clean grain straw (i.e. oats, wheat) that is certified by the Minnesota Crop Improvement Association (MCIA) to be weed free. All mulch bales shall be in an air dried condition at the time of delivery and shall have an MCIA inspection tag attached indicating that the mulch has passed inspection.

TYPE 4

Type 4 mulch shall consist of a combination of Type 1 mulch and Type 5 Hydraulic Soil Stabilizer. The combination shall consist of 3.4 metric ton/hectare (**1 ½ tons/acre**) of Type 1 mulch and 840 kg/ha (**750 pounds per acre**) of Type 5 Hydraulic Soil Stabilizer.

TYPE 5

Type 5 mulch shall consist of raw wood slash from either hard or soft timber harvested during clearing and grubbing operations on the Project. It shall be a product of a mechanical chipper, hammermill, or tub grinder. The material shall all pass a 100 mm (**4 inch**) screen and not more than 20 percent by mass of the material shall pass a 2.36 mm (**0.1 inch**) sieve. Maximum length of individual pieces shall not exceed 500 mm (**20 inches**).

TYPE 6

Type 6 mulch shall consist of raw wood material from either hard or soft timber and shall be a product of a mechanical chipper, hammermill, or tub grinder. The material shall be substantially free of mold, dirt, sawdust, and foreign material and shall not be in an advanced state of decomposition. The material shall not contain chipped up manufactured boards or chemically treated wood, including but not limited to wafer board, particle board, and chromated copper arsenate (CCA) or penta treated wood. The material, when air dried, shall all pass a 100 mm (**4 inch**) screen and not more than 20 percent by mass of the material shall pass a 2.36 mm (**0.1 inch**) sieve. Unattached bark or green leaf composition, either singly or combined, shall not exceed 20 percent each by mass. Maximum length of individual pieces shall not exceed 500 mm (**20 inches**).

TYPE 7 (Prairie Mulch)

Prairie mulch shall be of a type that has been thrashed to remove seeds so that it consists of clippings, chaff, or residue from harvesting or cleaning operations. This material may be harvested from native stands or from native grass production fields. Prairie mulch shall be free of noxious weed seeds, and shall be from the Approved Sources list for native seeds on file on the Mn/DOT web pages under the Materials Engineering Section.

TYPE 8 (Prairie Hay)

Prairie hay shall be of a type that has not been thrashed to remove seeds so that it consists of material that has been bailed directly. This material may be harvested from native stands or from native grass fields. Prairie hay shall be free of noxious weed seeds, and shall be from the

Approved Sources list for native seeds on file on the Mn/DOT web pages under the Materials Engineering Section.

TYPE 9

Aggregate mulch will be 9.5 to 50 mm (**3/8 to 2 inches**), with 5 percent by mass allowable passing the 9.50 mm (**3/8 inch**) sieve. Crushing is allowable, but not required.

3882.3 SAMPLING AND TESTING

Test samples, when required, shall be obtained at a rate determined by the Engineer. Testing for moisture content will be in accordance with ASTM D 4444 and sieve analysis in accordance with ASTM D 422. Type 5 Hydraulic Soil Stabilizer will be accepted on the basis of the manufacturer's certified results in accordance with 1603.

3883**Erosion Control Netting****3883.1 SCOPE**

This Specification covers biodegradable mesh placed over Type 1 mulch, on the bottom of freshly placed sod, or on top of hydraulic soil stabilizer, or alone to reinforce the materials while vegetation is establishing.

3883.2 REQUIREMENTS

A Netting material shall conform to the following requirements for one of the following types, as specified in the Contract.

Type 1

Polypropylene netting shall consist of polypropylene plastic net with bonded joints. Mesh openings shall be a minimum of 15 mm (**1/2 inch**) to a maximum of 25 mm (**1 inch**) measured in either direction. The net shall have a minimum mass of 12.2 g/m² (**2.5 pounds per 1,000 square feet**). The minimum tensile force shall be 90 N per 4 strands (**20 pounds/4 strands**) in the length direction and 70 N (**16 pounds**) per 4-strands in the width direction. Tensile force shall be the average of three tests.

3883.2

Type 2

Jute netting shall consist of jute yarn woven into an open mesh with approximate 25 mm (**1 inch**) openings. The net shall have a minimum mass of 0.40 kg/m² (**0.92 pounds per square yard**). Each strand shall be no less than 03.6 mm (**0.14 inch**) in diameter with a minimum yarn count of no less than 50 per meter (**164 per foot**).

Type 3

Coir netting shall be 100% coconut, woven material. The yarns shall be of machine spun coir twine uniformly twisted, with average thickness 4 mm-7.5 mm (**0.16-0.3 inch**). With 37-40 curls per 0.3 m (**1 foot**). The percent opening area shall be 48-68%.

B Staples

Wire staples used to secure the netting shall be 3 mm (**11 gauge**) or heavier, steel wire, "U" shaped, and have a length of not less than 150 mm (**6 inches**), unless otherwise specified in the Contract.

3883.3 SAMPLING AND TESTING

Samples for testing shall be of such size and numbers as requested by the Engineer.

3884

Hydraulic Soil Stabilizer

3884.1 SCOPE

This specification covers soil-stabilizing materials, which are applied by hydro spreading and used for controlling erosion and establishing vegetative cover.

3884.2 REQUIREMENTS

Hydraulic soil stabilizers shall easily mix with water and shall be noncorrosive to hydraulic application equipment. They shall be nonfoaming and contain mixture enhancers to prevent foaming and mixing problems during agitation in the application equipment. Application equipment shall have both mechanical agitation and also slurry bypass.

Hydraulic soil stabilizers shall be considered safe to the applicator, adjacent workers, and the environment when properly applied according to Environmental Protection Agency (EPA) and other regulatory agencies. Material Safety Data Sheets (MSDS) shall be submitted annually to the Office of Environmental Services, Erosion Engineering Unit. The materials shall be nontoxic to plants, fish and other wildlife and shall be 100% biodegradable.

A Type 1–Natural Tackifier

Water soluble natural proteins, vegetable gums, guar gums, starch, psyllium, pitch, or rosen type blended with gelling and hardening agents, or a water soluble blend of hydrophilic polymers, viscosifiers, sticking aids and other gums. Proof of the proper application rate as indicated by the manufacturer product label for the site conditions and time of year will be required.

Guar gum based tackifiers shall consist of a minimum of 95% guar gum, by weight. The remaining 5% shall consist of dispersing and cross-link additives. Starch shall be a non-ionic, cold-water soluble (pre-gelatinized) granular cornstarch. For use needing less than three months of lasting duration. Psyllium shall be a finely ground muciloid coating of plantago seeds that is applied as a dry powder or in a wet slurry to the surface of the soil. Pitch and Rosen shall be a non-ionic pitch and rosin emulsion that has a minimum solids content of 48 percent. The rosin shall be a minimum of 26 percent of the total solids content. The soil stabilizer shall be a non-corrosive, water-dilutable emulsion that cures to water-insoluble binding and cementing agent upon application.

B Type 2–BLANK**C Type 3–BLANK****D Type 4–BLANK****E Type 5–Hydromulch**

Type 5 shall consist of wood cellulose fibers that shall contain no germination or growth inhibiting factors. It shall not contain nor be processed from sawdust or pulverized newspaper. It shall be dyed an appropriate color to allow visual metering of its application, and shall have the property of becoming dispersed and suspended when agitated in water. It shall contain 2.5 to 5.0 percent tackifier (Type 1) by weight when premixed in the bag. When Type 1 is added independently to the Type 5 mulch, it shall be added at the rate of the manufacturer's recommendations. The tackifier shall be incidental to the Type 5 hydromulch material. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like ground cover that readily absorbs water and allows infiltration to the underlying soil. Moisture content shall not exceed 15 percent at the time of delivery. When washed on an 850 µm sieve at least 50 percent shall be retained on the sieve.

F Type 6–Hydromulch blend

Type 6 shall meet the requirements of Type 5 above except that it shall be a blend of 40 to 60% recycled paper and 40 to 60% wood cellulose fibers by weight.

G Type 7–BLANK

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H Type 8–Bonded Fiber Matrix

Type 8 shall be composed of 100% wood or wood by products. A minimum of 25% of the fibers shall average 10.16 mm (**0.4 inches**) in length and 50% or more shall be retained on a Clark Fiber Classifier 24-mesh screen. Fibers shall be colored with water soluble, non-toxic dye, to aid in uniform application over the site. The material shall contain a hydrocolloid based (guar gum) binder equaling 10% or greater by volume. The crosslinker shall contain slow-release and agricultural based fertilizers or other proprietary chemicals equaling less than 2 % by volume. These binder and crosslinkers shall not dissolve or disperse upon rewetting. The moisture content of the matrix shall be 12%+/-3% by weight. The mix ratio shall be 378-473 L (**100 to 125 gallons**) water to 24 kg (**50 pounds**) material.

3884.3 SAMPLING AND TESTING

Samples for laboratory testing shall be of numbers and size requested by the Engineer. Testing for moisture content will be in accordance with ASTM D4444 and particle sieve analysis in accordance with ASTM D422. For Type 8 hydraulic soil stabilizer a field “slump-test” or equivalent shall be performed to measure product specific free water movement in one time unit. This must be demonstrated to the Mn/DOT inspector prior to placement.

3884.4 CERTIFICATION AND TRAINING

Certification of Applicator will consist of Manufacture/Vendor Training program, consisting of a minimum of 4 hours of Classroom and Field Experience. Successful completion of the certification program shall be good for 2 years from the training date. Contractors wishing to use this specification shall provide written proof annually from the Manufacture/Vendor of a list of the individuals passing the Certification within the company. The Training program shall be subject to approval by Mn/DOT.

3885

Erosion Control Blankets

3885.1 SCOPE

This Specification covers biodegradable rolled out products used for controlling erosion, aiding the establishment of vegetation, and reinforcing vegetation on slopes, ditch bottoms and shorelines. The blankets are designed to reduce erosion until the vegetation is established. Typical uses for the blanket categories are as follows:

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<u>Category</u>	<u>Service Life</u>	<u>Use</u>
00	6-8 weeks	Flat areas, mowed areas
0	6-8 weeks	Flat areas, mowed areas
1	6-8 weeks	Flat areas, shoulder drain outlets, roadway shoulders, and lawns.
2	One Season	Slopes 1v:3h to 1v:2h less than 15 m (50 feet) long, ditches with gradients of 2 percent or less, flow velocities less than 1.0 m/second (3.5 feet/sec.).
3	One Season	Slopes 1v:3h to 1v:2h more than 15 m (50 feet) long, ditches with gradients of 3 percent or less, flow velocities less than 1.4 m/second (4.5 feet/sec.), flow depth 50 mm (2 inches) or less.
4	Semi-permanent	Slopes 1v:2h and steeper, ditches with gradients of 4 percent or less, flow velocities less than 1.7 m/sec. (5.5 feet/sec.), flow depth 75 mm (3 inches) or less.
5	Semi-permanent	Ditch bottoms with gradients of 5 percent and less, flow velocities less than 1.8 m/sec. (6 feet/sec.), and under 100 mm (4 inches) flow depth, water course banks within the normal flow elevation.
6	Permanent	Ditch bottoms with gradients of 6 percent and less, flow velocities less than 2 m/sec. (6.5 feet/sec.), and under 150 mm (6 inches) flow depth.
7	Permanent	Ditch bottoms with gradients of 7 percent and less, flow velocities less than 2.1 m/sec. (7 feet/sec.), and under 150 mm (6 inches) flow depth.

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3885.2 REQUIREMENTS

A Acceptable Types

Acceptable types of blankets allowed in the various categories shall be as follows:

<u>Category</u>	<u>Acceptable Types</u>
00	Wood Cellulose 1S, NT, RD
0	Wood Fiber 0S, RD
1	Straw RD 1S, or Wood Fiber RD 1S
2	Straw 1S, or Wood Fiber 1S
3	Straw 2S, or Wood Fiber 2S
4	Straw/Coconut 2S, or Wood Fiber HV 2S
5	Straw/Coconut 2S
6	Straw/Coconut 3S, or Wood Fiber 3S
7	Coconut 3S, or Wood Fiber 3S

The lettering designation shall be defined as follows:

0S-	No netting, stitching only
1S -	Netting on one side
2S -	Netting on two sides
3S-	More than 2 nettings forming a three dimensional matrix
RD -	Rapidly degradable netting and stitching
NT-	No thread/stitching
HV -	High velocity

B Physical Requirements

For Categories 1 through 5, the netting and stitching shall be composed of materials that have the same life expectancy. Blankets shall conform to the general requirements listed below and to their respective table requirements. Categories 00, 0, and 1 shall conform to Table 3885-1 Categories 2, 3, 4, and 5 shall conform to Table 3885-2. Categories 6 and 7 shall conform to Table 3885-3.

**TABLE 3885-1
RAPID DEGRADABLE BLANKET CRITERIA**

	Category 00	Category 0	Category 1	
	Wood Cellulose Fiber 1S, NT, RD	Wood Fiber 0S, RD	Straw 1S, RD	Wood Fiber 1S, RD
Min. weight per m ² (yd ²)	0.20 kg (0.38 lb.)	0.4 kg (0.73 lb.)	0.27 kg (½ lb.)	0.35 kg (0.64 lb.)
Fiber Length. 80% must be greater than	12.7 mm (½ in.)	150 mm (6 in.)	75 mm (3 in.)	150 mm (6 in.)
Material	100% Wood Cellulose	100% Excelsior Fibers	100% Straw Cuttings	100% Excelsior Fibers
Netting & Stitching Service Life	6-8 weeks (No stitching)	6-8 weeks (No netting)	1-3 Months	1-3 Months
Netting & Stitching Material	Rapid Photodegradable Polypropylene	Rapid Photodegradable Polypropylene	Rapid Photodegradable Polypropylene	Rapid Photodegradable Polypropylene
Netting Opening, Min.	13 x 13 mm (½ x ½ in.)	--	13 x 13 mm (½ x ½ in.)	19 x 19 mm (¾ x ¾ in.)
Min. Netting Weight per 836 m ² (1000 Sq. Yd)	8 kg (17.7 lb.)	--	8 kg (17.7 lb.)	8 kg (17.7 lb.)

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**TABLE 3885-2
STANDARD BLANKET CRITERIA**

	Category 2		Category 3		Category 4		Category 5
	Straw 1S	Wood Fiber 1S	Straw 2S	Wood Fiber 2S	Straw-Coconut 2S	Wood Fiber HV 2S	Coconut-Straw 2S
Min. weight per m ² (yd ²)	0.27 kg (½ lb.)	0.35 kg (0.64 lb.)	0.27 kg (½ lb.)	0.35 kg (0.64 lb.)	0.27 kg (½ lb.)	0.72 kg (1.33 lb.)	0.27 kg (½ lb.)
Fiber Length. 80% must be greater than	75 mm (3 in.)	150 mm (6 in.)	75 mm (3 in.)	150 mm (6 in.)	75 mm (3 in.)	150 mm (6 in.)	75 mm (3 in.)
Material	100% Straw Cuttings	100% Excelsior Fibers	100% Straw Cuttings	100% Excelsior Fibers	Straw 70% plus Coconut Fibers 30%	100% Excelsior Fibers	Straw 30% plus Coconut Fibers 70%
Netting & Stitching Backing Service Life	6-9 months	6-9 Months	6-9 Months	6-9 Months	24-36 Months	24-36 Months	24-36 Months
Netting and Stitching Material ¹	Polypropylene or Natural	Polypropylene or Natural	Polypropylene or Natural	Polypropylene or Natural	Polypropylene or Natural	Black UV Stabilized Polypropylene	Black UV Stabilized Polypropylene
Netting Opening, Min.	13 x 13 mm (½ x ½ in.)	19 x 19 mm (¾ x ¾ in.)	13 x 13 mm (½ x ½ in.)	19 x 19 mm (¾ x ¾ in.)	13 x 13 mm (½ x ½ in.)	19 x 19 mm (¾ x ¾ in.)	15 x 15 mm (0.6 x 0.6 in.)
Netting Weight per 836 m ² (1000 sq. yd) Min. Top	--	8 kg (17.7 lb.)	8 kg (17.7 lb.)	8 kg (17.7 lb.)	15 kg (33.1 lb.)	15 kg (33.1 lb.)	15 kg (33.1 lb.)
Netting Weight per 836 m ² (1000 Sq. Yd.) Min. Bottom	8 kg (17.7 lb.)	--	8 kg (17.7 lb.)	8 kg (17.7 lb.)	15 kg (33.1 lb.)	15 kg (33.1 lb.)	15 kg (33.1 lb.)

¹Natural fibers required for netting and stitching required when "All natural netting and stitching" is specified in the Plan.

**TABLE 3885-3
PERMANENT BLANKET CRITERIA**

	Category 6		Category 7	
	Straw-Coconut 3S	Wood Fiber 3S	Coconut 3S	Wood Fiber 3S
Min. weight per m ² (yd ²)	0.35 kg (0.64 lb.)	0.66 kg (1.21 lb.)	0.48 kg (0.88 lb.)	0.95 kg (1.76 lb.)
Fiber Length. 80% must be greater than	75 mm (3 inches)	150 mm (6 inch)	75 mm (3 inches)	150 mm (6 inches)
Material	70% Straw and 30% Coconut Fibers	100% Excelsior Fibers	100% Coconut Fibers	100% Excelsior Fibers
Netting & Stitching Service Life	Longer than 36 months	Longer than 36 months	Longer than 36 months	Longer than 36 months
Netting & Stitching Material	Black UV Stabilized Polypropylene	Black UV Stabilized Polypropylene	Black UV Stabilized Polypropylene	Black UV Stabilized Polypropylene

B-1 Material Fiber

Each erosion control blanket shall consist of a uniform web of interlocking fibers. The blanket shall be of uniform thickness with the material fibers being evenly distributed over the entire area of the blanket. The blankets shall have sufficient porosity to shield the underlying soil surface from erosion and promote plant growth. All blankets shall be smolder resistant.

B-2 Netting

For Category 00 blankets, the netting shall start to break down within 6 weeks. For Category 1 blankets, the netting shall start to break down after 1 month with 80 percent breakdown occurring within 3 months. For Category 2 and 3 blankets, the netting shall contain sufficient UV stabilization for breakdown to occur within a normal growing season. For Category 4 and 5 blankets, the netting shall be UV stabilized to provide a service life of 2 to 3 years. For blankets designated as 2S, the fiber material shall be contained between an attached top and a bottom layer of netting.

All layers of netting or net-like material forming the 3-dimensional matrix of Category 6 and 7 blankets shall be UV stabilized to provide for permanent netting and vegetation reinforcement. The 3-dimensional

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matrix shall provide a minimum NRCS Vegetation Class E retardance and sediment trapping troughs.

B-3 Stitching

The material fiber in each blanket, except Category 00, shall be securely attached with stitching to the netting to prevent movement of the fiber in relation to the netting. For blankets consisting of 75 mm (**3 inch**) material fibers, the blanket shall be fastened together at a spacing not to exceed 50 mm (**2 inches**). For blankets consisting of 150 mm (**6 inch**) material fibers, the blanket shall be fastened together at a spacing not to exceed 100 mm (**4 inches**).

B-4 Anchors

Anchors for each category blanket shall be as defined in Table 3885-4.

**TABLE 3885-4
ANCHOR SPECIFICATION**

Blanket Category	Material	Type	Min. Bearing Width	Length
00 & 0	Biodegradable	Hook shaped stake	9.5 mm (0.375 in.) diameter	125 mm (5 inch)
1 & 2	Steel Wire	11 Gauge	25 mm (1 inch)	100 mm (4 inch)
3 & 4	Steel Wire	11 Gauge	25 mm (1 inch)	150 mm (6 inch)
5, 6, & 7	Steel Wire	11 Gauge	25 mm (1 inch)	200 mm (8 inch)

3885.3 SAMPLING AND TESTING

Approved products for this specification are on file on the Mn/DOT web page under the Materials Engineering Section.

3886
Silt Fence

3886.1 SCOPE

This Specification covers silt fence for use in retaining sediment. Installation procedures are to be in accordance with 2573. The following types are provided for specific uses:

Standard Machine Sliced	General use during site grading to keep sediment from moving off of the right-of-way and to protect critical areas. Can be used in ditch check applications.
Heavy Duty	Areas inaccessible to equipment due to space limitations, wet soils, steep slopes, etc. Must be hand installed.
Super Duty	Areas where extra strength and insurance is required for the protection of critical areas or traveling public due to long steep slopes next to and draining to the mainline, or stockpiles needing to be located near critical environmental areas.
Preassembled	Light duty applications are to protect temporary construction or to supplement the other types of silt fence.

3886.2 REQUIREMENTS

Silt fence shall conform to Table 3886-1 and the following requirements.

A Geotextile

Geotextile shall be uniform in texture and appearance and shall have no defects, flaws, or tears that would affect its physical properties. It shall contain sufficient ultraviolet ray (U.V.) inhibitors and stabilizers to provide a minimum 2 -year service life from outdoor exposure.

B Pre-manufactured Materials**B1 Super Duty**

The main support and strength shall conform to 2533, Precast Concrete Median Barrier.

B2 Preassembled

Each post shall be securely fastened to the geotextile by a minimum of five gun staples 25 mm (**1 inch**) long that are also suitable for such a purpose. Stapling should be done at a diagonal angle to the threads of the geotextile fabric.

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C Posts

Standard metal T posts with a welded plate shall be used in conjunction with the machine sliced and heavy duty installations. Wooden posts used in conjunction with the preassembled silt fence shall have a sharpened end and shall protrude below the bottom of the geotextile to allow for a minimum of 457 mm (**18 inch**) embedment.

D Geotextile Fasteners

D1 Zip Ties

Geotextile used in Machine Sliced and Heavy Duty applications shall be fastened to posts using plastic zip ties with a minimum tensile strength of 22 kg (**50 pounds**).

D2 Wire Ties

Geotextile used in Super Duty applications shall be fastened to anchor points using wire ties or plastic zip ties with a minimum tensile strength of 22 kg (**50 pounds**).

3886.3 SAMPLING AND TESTING

Geotextiles must be sampled and tested prior to use, when the amount to be installed is 300 m (**1000 feet**) or greater or in special circumstances at the request of the Engineer. In the presence of the Engineer, sampling shall be by random selection in the field at the rate of one swatch (sample) per ten rolls or fraction thereof. Swatches shall be a full roll width and at least 3 m (**9 feet**) long, discarding the first 1 m (**3 feet**) of fabric from the outside of the roll. Samples shall be available for testing at least 21 days prior to intended use.

**TABLE 3886-1
SILT FENCE**

	Machine Sliced	Heavy Duty	Super Duty	Preassembled
Description	Machine installed geotextile fastened to posts on-site	Hand installed geotextile fastened to posts on-site.	Pre-cast concrete median barriers placed end to end with geotextile fastened to front face of barriers.	Ready to install unit of geotextile attached to drivable posts
Geotextile				
Type	Woven monofilament*	Woven monofilament*	Woven monofilament*	Woven
Width	915 mm (36 inches)	915 mm (36 inches)	915 mm (36 inches)	915 mm (36 inches)
Grab Tensile ASTM D 4632 (machine direction)	59 kg (130 lb) min.	59 kg (130 lb) min.	59 kg (130 lb) min.	45 kg (100 lb) min.
Apparent Opening Size ASTM D 4751	0.60-0.425 mm (# 30-40 Sieve)	0.60-0.425 mm (# 30-40 Sieve)	0.60-0.425 mm (# 30-40 Sieve)	0.85- .212 mm (# 20-70 Sieve)
U.V. Stability ASTM D 4355, 500 hrs.	70% min.	70% min.	70% min.	70% min.
Permittivity (minimum) ASTM D 4491	1.0/sec	1.0/sec	1.0/sec	0.05/sec
Posts			N/A	
Material	Steel T-Post with welded plate	Steel T-Post with welded plate		Wood
Min. Size	1.8 kg / m (1.26 lbs./ft)	1.8 kg / m (1.26 lbs./ft)		50 mm x 50 mm (2 x 2 inches)
Min. Length	1.5 m (5 feet)	1.5 m (5 feet)		1.5 m (5 feet)
Min. Embedment	610 mm (24 inches)	610 mm (24 inches)		458 mm (18 inches)
Max. Spacing	1.8 m (6 feet), 1.2 m (4 feet) for ditch checks	1.8 m (6 feet)		1.8 m (6 feet)
Geotextile Fastener to Post				
Fastener	Plastic Zip Ties- 22 kg (50 lb.) Tensile	Plastic Zip Ties- 22 kg (50 lb.) Tensile	Wire Tie or Plastic Zip Tie- min. 22 kg (50lb) Tensile	Gun Staples 25 mm (1 inch) long
Min. Fasteners per post	3	3	1 tie at each individual barrier end	5

* No substitutions allowed, monofilament in both directions.

3887

3887
Flotation Silt Curtain

3887.1 SCOPE

This specification covers flotation silt curtain used for containing suspended sediment in an area of open water. The following types are provided for the specified uses:

Still Water	Lakes or large bodies of water with little to no current
Moving Water	Streams and rivers with a current less than 2.1 m/s (7.0 feet/second)
Work Area	Moving or still water, used to confine a work area

3887.2 REQUIREMENTS

Flotation silt curtain shall be constructed of fabric fastened to a flotation carrier and weighted along the bottom edge. Depth of curtain shall be as indicated in the Plans. Depth of curtain shall refer to the dimension of the curtain fabric extending below the flotation, i.e. hanging in the water. The flotation silt curtain shall conform to Table 3887-1. Upon completion of the work the curtain shall be removed in a manner that will prevent re-suspension of sediment into the water.

**TABLE 3887-1
FLOTATION SILT CURTAIN REQUIREMENTS**

	TYPE	
	Still Water	Moving Water & Work Area
Curtain Fabric Material Type	Impermeable vinyl-nylon laminate	Impermeable vinyl- coated nylon
Mass per square meter (square yard)	0.6 kg (18 oz)	0.75 kg (22 oz)
Grab Tensile Strength ASTM D 4632 (B)	1.3 kN (300 lbs)	2.2 kN (500 lbs)
Depth of Curtain (A)	From 0.6 to 3 m (2-10 feet)	From 0.6 to 3 m (2-10 feet)
Flotation	150 mm (6 inches) diameter Marine quality expanded polystyrene	200 mm (8 inches) diameter Marine quality expanded polystyrene
Net Buoyancy, per meter (foot)	200 N (13 lbs)	300 N (20 lbs)
Top Load Carrying Components	Fabric Only	Fabric plus 8 mm (5/16 inch) galvanized steel cable 40.0 kN (9800 lb) min. break strength
Ballast, mass per meter (pound/ foot), min.	1.0 kg (0.7 lb/foot) enclosed 6 mm (1/4 inch) galvanized chain	1.6 kg (1.1 lb/foot) enclosed 8 mm (5/16 inch) galvanized chain
Connection Between Sections	Laced grommets	Aluminum collar reinforced quick disconnects

- (A) As specified in the Contract
(B) Minimum average roll value.

3887.3 SAMPLING AND TESTING

Material furnished under this Specification may be accepted on the basis of the manufacturer's guaranteed analysis. However, the Department reserves the right to sample, test, inspect, and accept or reject the materials based on its own tests.

3888

3888
Erosion Stabilization Mats

3888.1 SCOPE

This Specification covers permanent, long lived turf reinforcement mats to provide soil reinforcement for vegetation establishment in ditch bottoms, waterways, steep and engineered slopes, and shorelines where shear stresses are high or where there are highly erodible soils that have frequent runoff. Erosion stabilization mats shall be composed of UV stabilized, non-degradable, synthetic fibers, filaments, nettings, and/or wire mesh processed into three dimensional reinforcement matrices. Erosion stabilization mats shall provide sufficient thickness, strength, and void space to permit soil filling and retention and the development of vegetation within the matrix. All turf reinforcement mats shall be filled with topsoil, topsoil blends, or compost. To prevent temporary loss of topsoil media after placement, see 2575 and 3885. Various classes with different applications, varying in severity of shear stresses, are as follows:

ESM Class	Application	Minimum Permissible Shear Stress (A) in channel applications -½ hr. Pa (pounds/sq. foot)	Minimum Tensile Strength (B) ASTM-D 6818	Matrix Composition (C)
1	Slopes and ditches	100 Pa (2.1 lbs/sq. ft)	1.82 kN/m (125 lbs/ft)	Nylon, Polypropylene, Polyolefin, or Polyester
2	Slopes and ditches	288 Pa (6 lbs/sq. ft)	2.19 kN.m (150 lbs.ft)	Nylon, Polypropylene, Polyolefin, or Polyester
3	Slopes and ditches	384 Pa (8 lbs/sq. ft)	2.55 kN/m (175 lbs/ft)	Nylon, Polypropylene, Polyolefin, or Polyester
4	Slopes and ditches	480 Pa (10 lbs/sq. ft.)	20 kN/m (1370 lbs/ft)	Nylon Polypropylene, polyolefin, or Polyester
5	Steep slope surface soil reinforcement		20 kN/m (1370 lbs/ft)	Nylon, Polypropylene, Polyolefin, or Polyester, bonded to twisted wire mesh (D)

3889.1

- (A) Sustained shear for minimum ½ hour vegetated with Retardance Class B.
- (B) Minimum Average Roll Value of either direction.
- (C) Minimum thickness of 6.4 mm (¼ inches), UV stability ASTM D4355 at 500 hours of 80 percent.
- (D) Minimum 50-year design life.

3888.2 REQUIREMENTS

A General

Erosion stabilization mats are made of a three dimensional matrix of synthetic material and shall be continuously bonded at filament intersections. Filaments which are discontinuous or loosely held together by woven, unstitched, or glued netting will not be permitted.

All mats shall be soil filled. The mats shall have cells at least 10-19 mm (3/8 -3/4 inch) in depth to allow soil filling and retention.

B Materials and Dimensions

Material and dimension requirements will be as indicated in the Plans.

C Anchors, Staples, and Pins

The anchoring method and installation pattern used to link the Erosion Stabilization Mats to the soil surface shall be identified in the Plan. Where the anchoring method is not specified in the Plan, the following shall be used as directed by the Engineer:

1. Metal U -shaped, 11 gauge, 254 mm (10 inches) in length.
2. Metal pins should be at least 4.7 mm (3/16 inch) diameter steel with a 38 mm (1 ½ inch) steel washer at the head of the pin, 254 mm (10 inches) in length.
3. Welded 95 mm (3/8 inch) diameter rebar "T" stakes 305 mm (12 inches) in length.

3888.3 APPROVED MATERIALS

Approved products for this specification are on file on the Mn/DOT Web page under the Materials Engineering Section.

3888.4 SAMPLING AND TESTING

Material furnished under this specification may be accepted on the basis of the manufacturer's guaranteed analysis. However, the Department reserves the right to sample, test, inspect, and accept or reject the materials based on its own tests.

3889

Temporary Ditch Checks

3889.1 SCOPE

This Specification covers temporary ditch checks used for slowing water velocity and temporarily containing sediment in ditch bottoms.

3889.2

3889.2 REQUIREMENTS

Temporary ditch checks shall conform to the requirements for the following types, as specified in the Contract.

A Type 1: Sliced in Silt Fence

Type 1 ditch check shall meet the requirements of 3886-silt fence-machine sliced with a maximum 1.2 m (**4 foot**) post spacing.

B Type 2: Bioroll

Type 2 ditch checks shall consist of 3987 Type 2 Storm Water Filter Logs.

C Type 3: Bioroll Blanket System

Type 3 ditch checks shall consist of two components; Type 2 or 3 Storm Water Filter Log in accordance with 3897, staked on top of a Category 3, specification 3885 erosion control blanket. The blanket shall form a minimum width of 3.7 m (**12 feet**) perpendicular to the ditch gradient.

D Type 4: BLANK

E Type 5: Rock Weeper

Type 5 ditch checks shall be composed of a geotextile liner, coarse concrete aggregate, and riprap. The geotextile filter fabric liner shall be in accordance with 3733 Type IV. The coarse concrete aggregate forming the front half of the weeper shall be in accordance with 3137-1 CA-1. The riprap forming the back half of the weeper shall be in accordance with 3601, Class I and be composed of 100 percent crushed or quarry run material.

The rock weeper shall be created such that the side profile forms a triangle with 1:2 (V:H) slopes on both the front and back slopes. The coarse concrete aggregate shall be installed on the front half of the triangle with a 1:2 slope to a height of 0.6 m (**2 feet**). The riprap shall be installed on the back half of the triangular section.

F Type 6: Geotextile Triangular Dike

Type 6 ditch checks shall be triangular shaped having a height of at least 200 mm – 250 mm (**8-10 inches**) in the center with equal sides and a 400 mm – 500 mm (**16-20 inches**) base. The triangular shaped inner material shall be urethane foam. The outer cover shall be a woven geotextile fabric placed around the inner material and allowed to extend beyond both sides of the triangle 0.61-0.91 m (**2-3 feet**). Length of each section shall be 0.91-2.1 m (**3-7 feet**). Standard length shall be 2.1 m

(**7 feet**) unless otherwise indicated in the plans.

G Type 7: Rock Check

Type 7 ditch checks shall be composed a geotextile liner and riprap. The geotextile filter fabric liner shall be in accordance with 3733 Type IV. The riprap shall be in accordance with 3601, Class I-IV, as

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specified in the Contract, and be composed of 100 percent crushed or quarry run material. Riprap shall be configured in a trapezoidal shaped berm with respect to the side profile such that the bottom of the berm is approximately 1.5 m (**5 feet**) wide, the top of the berm is approximately 0.6 m (**2 feet**) wide, and the height of the berm is approximately 0.6 m (**2 feet**) deep.

3889.3 SAMPLING AND TESTING

Samples for testing shall be of such size and numbers as requested by the Engineer.

3890

Compost

3890.1 SCOPE

This Specification covers compost material used as a soil amendment for landscape planting or turf establishment purposes.

3890.2 REQUIREMENTS

Compost material furnished under this Specification shall consist of a natural humus product derived from the aerobic decomposition of organic wastes. The compost shall be considered mature and usable by Mn/DOT when 60 percent decomposition has been achieved as determined by an ignition-loss analysis and any one additional test method including the Solvita test of 5 or above. This shall mean that the compost product has no offensive smell, no identifiable organic materials, and will not reheat more than 11 °C (**20 °F**) degrees above ambient temperature. Compost must be produced by a process to further reduce pathogens (PFRP) and weed seeds, and process verified by fecal coliform or *Salmonella* sp. Tests, where applicable. Compost foreign particle restrictions up to 3% at 4 mm (**0.16 inch**) will apply to the shredded pieces from the plastic bags used to transport feedstocks to the composting facility, but will be considered acceptable if visible in the finished product. Biosolids as a compost additive or co-compost material shall be acceptable if product description and source is on file with Mn/DOT and meets all specifications for Grade 1 Compost.

Compost shall be registered for sale with the State of Minnesota. Additionally, the material shall meet the Minnesota Pollution Control Agency requirements for allowable levels of any inherent contaminants (7035.2836 Subp. 6 Sec. A), or the Code of Federal Regulations, Title 40, section 503.13(b)(3), amended for mercury. Compost must meet minimal chemical contaminant standards in order to be used in a Mn/DOT project. No material may be mixed into a compost that does

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not comply with Minnesota Rules Chapter 7045 (Hazardous Waste). Compost used in Mn/DOT transportation systems is not allowed to exceed 10% of the Minnesota Pollution Control Agency's Superfund residential soil cleanup guidelines, termed Soil Reference Values or SRVs (i.e. 10% of individual chemical or chemical mixture Hazard Index, Hazard Quotient, or acceptable cancer risk level). No chemical contaminant, including pesticides, can be present in concentrations that would result in toxic effects to soil organisms, plants, or animals which reside in or on the composted soil areas or use the treated area for food or shelter. At the time of delivery to the Project, the compost shall be in a condition considered safe for exposure to dusts during handling.

A Grade 1 Compost

Grade 1 compost for use in turf establishment shall be a nutrient rich type derived from the decomposition of animal derived material with a texture similar to a highly organic soil and meeting the following requirements:

	Min	Max
Organic Matter Content	30%	----
C/N Ratio	6:1	20:1
NPK ratios ^a	2:2:1	4:4:2
pH	5.5	8.0
Moisture Content	35%	55%
Bulk Density kg/m ³ (lbs/cy. yd)	415 (700)	950 (1600)
Inert Material	---- 3%	@ 4 mm (0.15 inch)
Soluble salts (mmho/cm)	----	10
Germination Test ^b	80%	100%
Screened Particle Size	----	10 mm (0.375 inch)
Contaminants	----	US EPA 503 ^c

^a To obtain the nitrogen, phosphorus or potassium levels specified, the compost may be fortified with commercial fertilizer.

^b Germination test must list the species of Cress or lettuce seed used.

^c or MPCA 7035.2836 Subp. 6 Sec. A.

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B Grade 2 Compost

Grade 2 compost for use of as a landscape planting medium, shall be a humus rich type derived from the decomposition of leaves and yard wastes. Animal or poultry manure, at any stage of decomposition, shall not be acceptable. Texture shall be similar to a shredded peat and shall meet the following requirements:

	Min	Max
Organic Matter Content	30%	----
C/N Ratio	6:1	20:1
pH	5.5	8.5
Moisture Content	35%	55%
Bulk Density kg/m ³ (lbs/cu.yd.)	415(700)	890(1500)
Inert Material ^a	----	3% @ 4 mm (0.15 inch)
Soluble salts (mmhos/cm)	----	10
Germination Test ^b	80%	100%
Screened Particle Size	----	19 mm (¾ inch)
Contaminants	----	US EPA 503 ^c

^a Includes plastic bag shreds

^b Germination test must list the species of Cress or lettuce seed used.

^c or MPCA 7035.2836 Subp. 6 Sec. A.

C Grade 3 Compost

Grade 3 compost derived from a composite of up to 10 percent of animal derived material feedstock added to leaf and yard waste feedstock by weight, meeting all requirements of Grade 1 Compost.

3890.3 APPROVED MATERIALS

Vendors approved by the Department's Turf Establishment and Erosion Prevention Unit and on file on the web under the Materials Engineering Section meet this specification requirement.

3890.4 SAMPLING AND TESTING

Compost shall be tested and approved by the Engineer prior to delivery to the Project. Prior to the Engineer sampling the product, compost vendors must furnish certification that their compost has been chemically and biologically tested and found to meet the specification standards described above. When any federal or state chemical specific requirements are conflicting, the vendor shall meet the most stringent requirement. The Department also reserves the right to conduct bioassay testing of any material.

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Prospective sources shall be indicated to the Engineer at least 1 month prior to delivery to the Project in order to allow adequate time for testing and approval of the material. Material from sources approved by the Agricultural Engineer may be accepted on the basis of a certificate of compliance according to 1603. In this case, certified test reports shall be furnished prior to delivery and acceptance to the Engineer and also to the Agricultural Engineer.

All testing shall be in accordance to current standard testing procedures of the University of Minnesota Soils Testing Laboratory, Soil Science Department, or equivalent.

3891

Storm Drain Inlet Protection

3891.1 SCOPE

This specification covers materials used for temporarily protecting storm drain inlets that are either constructed during the Project or exist prior to the Project, from sedimentation during construction activities. For purposes of this specification storm drain inlets are defined as manholes, catch basins, curb inlets and other drop type inlets that provide for the ingress of surface water into underground drainage systems.

3891.2 TYPES

Types of storm drain inlet protection to be provided shall be as follows:

Inlet protection to be utilized in median areas, field inlets and other areas where vegetation will ultimately be established.

Inlet protection to be utilized in and adjacent to streets, parking lots and other areas that will ultimately be paved.

3891.3 APPROVED MATERIALS

In addition to the Approved Products List, approved materials that can be furnished for use are as follows:

A Rock Log

Rock logs shall meet the requirements of 3897.2 Type 7.

B Compost Log

Compost logs shall meet the requirements of 3897.2 Type 5.

C Sediment Control Inlet Hat

Sediment control inlet hats shall be a polyethylene hat-like structure covering the inlet with small weep holes on the side providing a filtering function of the storm water runoff and a large opening above the weep holes for emergency overflow.

D Silt Fence Ring and Rock Filter Berm or Rock Log Combination

Silt fence shall meet the requirements of 3886 Type Heavy Duty. Silt fence shall be placed in a circular configuration around the inlet to form a minimum 1.5 m (**5 foot**) diameter zone of protection. Rock logs (3897.2 Type 7) shall line the outside toe of the silt fence. Rock Filter berms shall consist of 3882 Type 9 Mulch, at the Silt Fence toe, as indicated on the Plans.

E Pop-up Head

Pop-up head inlet protection shall form a solid steel plate over the inlet casting or solid steel box that fits inside a grate assembly with the exception of a center cylindrical drain tube riser. The tube riser shall be fully extended when providing drainage functions and have holes that provide filtering capabilities. The tube riser shall be covered with a removable knit type geotextile that provides additional sediment filtering capabilities. The tube riser shall be able to be pushed down flat to the steel plate to allow construction vehicles to drive over it, facilitate cleanout, or to shut off drainage to the inlet.

F Filter Bag Insert

Filter bag insets shall consist of a replaceable reinforced filter bag suspended from a retainer ring, or frame that fits within a grate or it shall consist of a geosynthetic filter bag suspended from a rebar or steel rods. The filter bag that is suspended from a frame shall be constructed of a polypropylene filter geotextile fabric with a minimum weight of 222 g/m² (**4 ounce/square yard**), a minimum flow rate of 5908 L/minute/m² (**145 gallon/minute/square feet**), a minimum permittivity of 2 per second, and designed for a minimum silt and debris capacity of 0.57 m³ (**2 cubic feet**). The filter bag shall be reinforced with an outer polyester mesh fabric. The filter bag shall be suspended from a galvanized steel ring or frame utilizing a stainless steel band and locking clamp. The frame shall be designed with an overflow feature. Overflow capacity shall be at a minimum equal to the design flow capacity of the structure's grate opening.

When the filter bag insert is the type suspended from the grate the geosynthetic fabric shall meet 3886 for Machine Sliced and a minimum silt and debris capacity of 0.57 m³ (**2 cubic feet**). All edges, seams shall be minimum double stitched. The Filter bag insert shall have an oval, edge heat sealed overflow 10 by 15 mm (**4 by 6 inches**) holes cut into all four panel sides.

G BLANK

H BLANK

I BLANK

3891.3

J BLANK

K Other

Devices approved by the Department's Erosion Control Engineering Unit and on file on the web under the Materials Engineering Section's Approved Products List can be furnished as meeting this specification requirement.

3891.4 REQUIREMENTS

Dimension requirements will be as indicated in the Plans.

3891.5 SAMPLING AND TESTING

Sampling and testing samples shall be furnished in the size and number directed by the Engineer.

3892

Temporary Down Drain

3892.1 SCOPE

This Specification covers material used as a temporary Down drain to convey drainage down a slope while turf is establishing.

3892.2 REQUIREMENTS

In the absence of plan specifications, Temporary Down drain shall consist of a 250 mm (**10 inch**) minimum diameter corrugated polyethylene tubing (PE). The corrugated polyethylene tubing shall be nonperforated and shall comply with AASHTO M 252.

The Down drain shall be anchored with stakes. The stakes shall be nominal 50 x 50 mm (**2 x 2 inch**) cross-section, at least 1 m (**3 feet**) long, and with a pointed end. Maximum spacing between the stake installations shall be 2.5 m (**8 feet**).

3892.3 SAMPLING AND TESTING

Samples for testing shall be of such size and numbers as requested by the Engineer.

3893

Sandbags

3893.1 SCOPE

This Specification covers material used for sandbags to dike off construction areas or to serve as temporary erosion control installations.

3893.2 REQUIREMENTS

Sandbags shall consist of a woven polypropylene fabric sewn together with double stitching. The polypropylene fabric shall meet or exceed the following:

Grab Tensile Strength

ASTM D 4632 420 N, min.

UV Stability

ASTM D 4355 70% min.

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Overall size of the sandbag shall be at least 350 x 650 mm (**14 x 26 inch**).

3893.3 SAMPLING AND TESTING

Samples for testing shall be of such size and numbers as requested by the Engineer.

3894

Sediment Mat

3894.1 SCOPE

This Specification covers a sediment absorbing biodegradable mat temporarily placed in a stream bed to intercept and retain sediment caused by in-stream construction activities.

3894.2 REQUIREMENTS

The sediment mat shall consist of a flat pad that can be laid out singly or grouped together. The pad shall be composed of a bottom layer of burlap, a center core of wood excelsior fiber blanket and an upper layer of jute netting. The burlap shall be a construction grade 280 g (**10 ounce**) mass fabric. The wood excelsior fiber center core shall be approximately 25 mm (**1 inch**) thick and shall have a mass of at least 0.50 kg (**1 pound**) per m² (**square yard**). The jute netting shall be a construction grade having a mass of at least 0.50 kg (**1 pound**) per m² (**square yard**) with approximately 25 mm (**1 inch**) openings. The pad shall be stitched together along the edges and through the center to prevent movement of the layers in relation to each other. Overall size of each pad shall be approximately 1.2 x 3.0 m (**4 x 10 feet**) with an overall mass of approximately 11 kg (**24 pounds**).

3894.3 SAMPLING AND TESTING

Samples for testing shall be of such size and numbers as requested by the Engineer.

3895

Fiber Log

3895.1 SCOPE

This Specification covers fiber logs used to stabilize shorelines and to facilitate the establishment of vegetation.

3895.2 REQUIREMENTS

The fiber log shall consist of natural coconut fibers (coir) that have been compressed and stuffed into a netting. Dimensions of the log shall be approximately 300 mm (**12 inches**) in diameter. Mass of the log shall be no less than 11 kg/m (**7.4 pounds per foot**). The outer netting shall consist of coir yarn. Service life shall be a minimum of 5 years.

3895.3

3895.3 SAMPLING AND TESTING

Samples for testing shall be of such size and numbers as requested by the Engineer.

3896

Soil and Root Additives

3896.1 SCOPE

This specification covers additives for improving soil or root stock to ease transplanting, stimulate growth and improve the health of plant stock or seed.

3896.2 REQUIREMENTS

Additives shall conform to the requirements for one or more of the following, as specified in the Contract:

A Plant Hormones

Rooting hormone powder or liquid, used to stimulate rooting of plant cuttings, bare root stock and perennial plant material, shall contain known root hormones including any of the following: indole-3-butyric acid (IBA) indole acetic acid (IAA) or cytokinins. The inert ingredients shall not be harmful to the environment. Pre-mixed liquid forms must be handled and mixed according to the manufacturer's recommendations. This material may be tank mixed or pre-blended with hydrophilic polymers and endomycorrhizal inoculum.

B Hydrophilic Polymers

Super-absorbent polymer or hydrophilic compound, used to modify physical characteristics of soils to manage soil air and water, shall be an organic and fully biodegradable cross-linked polymer or other hydroscopic compound with water-binding groups and shall consist of potassium polyacrylate/polyacrylamide copolymer, sugar alcohols, polysaccharides, humates, alpha-hydroxypropionic acid or other documented hydrophilic compound. The product shall have a minimum life span of 60 days in the soil. Application rate shall be in accordance to manufacturer's recommendations for new plantings. This material may be mixed or pre-blended with rooting hormones and mycorrhizal treatments.

C Mycorrhizal Inoculum

C1 Endomycorrhizal Inoculum

Endomycorrhizal inoculum, microorganisms symbiotic with, and beneficial to plant roots, shall contain several species of *Glomus* that can be applied to the soil or base of a plant as a liquid, powder, or pellet. Minnesota origin of inocula is preferred. Additional endomycorrhizal species of *Gigaspora*, *Scutellospora*, *Entrophospora*, *Acaulospora*, or *Sclerocystis* may also be present. The Inoculum will not be rejected if ectomycorrhizal species of *Pisolithus* or *Rhizopogon*

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are present. The inoculum shall have a defined live spore count and shall be applied according to the manufacturer's recommendations for new plantings. Antagonistic pathogens shall not be present above trace levels. This material may be mixed or pre-blended with hydrophilic polymers and rooting hormones.

C2 Ectomycorrhizal Inoculum

Ectomycorrhizal inoculum, microorganisms symbiotic with, and beneficial to plant roots, shall contain *Rhizopogon* and or other cold tolerant species that can be applied to the soil or base of a plant as a liquid, powder, or pellet. Minnesota origin of inocula is preferred. The inoculum shall have a defined live spore count and shall be applied according to the manufacturer's recommendations for new plantings. Antagonistic pathogens shall not be present above trace levels. This material may be mixed or pre-blended with hydrophilic polymers and rooting hormones.

3896.3 SAMPLING AND TESTING

Product data sheet, research tests and Material Safety Data Sheet shall be submitted to the Engineer for approval prior to delivery and use on the project.

3897

Filter Logs

3897.1 SCOPE

This specification covers filter logs used for slowing and filtering storm water runoff, and other water encountered on the Project.

3897.2 REQUIREMENTS

Filter logs shall conform to the requirements of the following types, as specified in the Contract.

Type Straw Bioroll

Straw Bioroll shall consist of grain straw free of seed bearing stalks of noxious grasses or weeds as defined by the rules and regulations of the Minnesota Department of Agriculture. Straw shall be encased in polypropylene netting that will photo degrade within 6 to 9 months. The netting shall have approximate openings of 13 mm x 13 mm (**½ inch x ½ inch**). The encased straw shall form a cylindrical log that is a minimum of 3 m (**10 feet**) long and 150-175 mm (**6 – 7 inches**) in diameter. Straw shall be packed into the net casing at a density between 32 to 64 kg/m³ (**2 to 4 pounds/cubic feet**).

3897.2

Type Wood Fiber Bioroll

Wood Fiber Bioroll shall consist of excelsior fibers. Excelsior fibers shall be encased in a polypropylene netting that will photo degrade within 6 to 9 months. The netting shall have approximate openings of 13 mm x 13 mm (**½ inch x ½ inch**). The encased excelsior fibers shall form a cylindrical log that is a minimum of 3 m (**10 feet**) long and 150-175 mm (**6 – 7 inches**) in diameter. A minimum of 80 percent of the fiber material shall be 150 mm (**6 inches**) or longer. Excelsior fibers shall be packed into the net casing at a density between 22 to 58 kg/m³ (**1.4 to 3.6 pound/cubic feet**).

Type Compost Log

Compost Log shall consist of a blend of 30-40% weed free compost as per 3890 Grade 2 and 60-70% partially decomposed wood chips. The compost/wood blend material shall pass a 51 mm (**2 inches**) sieve with a minimum of 70% retained on the 10 mm (**3/8 inch**) sieve, in accordance with TMECC 02.02-B, "Sample Sieving for Aggregate Size Classification". The compost/wood chip blend shall be pneumatically shot into a geotextile cylindrical bag. The geotextile bag shall consist of a knitted material with openings of 10 mm (**3/8 inches**) and contain the compost/wood chip material while not limiting water infiltration. The encased compost shall form a cylindrical log that is a maximum of 55 m (**180 feet**) and approximately 200 mm (**8 inches**) in diameter.

Type Rock Log

All aggregate shall be washed before placed in a rock bag. Rock shall be supplied in accordance with 3137.2 Class D with a gradation in accordance with Table 3137-1 CA-1 through CA-5. The casing material for the rock shall be between 1.2 m (**4 feet**) and 3 m (**10 feet**) in length and between 100 mm (**4 inches**) and 150 mm (**6 inches**) in diameter when filled with rock. The casing material shall have a minimum grab tensile strength of 575 N (**130 pounds**) and a minimum Mullen Burst Strength of 1200 kPa (**175 psi**).

3897.3 SAMPLING AND TESTING

Samples for laboratory testing shall be of numbers and size as requested by the Engineer.

3898

Flocculants

3898.1 SCOPE

This specification covers naturally derived additives for coagulating dispersed clays, and reducing turbidity in storm water runoff prior to discharge to natural surface waters. The use of flocculants to settle out clay-sized particles allows for increased sediment trapping efficiency and is to be used as part of a designed storm water treatment system.

3898.2 REQUIREMENTS

Flocculants shall be environmentally benign, biodegradable, and consist of natural origin biopolymers to improve water quality and protect aquatic biota. The pH and temperature of the sediment laden storm water must be tested and be within the manufactures specified pH and temperature range. Adequate time for chemical reaction with clay-sized particles must be provided for in the field prior to discharge to a surface water, wetland, or identified water of concern.

Flocculants shall conform to the requirements as detailed by each type.

A Liquid

The flocculant shall be stored in a concentrated liquid state. A manufacture's label must be affixed to the container that lists the percent of concentration in the container and the application dose rate. All dose rate calculations must be verified by the Engineer prior to application to the treatment system.

B Flocculant Sock

The flocculant shall be in a gelatin-like state that is packaged in individual compartments of the encasing sock material. The encasing material shall allow water to flow through it such that the water to be treated comes in contact with the gelatin-like flocculant material.

The Flocculant Sock shall have attachment anchor cords or grommets as needed for use in pipes, sediment control filter systems, and ditch bottoms.

The Flocculant Sock shall at a minimum treat 945 m³ (250,000 gallons) of water flowing through it.

C Granular Flocc

The flocculant shall be stored in a granulated state. A manufacture's label must be affixed to the bag or container that states the purity of the product and the application mixing rate. All dose rate calculations must be verified by the Engineer prior to application to the treatment system.

3898.3 SAMPLING AND TESTING

A certificate of compliance, and Material Safety Data Sheet shall be submitted to the Engineer for approval prior to delivery and use on the project.

3902

**3902
Form Coating Material**

3902.1 SCOPE

This Specification covers coating material that will prevent bonding between a form, dowel, or other object and concrete.

3902.2 REQUIREMENTS

The form coating material shall meet the following requirements and also be approved by the Concrete Engineer. The form coating material shall be a chemical release agent containing no ordinary lubrication oil, conventional form oil, fuel oil, or kerosene. The form coating material shall prevent bonding to concrete; shall not penetrate, stain, or leave a residual film on the concrete surface; and shall not attract dirt or other deleterious matter.

The form coating material shall be applied at a rate recommended by the manufacturer that will provide a smooth surface free of dusting action caused by reactions of the chemical release agent.

The flash point of the chemical release agent shall be not less than 65°C (149°F).

3902.3 SAMPLING AND TESTING

A Sampling

Samples for testing shall be of such size and numbers as required by the Schedule of Materials Control.

B Testing

Flash Point ASTM D 92

3906

Water for Concrete and Mortar

3906.1 SCOPE

This Specification covers water for use in portland cement concrete and mortar.

3906.2 REQUIREMENTS

Water for use in mortar or concrete shall be subject to the approval of the Engineer. It shall not be salty or brackish and shall be reasonably clear and free from oil, acid, injurious alkali or vegetable matter.

When comparative tests are made with a water of known satisfactory quality, any indication of unsoundness, marked change in time of setting, or a reduction of more than 10 percent in mortar strength shall be sufficient cause for rejection of the water under test.

3906.3 SAMPLING AND TESTING

Samples for testing shall be as required by the Schedule of Materials Control. The quality of the water shall be determined in accordance with AASHTO T 26.

3911.2

In sampling water for testing, care shall be taken that the containers are clean and that samples are representative.

3910 Rock Salt

3910.1 SCOPE

This Specification covers rock salt to be used as a deicer for road construction and maintenance purposes.

3910.2 REQUIREMENTS

The quality and grading of the salt shall conform to ASTM D 632 for Type 1, Grade 1 material. At the time of delivery to the Department, the salt shall not contain more than 1.5 percent moisture, and it shall be free flowing and free of lumps, aggregations and foreign matter.

3910.3 SAMPLING AND TESTING

A Sampling

The Department reserves the right to sample and inspect the salt at the Contractor's unloading and storage facilities or at the point of delivery to the Department.

B Testing

The chemical analysis for determination of sodium chloride content shall be made in accordance with the Rapid Method of Test for Sodium Chloride, as published in the Annex to ASTM D 632.

3911 Calcium Chloride

3911.1 SCOPE

This Specification covers liquid and solid calcium chloride for use in dust control accelerating the hardening of concrete and other purposes.

3911.2 GENERAL REQUIREMENTS

Calcium chloride shall be in liquid or solid form, as specified in the Contract, and shall conform to AASHTO M 144 for the type and grade specified. Unless otherwise authorized, liquid calcium chloride shall contain a minimum of 38 percent, by mass (weight), anhydrous CaCl_2 . The solution shall be clear and free of solid matter.

3911.3

3911.3 SAMPLING AND TESTING

A Sampling

Sampling shall be according to ASTM D 345. Calcium chloride shall be sampled at the rate of one 1 kg (**2 pounds**) sample of solid material and 0.5 L (**1 pint**) of liquid material for each shipment or lot. Sample containers shall be well sealed plastic jars.

B Testing

Calcium chloride, CaCl₂ Atomic Absorption Method (A)
Alkali chlorides ASTM E 449

(A) Test Method on file in the Chemical Laboratory of the Office of Materials

3912

Magnesium Chloride Solution

3912.1 SCOPE

This Specification covers magnesium chloride solution used for dust control.

3912.2 REQUIREMENTS

The magnesium chloride solution shall be water clear, thoroughly mixed, free from any solid matter or deleterious substances. The solution solids shall consist primarily of magnesium chloride.

Chemical Composition

Magnesium chloride, anhydrous, percent minimum 28.0
Sulfate, as SO₄, percent maximum 3.5
Alkali chlorides, as NaCl, percent maximum 5.0

3912.3 SAMPLING AND TESTING

A Sampling.....

Magnesium chloride shall be sampled at the rate of 0.5 L (**1 pint**) sample per load. Sampling procedure shall be according to ASTM D 345. Sampling containers shall be well sealed plastic jars.

B Testing

Magnesium chloride, MgCl₂ ASTM E 449 Modified (A)
Sulfate SO₄..... Gravimetric precipitation with BaCl₂
Alkali chlorides ASTM E 449 (or flame emission)

(A) Test Method on file in the Chemical Laboratory of the Office of Materials.

3917
Concrete Treating Oil

3917.1 SCOPE

This Specification covers two types of mixtures to be applied as a protective coating on concrete. Unless otherwise specified, the type used shall be optional with the Contractor.

3917.2 REQUIREMENTS

A Type I

Type I concrete treating oil shall consist of a mixture of equal parts, by volume, of:

- (a) Mineral spirits conforming to ASTM D 235.
- (b) Neutral petroleum oil (plain) having a viscosity of 75-100 SUS at 38°C (100°F).

B Type II

Type II concrete treating oil shall consist of a mixture of boiled linseed oil and petroleum spirits conforming to AASHTO M 233.

3917.3 SAMPLING AND TESTING

- A Sampling and testing boiled linseed oil.....ASTM D 260**
- B Tests for mineral spiritsASTM D 235**
- C Sampling petroleum products.....ASTM D 4057**
- D Viscosity.....ASTM D 445**

3973
Buried Cable Signs

3973.1 SCOPE

This Specification covers the buried cable signs used to mark the route of underground fiberoptic cables.

3973.2 REQUIREMENTS

Install the ground mounted signs to 3.8 kg/m (**2.6 pounds per foot**) galvanized steel fence posts that comply with 3401. Use stainless steel bands and fittings when installing the signal mounted signs to the RCS.

The aluminum signs shall comply with 3352, 2564, the Contract detail and with the Mn/DOT Standard Signs Manual. The sign is 150 mm wide x 300 mm high (**6 x 12 inches**), with black legend on a non-reflective yellow face and complies with Department standards. The Engineer must approve the sign design before they are procured by the contractor.

A Buried Cable Sign

The sign is aluminum, 200 mm wide x 300 mm high (**8 x 12 inches**), with black legend silk screened on a yellow face, complying with the Mn/DOT Standard Signs Manuals.

The sign legend is:

CAUTION	(line 1)
BURIED FIBER	(line 2)
OPTIC CABLE	(line 3)
BEFORE DIGGING CALL	(line 4)
GOPHER STATE ONE CALL	(line 5)
612.454.0002	(line 6)
Mn/DOT LOGO	(line 7)

B Legend Size

The legend size is: The first line has 40 mm (**1.575 inch**) yellow characters centered on a black 50 mm x 180 mm (**2 x 7 inch**) background. The second has 30 mm (**1.18 inch**) black characters, third and fourth 20 mm ($\frac{3}{4}$ **inch**), fifth 15 mm (**0.59 inch**), and the sixth 25 mm (**1.0 inch**).

The logo is a 40 mm (**1.575 inch**) diameter circle with a white background. The blue letters "MINNESOTA DEPARTMENT OF TRANSPORTATION" are in margin of the circle. The left half of the logo inside the margin has a silhouette of the left one half of a coniferous tree on a green foreground. The right half of the logo inside the margin has a five point star silhouette inside a blue foreground.

3973.2

C Sign Placement

Place the signs less than 220 m (**722 feet**) apart, and at each change of direction, along the route of direct buried fiberoptic cable.

3973.3 TESTING 2550

END