

CONSTRUCTION SPECIFICATION

26. SALVAGING AND SPREADING TOPSOIL

1. SCOPE

The work shall consist of salvaging topsoil from the dam foundation area and borrow areas and spreading it on all earthfill embankment and all other disturbed areas above permanent waterline to a depth of six inches, unless otherwise specified on plans.

2. QUALITY OF TOPSOIL

Topsoil shall consist of friable surface soil reasonably free of grass, roots, weeds, sticks, stones or other foreign materials.

3. EXCAVATION

After the site has been cleared and grubbed the topsoil shall be removed from the designated areas and shall be stockpiled at locations shown on the drawings or approved by the Engineer. Objectionable materials encountered during excavation shall be removed and buried at locations shown on the drawings or approved by the Engineer or otherwise removed from the construction site.

4. SPREADING

Method 1 Spreading shall not be done when the ground or topsoil is frozen, excessively wet or otherwise in a condition detrimental to the work. Surfaces designated to be covered shall be lightly scarified just prior to the spreading operation.

After placement is completed the surface of the topsoil shall be finished to a reasonably smooth surface.

Method 2 Spreading shall not be done when the ground or topsoil is frozen, excessively wet or otherwise in a condition detrimental to the work. Surfaces designated to be covered shall be lightly scarified just prior to the spreading operation. Where compacted fills are designated to be covered by topsoil, the topsoil shall be placed concurrently with the fill and shall be bonded to the compacted fill with the compacting equipment.

After placement is completed the surface of the topsoil shall be finished to a reasonably smooth surface.

5. MEASUREMENT AND PAYMENT

Method 1 The total areas of the surfaces covered by topsoil will be computed to the nearest square yard. Payment for salvaging and placing topsoil will be made at the contract unit price. Such payment will constitute full compensation for all materials, labor and equipment and all other items necessary and incidental to the completion of the work, including excavating, stockpiling, hauling, and spreading.

Method 2 The total area of the surfaces covered by topsoil will be computed to the nearest square yard except that the areas of the surfaces of embankments, levees, dikes and other earthfills will not be included for payment. Payment for salvaging and placing topsoil will be made at the contract unit price. Such payment will constitute full payment for all materials, labor and equipment and all other items necessary and incidental to the completion of the work, including excavating, stockpiling, hauling, and spreading.

Payment for topsoil spread on the surfaces of embankments, levees, dikes and other earthfills will be considered as included in the payment for the item of earthfill under which the embankment, levee, dike, or other earthfill is constructed.

Method 3 For items of work for which specific unit prices are established in the contract, the volume of topsoil salvaged and spread will be measured by cross section surveys of the stockpile from which it is taken if it is stockpiled, otherwise, of the area from which it is borrowed; and will be computed to the nearest cubic yard by the method of average cross-sectional end areas. Payment for salvaging and spreading topsoil will be made at the contract unit price. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work including excavation, stockpiling, hauling, and spreading.

All Methods The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 6 of this specification.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details therefore are:

a. Bid Item Salvaging and Spreading Topsoil

(1) This item shall consist of the salvaging of selected topsoil from required excavations and placing and spreading it as described in Method 1, on the auxiliary spillway as shown on the drawings and to the depth specified.

(2) Topsoil shall be lightly compacted and dressed to a reasonably smooth, firm surface.

(3) The finished surface of topsoil placed on the auxiliary spillway level crest section shall be within ± 0.1 foot of the planned elevation. The

surface of topsoil placed on the auxiliary spillway inlet or outlet channel shall be within ± 0.5 foot of the planned elevation. The channel shall be essentially level from side to side; the maximum variation in the channel surface at a cross section shall be ± 0.2 foot. The surface of topsoil on excavated slopes shall be within -0.0 to $+ 0.5$ foot of planned elevation.

(4) Measurement and payment shall be as described in Section 5.

b. Subsidiary Item - Salvaging and Spreading Topsoil

(1) This item shall consist of the salvaging of selected topsoil from required excavations and the placing and spreading (Method 2) of it on earthfill areas and any other disturbed areas as shown on the drawings and to the depth specified.

(2) Topsoil shall be compacted in accordance with the requirements for the zone of compacted earth to which it is bonded except the outermost 12 inches of topsoil shall be only lightly compacted.

(3) The finished surface of topsoil placed on earthfill areas shall be within -0.0 to $+0.5$ foot of the planned elevation. All slopes shall be nearly uniform (within 0.5 ft) from top to bottom.

(4) No separate payment will be made for this item. Compensation for this item will be included in the payment for Earthfill, Embankment; Earthfill, Miscellaneous; and Earthfill, Random.

CONSTRUCTION SPECIFICATION

32. CONCRETE FOR MINOR STRUCTURES

1. SCOPE

The work shall consist of furnishing, forming, placing, finishing and curing Portland cement concrete as required to install the structures as shown on the drawings and described in the specifications.

2. MATERIALS

Portland cement shall conform to the requirements of ASTM Specification C 150 for Type I or II Portland cement.

Aggregate shall conform to the requirements of ASTM Specification C-33 for the specified sizes. The grading of coarse aggregates shall be of size 57 or 67.

Water shall be clean and free from injurious amounts of oil, salt, acid, alkali or organic matter or other undesirable substances.

3. CLASS OF CONCRETE

Concrete for minor structures shall be Class 3000. The mix shall contain a minimum of 6 bags of Portland cement per cubic yard and have a maximum net water content of 6½ gallons of water per bag of cement.

4. DESIGN OF THE CONCRETE MIX

The proportion of the aggregates shall be such as to produce a concrete mixture that will work readily into the corners and angles of the forms and around reinforcement when consolidated, but will not segregate or exude free water during consolidating. The slump the time of placement shall be between 2 and 5 inches.

5. PREPARATION OF FORMS AND SUBGRADE

Forms shall be wood, steel or other approved material and shall be mortar tight. The forms shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Forms shall be coated with a non-staining form release agent before being set into place. The forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, oil or other harmful substances.

6. CONVEYING

Concrete shall be delivered to the site and placed into the forms with 1½ hours after the introduction of the cement to the aggregates. When the temperature exceeds 90 degrees F, the concrete will be placed in the forms within 45 minutes.

7. PLACING

Concrete shall not be placed until the subgrade, forms and steel reinforcement have been inspected and approved. No concrete shall be placed except in the presence of the engineer. The contractor shall give reasonable notice to the engineer each time he intends to place concrete. Concrete shall not be dropped more than five feet vertically unless suitable equipment is used to prevent segregation. Immediately after the concrete is placed in the forms, it shall be consolidated by spading, hand tamping or vibration as necessary to insure smooth surfaces and dense concrete. All exposed surfaces of the concrete shall be accurately screeded to grade and then float finished.

8. CURING

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period or until curing compound is applied.

9. REMOVAL AND REPLACEMENT OR REPAIR

When concrete is honeycombed, damaged or otherwise defective, the contractor shall remove and replace the structure or member containing the defective concrete or if approved by the engineer shall correct or repair the defective parts.

10. CONCRETING IN COLD WEATHER

Concrete shall not be mixed nor placed when the daily minimum temperature is less than 40 degrees F unless facilities are provided to prevent the concrete from freezing. The use of accelerators or antifreeze compounds will not be allowed.

11. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, concrete will be measured to the neat lines shown on the drawings and the volume of concrete will be computed to the nearest 0.1 cubic yard.

Payment will be made at the contract unit price. Such payment shall constitute full compensation for all labor, materials, equipment and other items necessary and incidental to the completion of the work.

ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details there are:

Bid Item Reinforced Concrete, Class 3000

(1) These items shall consist of the cast-in-place concrete structures shown on the drawings.

(2) Payment for minor concrete structures will be at the contract lump sum price.

CONSTRUCTION SPECIFICATION

51. CORRUGATED METAL PIPE CONDUITS

1. SCOPE

The work consists of furnishing and placing circular, arched, or elliptical corrugated metal pipe and the necessary fittings.

2. MATERIAL

Pipe and fittings shall conform to the requirements of Material Specification 551, Coated Corrugated Steel Pipe, or Material Specification 552, Aluminum Corrugated Pipe, whichever is specified.

Unless otherwise specified in section 11 of this specification, perforated pipe furnished shall conform to the requirements for Class I perforations as described in ASTM A 760 or A 762.

3. COUPLING BANDS AND HARDWARE

Pipe joint coupling bands shall be provided meeting the requirements specified in section 11 of this specification.

Hardware consisting of coupling bands and band fastening devices, such as connecting bolts, rods, lugs, and angles used in conjunction with zinc-coated iron or steel pipe, shall be galvanized by the hot-dip method. Hardware used in conjunction with aluminum pipe and aluminum or aluminum-zinc alloy-coated iron and steel pipe shall be of the same material as the pipe except that hot-dip galvanized or cadmium-plated fasteners may be used. The surface of all band-fastening devices for pipe specified with bituminous or polymer coating shall be coated with asphalt-mastic material meeting the requirements of ASTM A 849. The coupling band shall be coated similar to that specified for the pipe unless otherwise specified in section 11 of this specification.

Coupling bands shall be installed to provide straight alignment of the connecting pipe ends. Unless otherwise specified in section 11 of this specification, the bandwidth shall be as specified in

ASTM A 760 and A 762. The bands shall be positioned to overlap adjacent pipe ends equally. The coupling bands shall be corrugated to match the corrugations of the pipe section ends being connected.

4. FABRICATION

Fabrication of appurtenant sections shall be performed as shown on the drawings and described in section 11 of this specification. The items may consist of inlet sections, outlet sections, end sections, elbows, skew or beveled sections, rod reinforced ends, cut-off collars, or headwalls. Fabrication of these appurtenant sections shall be made from metallic-coated material identical to that from which the attached pipe is fabricated. Fabrication shall be of a quality and finished workmanship equal to that required for the pipe.

5. HANDLING THE PIPE

The contractor shall furnish equipment as necessary to install the pipe without damaging the pipe or coating. The pipe shall be transported and handled in a manner to prevent damage to the pipe and coating.

6. LAYING AND BEDDING THE PIPE

Unless otherwise specified, the pipe shall be installed in accordance with the manufacturer's recommendations. Pipe shall be installed so no reversal of grade between joints results unless otherwise shown on the drawings. The pipe shall be installed with the outside laps of circumferential joints pointing upstream and with longitudinal laps at the sides near the vertical mid-height of the pipe.

Field welding of corrugated galvanized iron or steel pipe is not permitted. The pipe sections shall be joined with fabricator-supplied coupling bands meeting the specified joint requirements. The coupling shall be installed as recommended by the fabricator.

The pipe shall be firmly and uniformly bedded throughout its full length to the depth and in the manner specified on the drawings.

Perforated pipe shall be installed with the perforations down and oriented symmetrically about a

vertical centerline. Perforations shall be clear of any obstructions at the time the pipe is installed in its final position.

The pipe shall be loaded sufficiently during backfilling to prevent displacement from line and grade and to maintain full contact with the bedding during the placement operations.

7. STRUTTING

When required, struts or horizontal ties shall be installed in the manner specified on the drawings. Struts and ties shall remain in position until the backfill has been placed above the top of the pipe to a height of 5 feet or the pipe diameter, whichever is greater, or to the surface of the completed earth backfill when the fill height is less than 5 feet above the top of the pipe. The contractor shall remove the struts or ties following completion of the earth backfill requirements that apply.

8. EMBEDMENT IN CONCRETE

Special treatment shall be provided to the pipe surface when embedded or attached to concrete and the pipe material is aluminum or aluminum-coated and aluminum-zinc alloy-coated. Potential contact surfaces in contact with concrete and masonry surfaces shall be coated with two coats of a bituminous paint of the cutback type. Placement of the pipe shall be such that direct metal-to-metal contact with other metallic material, such as embedded steel reinforcement or water control gates, is prevented.

9. REPAIR OF DAMAGED COATING

Any damage to the metallic coating shall be repaired by cleaning the damaged surface area by sand blasting, power disk sanding, or wire brushing. All loose and cracked coating, dirt, and any products of corrosion shall be removed before application of paint. Oil and grease material shall be removed by use of a solvent. The surface shall be clean and dry during the painting period and until the coating has completely dried.

Painting shall be accomplished by one of the following options based upon installed exposure conditions of the pipe as determined by the engineer.

Normal exterior or interior atmospheric exposure:

- (a) Zinc dust - zinc oxide primer, ASTM D 79 and D 520
- (b) Single package, moisture cured urethane prime in silver metallic color, or
- (c) Zinc-rich cold galvanized compound, brush, or aerosol application

Submergence in water exposure:

- (a) Zinc dust - zinc oxide primer, ASTM D 79 and D 520
- (b) Zinc dust paint, ASTM D 4146

When the metallic coating is damaged in any individual area larger than 12 square inches or if more than 0.2 percent of the total surface area of a single pipe section is damaged, that section of pipe will be rejected.

Breaks or scuffs in bituminous coatings that are less than 36 square inches in area shall be repaired by applying two coats of hot-asphaltic paint or a coating of cold-applied bituminous mastic. The repair coating shall be a minimum of 0.05 inch thick after hardening and shall bond securely and permanently to the pipe and coating. The material shall meet the minimum physical requirements for bituminous coating in ASTM A 849 and A 885. Whenever individual breaks exceed 36 square inches in area or when the total area of breaks exceeds 0.5 percent of the total surface area of an individual pipe section, that section of pipe will be rejected.

Bituminous coating damaged by welding of coated pipe or pipefittings shall be repaired as specified in this section for breaks or scuffs in bituminous coatings.

Breaks or scuffs in polymer coatings that are less than 36 square inches in area shall be repaired by the application of a polymer material similar to and compatible with the durability, adhesion, and appearance of the original polymer coating, as described in ASTM A 849, paragraph 6.8. The repair coating shall be a minimum thickness of 0.010 inch (10 mils) after drying. Whenever individual breaks exceed

36 square inches in area or when the total area of breaks exceeds 0.5 percent of the total surface area of the individual pipe section, that section of pipe will be rejected.

10. MEASUREMENT AND PAYMENT

Method 1 For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size, and gauge of pipe is determined to the nearest 0.1 foot by measurement of the laid length of the pipe along the centerline of the pipe. Payment for each type, class, size, and gauge of pipe is made at the contract unit price for that type, class, size and gauge of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe and fittings and all other items necessary and incidental to the completion of the work except items designated as *special fittings*. Special fittings are those sections of pipe requiring special fabrication to meet layout requirements. Payment for special fittings is made at the contract unit price for special fittings (CMP).

Method 2 For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size, and gauge of pipe is determined as the sum of the nominal laying lengths of the pipe sections installed. Payment for each type, class, size, and gauge of pipe is made at the contract unit price for that type, class, size, and gauge of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe and fittings and all other items necessary and incidental to the completion of the work except items designated as *special fittings*. Special fittings are those sections of pipe requiring special fabrication to meet layout requirements. Payment for special fittings is made at the contract unit price for special fittings (CMP).

Method 3 For items of work for which specific lump sum prices are established in the contract, payment for corrugated metal pipe structures is made at the contract lump sum price. Such payment constitutes full compensation for furnishing, fabricating, transporting, and installing the pipe structure complete with metal pipe, fittings, and appurtenances, and all other items necessary and incidental to

completion of the work, which includes, except as otherwise specified, required excavation, dewatering, and earth backfill.

All Methods The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in section 11 of this specification.

11. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details therefore are:

a. Bid Item - Principal Spillway Pipe

(1) This item shall consist of furnishing and installing the pipe and appurtenances for the principal spillway to achieve a water-tight conduit, as shown on the drawings.

(2) The pipe shall conform to Material Specification 551 and shall be Class II, Series C, Shape 1, 16 gauge, zinc-coated.

b. Bid Item - Pipe Support

(1) This item shall consist of furnishing and installing the pipe support as shown on the drawings.

(2) Pipe shall conform to Material Specification 551 and shall be Class II, Series C, Shape 1, 16 gauge, zinc-coated.

1 CONSTRUCTION SPECIFICATION

61. LOOSE ROCK RIPRAP

1. SCOPE

The work shall consist of the construction of loose rock riprap revetments and blankets, including filter layers or bedding where specified.

2. MATERIALS

Rock for loose rock riprap shall conform to the requirements of Material Specification 523 or, if so specified shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines and other materials not meeting the required gradation limits.

At least 30 days prior to delivery of rock from other than designated sources, the Contractor shall designate in writing the source from which he intends to obtain the rock and information satisfactory to the Contracting Officer that the material meets the requirements of the contract. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified in Section 9 of this specification.

Rock from designated sources shall be excavated, selected and processed as necessary to meet the grading requirements in Section 9 of this specification. The equipment and methods used for stockpiling and removing the materials must be such that no degradation or segregation will result and that no appreciable amount of foreign material will be incorporated into the riprap. The rock shall conform to the specified grading limits when installed in the riprap.

Filter or bedding materials when required, shall, unless otherwise specified, conform to the requirements of Material Specification 521.

3. SUBGRADE PREPARATION

The subgrade surfaces on which the riprap or bedding course is to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. When fill to

subgrade lines is required, it shall consist of approved materials and shall conform to the requirements of the specified class of fill.

Riprap shall not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by the Engineer.

4. EQUIPMENT-PLACED ROCK RIPRAP

The rock shall be placed by equipment on the surfaces and to the depths specified. Riprap shall be placed by backhoe, orange peel, clam or drag buckets. The riprap shall be constructed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. The rock shall be delivered and placed in a manner that will insure that the riprap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks filling the voids between the larger rocks to provide the minimum practical percentage of voids.

Dumping of riprap at the top of slopes and rolling into place will not be permitted. Drifting, manipulating and moving riprap down the slopes by means of dozers or other blade equipment will not be permitted. A tolerance of plus two inches from the slope lines and grades will be allowed in the finished surface of the riprap. An occasional large stone will be permitted to protrude above the prescribed surface.

Riprap shall be placed in a manner to prevent damage to structures. Hand placing will be required to the extent necessary to prevent damage to the permanent works.

5. HAND-PLACED RIPRAP

The rock shall be placed by hand on the surfaces and to the depths specified. It shall be securely bedded with the larger rocks firmly in contact one to another. Spaces between the larger rocks shall be filled with smaller rocks and spalls. Smaller rocks shall not be grouped as a substitute for larger rock. Flat slab rock shall be laid on edge.

6. FILTER LAYERS OR BEDDING

When the drawings specify filter layers or bedding beneath riprap, the filter or bedding material shall be spread uniformly on the prepared subgrade surfaces to the depth specified. Compaction of filter layers or bedding will not be required, but the surface of such layers shall be finished reasonably free of mounds, dips or windrows.

7. TESTING

The Engineer will perform such tests as are required to verify that the riprap, filter, and bedding materials and the completed work meet the requirements of the specifications. These tests are not intended to provide the Contractor with the information he needs to assure that the materials and workmanship meet the requirements of the specifications, and their performance will not relieve the Contractor of the responsibility of performing his/her own tests for that purpose.

8. MEASUREMENT AND PAYMENT

Method 1 For items of work for which specific unit prices are established in the contract, the volume of each type of riprap, including filter layers and bedding, will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. Payment for each type of riprap, including filter layers and bedding, will be made at the contract unit price for that type of riprap. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap, filter layers and bedding.

Method 2 For items of work for which specific unit prices are established in the contract, the volume of each type of riprap and the volume of each type of filter layer or bedding will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. Payment for each type of riprap will be made at the contract unit price for that type of riprap. Payment for each type of filter or bedding will be made at the contract unit price for that type of filter or bedding. Such payment will be considered full compensation

for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap, filter layers and bedding.

Method 3 For items of work for which specific unit prices are established in the contract, the quantity of each type of riprap placed within the specified limits will be measured to the nearest ton by actual weight, and the volume of each type of filter layer or bedding will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. For each load of rock placed as specified, the Contractor shall furnish to the Engineer a statement-of-delivery ticket showing the weight, to the nearest 0.1 ton, of rock in the load.

Payment for each type of riprap will be made at the contract unit price for that type of riprap. Payment for each type of filter or bedding will be made at the contract unit price for that type of filter or bedding. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap, filter layers and bedding.

Method 4 For items of work for which specific unit prices are established in the contract, the quantity of each type of riprap placed within the specified limits will be measured to the nearest ton by actual weight, and the volume of each type of filter material or bedding delivered and placed within the specified limits will be measured to the nearest cubic yard by measurement of the hauling equipment. For each load of material placed as specified, the Contractor shall furnish to the Engineer a statement-of-delivery ticket showing the weight, to the nearest 0.1 cubic yard, of filter material or bedding in the load.

Payment for each type of riprap will be made at the contract unit price for that type of riprap. Payment for each type of filter or bedding will be made at the contract unit price for that type of filter or bedding. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to completion of the riprap, filter layers and bedding.

All Methods The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details therefore are:

a. Bid Item - Rock Riprap on Upstream Slope

(1) This item shall consist of furnishing and placing rock riprap on the upstream embankment slope as shown on the drawings.

(2) No filter material is required under the riprap.

(3) The riprap materials shall be reasonably well graded by weight within the limits stated below to meet the following requirements.

Gradation, By Equivalent Diameter

<u>Diameter (in)</u>	<u>% Finer by Weight</u>
12	100
8	60-85
6	30-50
3	0-15

Earth and other non-rock material shall not exceed 5%.

(4) Hand placing will be required to the extent necessary to prevent damage to the permanent works.

b. Bid Item - Rock Riprap of Stilling Basin

(1) This item shall consist of furnishing and placing rock riprap around the principal spillway stilling basin as shown on the construction drawings.

(2) The rock riprap shall be equipment placed.

(3) The riprap shall be placed on a bedding of gravel or geotextile as specified on the construction drawings

(4) The riprap material shall be well graded by weight within the limits stated on the construction drawings.

CONSTRUCTION SPECIFICATIONS

62. GEOTEXTILE INSTALLATION

1. SCOPE

The work shall consist of furnishing and installing non-woven geotextile as filter or bedding material as shown on the construction plans.

2. MATERIALS

The geotextile shall be non-woven needle punched as stated on the plans. The geotextile shall meet the Natural Resource Conservation Service (NRCS) Class I requirements. The geotextile shall be resistant to chemical attack, rot and mildew and shall have no tears or defects that will adversely alter its physical properties. The fabric shall meet the physical requirements specified below.

Property	Test Method	Requirement
Weight		8 oz/yd ² minimum
Tensile Strength	ASTM D4632 Grab Test	180 lbs minimum *
Elongation Failure	ASTM D4632 Grab Test	>50 percent*
Static (CBR) Puncture	ASTM D6241	460 lbs minimum*
Trapezoidal Tear	ASTM D4533	75 lbs minimum*
Ultraviolet Light	ASTM D4355 150 hour exposure	70 percent residual tensile strength
Apparent Opening Size (AOS)	ASTM D4751	#70 sieve maximum
Permittivity	ASTM D4491	0.70 sec ⁻¹ minimum
Riprap Dropping Height		3 feet maximum

* Minimum average roll value (weakest principal direction)

3. STORAGE

The geotextile shall be stored in a dry, clean location out of direct sunlight, not subject to temperature extremes, and with the manufacturer's

protective cover undisturbed.

4. SUBGRADE PREPARATION

The surface shall be graded and compacted as per the plans, relatively smooth with no clods, holes, depressions, projections, muddy conditions, and standing or flowing water.

5. PLACEMENT

The geotextile shall be unrolled and loosely laid, without stretching, along the placement area. The geotextile shall conform to the surface irregularities when the riprap is placed over it. The geotextile may be folded and overlapped to permit proper placement in designated areas. The geotextile shall be joined by overlapping a minimum of 18 inches. The riprap shall not be pushed or rolled over the geotextile. Any torn or punctured geotextile shall not be allowed.

6. MEASUREMENT and PAYMENT

Payment shall be by lump sum and shall cover all materials, labor, and equipment to furnish and install the nonwoven geotextile under the riprap surrounding the stilling basin.

7. ITEMS OF WORK AND CONSTRUCTION DETAIL

This item shall consist of furnishing and installing the nonwoven geotextile under the riprap on the stilling basin.

CONSTRUCTION SPECIFICATIONS

64. ROLLED EROSION CONTROL PRODUCTS

1. SCOPE

The work shall consist of furnishing and installing rolled erosion control products (RECP) as shown on the construction plans. The contractor shall provide manufacturer's testing results showing that the furnished RECP meets all applicable requirements of this specification.

2. MATERIALS

2.1 TEMPORARY RECP's

Temporary RECP's are for applications where natural vegetation alone will provide sufficient permanent erosion protection, furnish a temporary RECP with the necessary longevity and performance properties to effectively control erosion and assist in the establishment of vegetation under the anticipated immediate site conditions. The temporary RECP shall conform to one of the following specifications and corresponding properties found in Table 1.

A. *Mulch Control Netting*

A planar woven natural fiber or extruded geosynthetic mesh used as a temporary degradable RECP to anchor loose fiber mulches.

B. *Open Weave Textile*

A temporary degradable RECP composed of processed natural or polymer yarns woven into a matrix, used to provide erosion control and facilitate vegetation establishment.

C. *Erosion Control Blanket (ECB)*

A temporary degradable RECP composed of processed natural or polymer fibers mechanically, structurally or chemically bound together to form a continuous matrix to provide erosion control and facilitate vegetation establishment.

Table 1. Standard Specification for Temporary Rolled Erosion Control Products

For use where natural vegetation alone will provide permanent erosion protection

ULTRA SHORT-TERM - Typical 3 month functional longevity

Type	Product Description	Material Composition	Slope Applications*		Channel Applications*	Minimum Tensile Strength ¹
			Maximum Gradient	C Factor ^{2, 5}	Permissible Shear Stress ^{3, 4, 6}	
1.A	Mulch Control Nets	A photodegradable synthetic mesh or woven biodegradable natural fiber netting.	5:1 (H:V)	< 0.10 @ 5:1	≤ 0.25 lbs/ft ² (12 Pa)	5 lbs/ft (0.073 kN/m)
1.B	Netless Rolled Erosion Control Blankets	Natural and/or polymer fibers mechanically interlocked and/or chemically adhered together to form a RECP.	4:1 (H:V)	< 0.10 @ 4:1	≤ 0.5 lbs/ft ² (24 Pa)	5 lbs/ft (0.073 kN/m)
1.C	Single-net Erosion Control Blankets & Open Weave Textiles	Processed degradable natural and/or polymer fibers mechanically bound together by a single rapidly degrading, synthetic or natural fiber netting or an open weave textile of processed rapidly degrading natural or polymer yarns or twines woven into a continuous matrix.	3:1 (H:V)	< 0.15 @ 3:1	≤ 1.5 lbs/ft ² (72 Pa)	50 lbs/ft (0.73 kN/m)
1.D	Double-net Erosion Control Blankets	Processed degradable natural and/or polymer fibers mechanically bound together between two rapidly degrading, synthetic or natural fiber nettings.	2:1 (H:V)	< 0.20 @ 2:1	≤ 1.75 lbs/ft ² (84 Pa)	75 lbs/ft (1.09 kN/m)

Table 1. Continued

SHORT TERM - Typical 12 month function longevity

Type	Product Description	Material Composition	Slope Applications*		Channel Applications*	Minimum Tensile Strength ¹
			Maximum Gradient	C Factor ^{2, 5}	Permissible Shear Stress ^{3, 4, 6}	
2.A	Mulch Control Nets	A photodegradable synthetic mesh or woven biodegradable natural fiber netting.	5:1 (H:V)	< 0.10 @ 5:1	≤ 0.25 lbs/ft ² (12 Pa)	5 lbs/ft (0.073 kN/m)
2.B	Netless Rolled Erosion Control Blankets	Natural and/or polymer fibers mechanically interlocked and/or chemically adhered together to form a RECP.	4:1 (H:V)	< 0.10 @ 4:1	≤ 0.5 lbs/ft ² (24 Pa)	5 lbs/ft (0.073 kN/m)
2.C	Single-net Erosion Control Blankets & Open Weave Textiles	An erosion control blanket composed of processed degradable natural or polymer fibers mechanically bound together by a single degradable synthetic or natural fiber netting to form a continuous matrix or an open weave textile composed of processed degradable natural or polymer yarns or twines woven into a continuous matrix.	3:1 (H:V)	< 0.15 @ 3:1	≤ 1.5 lbs/ft ² (72 Pa)	50 lbs/ft (0.73 kN/m)
2.D	Double-net Erosion Control Blankets	Processed degradable natural and/or polymer fibers mechanically bound together between two degradable, synthetic or natural fiber nettings.	2:1 (H:V)	< 0.20 @ 2:1	≤ 1.75 lbs/ft ² (84 Pa)	75 lbs/ft (1.09 kN/m)

EXTENDED TERM - Typical 24 month functional longevity

Type	Product Description	Material Composition	Slope Applications*		Channel Applications*	Minimum Tensile Strength ¹
			Maximum Gradient	C Factor ^{2, 5}	Permissible Shear Stress ^{3, 4, 6}	
3.A	Mulch Control Nets	A slow degrading synthetic mesh or woven natural fiber netting.	5:1 (H:V)	< 0.10 @ 5:1	≤ 0.25 lbs/ft ² (12 Pa)	25 lbs/ft (0.36 kN/m)
3.B	Erosion Control Blankets & Open Weave Textiles	An erosion control blanket composed of processed slow degrading natural or polymer fibers mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix or an open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix.	1.5:1 (H:V)	< 0.25 @ 1.5:1	≤ 2.00 lbs/ft ² (96 Pa)	100 lbs/ft (1.45 kN/m)

Table 1. Continued

LONG TERM - Typical 36 month functional longevity

Type	Product Description	Material Composition	Slope Applications*		Channel Applications*	Minimum Tensile Strength ¹
			Maximum Gradient	C Factor ^{2, 5}	Permissible Shear Stress ^{3, 4, 6}	
4	Erosion Control Blankets & Open Weave Textiles	An erosion control blanket composed of processed slow degrading natural or polymer fibers mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix or an open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix.	1:1 (H:V)	< 0.25 @ 1:1	≤ 2.25 lbs/ft ² (108 Pa)	125 lbs/ft (1.82 kN/m)

Notes

* "C" factor and shear stress for Types 1.A., 2.A. and 3.A mulch control nettings must be obtained with netting used in conjunction with pre-applied mulch material.

¹ Minimum Average Roll Values when tested in the machine direction using ECTC Modified ASTM D 5035.

² "C" Factor calculated as ratio of soil loss from RECP protected slope (tested at specified or greater gradient, h:v) to ratio of soil loss from unprotected (control) plot in large-scale testing. These performance test values should be supported by periodic bench scale testing under similar test conditions using ECTC Test Method # 2.

³ Minimum shear stress RECP (unvegetated) can sustain without physical damage or excess erosion [> 12.7 mm (0.5 in) soil loss] during a 30-minute flow event in large-scale testing. These performance test values should be supported by periodic bench scale testing under similar test conditions and failure criteria using ECTC Test Method #3.

⁴ The permissible shear stress levels established for each performance category are based on historical experience with products characterized by Manning's roughness coefficients in the range of 0.01 - 0.05.

⁵ Acceptable large-scale test methods may include ASTM D6459 or other independent testing deemed acceptable by the engineer.

⁶ Acceptable large-scale testing protocol may include ASTM D6460 or other independent testing deemed acceptable by the engineer.

2.2 PERMANENT RECP's

For applications where natural vegetation alone will not sustain expected flow conditions and/or provide sufficient long-term erosion protection, furnish a permanent RECP with the necessary performance properties to effectively control erosion and reinforce vegetation under the expected long-term site conditions. The permanent RECP shall conform to one of the specifications and corresponding properties found in Table 2.

Turf Reinforcement Mat (TRM)

A rolled erosion control product composed of non-degradable synthetic fibers, filaments, nets, wire mesh and/or other elements, processed into a permanent, three-dimensional matrix of sufficient thickness. TRMs, which may be supplemented with degradable components, are designed to impart immediate erosion protection, enhance vegetation establishment and provide long-term functionality by permanently reinforcing vegetation during and after maturation. TRMs are designed for permanent protection in hydraulic applications where design discharges exert velocities and shear stresses that exceed the limits of mature natural vegetation. The TRM shall be resistant to chemical attack, rot and mildew and shall possess strength and elongation properties that limit stretching and can be maintained in a water-saturated condition. The TRM shall have light penetration of at least 20% passing by ASTM D6567.

Table 2. Standard Specification for Permanent Rolled Erosion Control Products

Type ¹	Product Description	Minimum Tensile Strength ^{2,3}	Minimum Thickness (ASTM D 6525)	UV Stability (ASTM D 4355 @ 500 Hours)	Applications Permissible Shear Stress ^{4, 5}
5.A	Turf Reinforcement Mat	125 lbs/ft (1.82 kN/m)	0.25 inches (6.35 mm)	80%	≤ 6.0 lbs/ft ² (288 Pa)
5.B	Turf Reinforcement Mat	150 lbs/ft (2.19 kN/m)	0.25 inches (6.35 mm)	80%	≤ 8.0 lbs/ft ² (384 Pa)
5.C	Turf Reinforcement Mat	175 lbs/ft (2.55 kN/m)	0.25 inches (6.35 mm)	80%	≤ 10.0 lbs/ft ² (480 Pa)

Notes:

- ¹ For TRMs containing degradable components, all property values must be obtained on the non-degradable portion of the matting alone.
- ² Minimum Average Roll Values, machine direction only for tensile strength determination using ASTM D6818 (Supersedes Mod. ASTM D5035 for RECPs)
- ³ Field conditions with high loading and/or high survivability requirements may warrant the use of a TRM with a tensile strength of 44 kN/m (3,000 lb/ft) or greater.
- ⁴ Shear stress that fully vegetated TRM can sustain without physical damage or excess erosion [> 12.7 mm (0.5 in.) soil loss] during a 30-minute flow event in large scale testing.
- ⁵ Acceptable large-scale testing protocol may include ASTM D6460 or other independent testing deemed acceptable by the engineer.

2.3 GROUND ANCHORING DEVICES

Ground anchoring devices shall be used to secure the RECP tightly to the subgrade in the number and spacings shown on the construction plans. The devices shall be U-shaped wire staples or metal pins with flat washers.

A. Length: 8 to 18 inches depending on soil type under mat. Sufficient ground penetration to resist pullout. Use longer anchors for loose soil.

B. Wire staples: minimum 8 guage.

C. Metal pins: minimum 0.20 inch diameter with 1.5 inch diameter steel flat washers.

3. STORAGE AND HANDLING

Product labels shall clearly show the manufacturer, product designation, and roll number. Each roll shall have a protective cover (wrapping) that is maintained in tact during storage. The RECP shall be stored off ground in a clean, dry location out of direct sunlight and protected from chemicals, fuel, and temperatures above 160°F.

4. SUBGRADE PREPARATION

The area to be covered with RECP shall be topsoiled, graded, and compacted per the plans and Specification 26 with no clods, holes, projections, or muddy conditions. The surface shall be seeded per Specification 6. No mulch shall be applied.

5. PLACEMENT

A. Excavate downstream anchor trench per plans.

B. Excavate top of slope and toe of slope anchor trenches per plans.

C. Begin RECP installation at downstream end trench.

D. Secure first blanket or mat in top slope trench with ground anchors per plans and unroll down the slope.

E. Secure first blanket or mat in downstream trench with ground anchors per plans and fill downstream trench with compacted soil.

F. Secure first run of RECP in toe slope trench with ground anchors per plans.

G. Install ground anchors in a diamond pattern throughout the RECP as shown on plans.

H. Continue installation moving upstream overlapping each run 6 inches and anchoring each seam with one row of ground anchors spaced 12 inches apart along each seam (see plans).

I. As each run is completed fill top slope and toe slope trench as per plans.

J. At each end of roll seam overlap 12 inches and secure to ground with two rows of anchors on 12 inch centers (see plans).

K. Equipment shall be kept off the installed RECP to avoid damage or disturbance.

6. MEASUREMENT and PAYMENT

The area of the installed RECP will be measured to the nearest square yard. Payment will be at the contract unit price per square yard for the measured area and shall cover all materials labor and equipment to install the RECP.

7. ITEMS OF WORK

Items of work to be performed in conformance with this specification and the construction details are as follows:

a. Bid Item - Turf Reinforcement Mat

This item shall consist of furnishing the materials, labor, and equipment to install turf reinforcing mat on the repaired channel bank in the area designated on the construction plans. The TRM shall meet the requirements in Table 2 for type 5.C turf reinforcement mat.

b. Bid Item - Erosion Control Blanket

This item shall consist of furnishing the materials, labor, and equipment to install erosion control blanket on all repaired channel banks with slope of 2.5 H to 1V or steeper that are not protected by either stone riprap or turf reinforcement mat, as shown on the construction plans. The ECB shall meet the requirements in Table 1 for type 2.D or 3.B erosion control blanket.

CONSTRUCTION SPECIFICATION

66. ROCK FENCE BARRIER

1. SCOPE

The work shall consist of the construction of rock fence barriers.

2. MATERIALS

Rock for rock fence barriers shall conform to the requirements of Material Specification 529 or, if so specified shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines and other materials not meeting the required gradation limits.

At least 30 days prior to delivery of rock from other than designated sources, the Contractor shall designate in writing the source from which he intends to obtain the rock and information satisfactory to the Contracting Officer that the material meets the requirements of the contract. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified in Section 9 of this specification.

Rock from designated sources shall be excavated, selected and processed as necessary to meet the grading requirements in Section 9 of this specification. The equipment and methods used for stockpiling and removing the materials must be such that no degradation or segregation will result and that no appreciable amount of foreign material will be incorporated into the riprap. The rock shall conform to the specified grading limits when installed in the riprap.

3. SUBGRADE PREPARATION

The subgrade surfaces on which the rock fence barrier is to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it shall consist of approved materials and shall conform to the requirements of class A fill.

Rock shall not be placed until the foundation preparation

is completed and the subgrade surfaces have been inspected and approved by the Engineer.

4. EQUIPMENT-PLACED ROCK

The rock shall be placed by equipment on the surfaces and to the depths specified. Rock shall be placed by backhoe, orange peel, clam or drag buckets. The rock shall be placed in such a manner as to avoid serious displacement of the underlying materials. The rock shall be delivered and placed in a manner that will ensure that the rock in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks filling the voids between the larger rocks to provide the minimum practical percentage of voids.

Dumping of rock at the top of slopes and rolling into place will not be permitted. Drifting, manipulating and moving riprap down the slopes by means of dozers or other blade equipment will not be permitted. A tolerance of plus six inches from the slope lines and grades will be allowed in the finished surface of the rock barriers. An occasional large stone will be permitted to protrude above the prescribed surface.

5. MEASUREMENT AND PAYMENT

Payment for rock fence barriers will be made at the contract lump sum price. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the rock fence barriers.

All Methods The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is a subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details therefore are:

a. Bid Item - Rock Fence Barriers

(1) This item shall consist of furnishing and placing rock to form rock fence barriers as shown on the drawings.

(2) No filter material is required.

(3) The rock shall be reasonably well graded by weight within the limits stated below to meet the following requirements.

Gradation, Percentage of Stones
Of Various Size (inches)

<u>Size (in)</u>	<u>Approx. Weight (pounds)</u>	<u>% Finer by Weight</u>
30	1900	100
24	1000	80-100
12	125	40-60
8	35	10-30
4	5	0-10

Earth and other non-rock material smaller than 1.5 inches shall not exceed 5%.

CONSTRUCTION SPECIFICATION

81. METAL FABRICATION AND INSTALLATION

1. SCOPE

The work shall consist of furnishing, fabricating and erecting metalwork, including the metal parts of composite structures.

2. MATERIALS

Unless otherwise specified, materials shall conform to the requirements of Material Specification 581. Steel shall be structural quality unless otherwise specified. Castings shall be thoroughly cleaned and subjected to careful inspection before installation. Finished surfaces shall be smooth and true to assure proper fit. Galvanizing shall conform to the requirements of Material Specification 582.

3. FABRICATION

Fabrication of structural steel shall conform to the requirements of Section 1.23 of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings (Riveted, Bolted and Arc-Welded Construction)," American Institute of Steel Construction.

Fabrication of structural aluminum shall conform to the requirements in the Aluminum Construction Manual, "Specifications for Aluminum Structures," Section 6 and Section 7, The Aluminum Association, October 1994.

4. ERECTION

The frame of metal structures shall be carried up true and plumb. Temporary bracing shall be placed wherever necessary to resist all loads to which the structure may be subjected, including those applied by the installation and operation of equipment. Such bracing

shall be left in place as long as may be necessary for safety.

As erection progresses the work shall be securely bolted up, or welded, to resist all dead load, wind and erection stresses. The Contractor shall furnish such fitting up bolts, nuts and washers as may be required.

No riveting or welding shall be done until as much of the structure as will be stiffened thereby has been properly aligned.

Rivets driven in the field shall be heated and driven with the same care as those driven in the shop. All field welding shall be done in conformance to the requirements for shop fabrication, except those that expressly apply to shop conditions only. Galvanized items shall not be cut, welded or drilled after the zinc coating is applied.

5. PROTECTIVE COATINGS

Items specified to be galvanized shall be completely fabricated for field assembly before the application of the zinc coatings.

6. MEASUREMENT AND PAYMENT

Method 1 The work will not be measured. Payment for metal fabrication and installation will be made at the contract lump sum price. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work, including connectors and appurtenances such as rivets, bolts, nuts, pins, studs, washers, hangers and weld metal.

Method 2 The weight of metal installed complete in place shall be determined to the nearest pound. Unless otherwise provided, the weight of metal shall be computed by the method specified in Section 3 of the "Code of Standard Practice for Steel Buildings and Bridges," American Institute of Steel Construction,

except that the following unit weights shall also be used, as appropriate, as the basis of computation:

<u>Material</u>	<u>Unit Weight</u> <u>Pounds per Cubic Foot</u>
Aluminum alloy	173.0
Bronze or copper alloy	536.0
Iron, malleable	470.0
Iron, wrought	487.0

Payment for furnishing, fabricating and installing metalwork will be made at the contract unit price for the specified types of labor, materials, equipment and all other items necessary and incidental to the completion of the work.

Method 3 The work will not be measured. Payment for furnishing, fabricating and installing each item of metalwork will be made at the contract price for that item. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work, including connectors and appurtenances such as rivets, bolts, nuts, pins, studs, washers, hangers and weld metal.

All Methods The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details therefore are:

a. Bid Item - Trash Rack

(1) This item shall consist of the fabrication and installation of the trash rack as shown on the drawings.

(2) The trash rack shall be fabricated of new structural steel.

(3) The trash rack shall be galvanized after fabrication in accordance with Material Specification 582.

(4) The fitting and welding of the various members shall be carried out in accordance with AWS D1.1 and D1.3.

(5) No material certification is required.

(6) Measurement and payment shall be by Method 1.

b. Subsidiary Item - Metalwork, Miscellaneous

(1) This item shall consist of furnishing, fabricating, and installing the animal guard for the drain outlet pipe.

(2) The metalwork shall be constructed of new structural steel and be of the size and shape shown on the drawings or specified herein.

(3) Each piece of metalwork and associated bolts shall be galvanized after fabrication in accordance with Material Specification 582. Bolts, screws, and other fasteners larger than 1/2 inch may be coated with electrodeposited cadmium, Type OS, conforming to the requirements of ASTM B 766.

(4) The fittings and welding of the various members shall be carried out in accordance with AWS D1.1 and D1.3.

(5) No material certification is required for this item.

(6) No separate payment will be made for this item. Compensation for this item shall be included in the payment for plastic pipeline, 4-inch Diameter.