

# Construction and Material Specification List

## WV EWP Streambank Stabilization 2021

Mingo County, WV

Blankenship, Lester, and Thompson

No.	Date	Title
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### **CONSTRUCTION SPECIFICATIONS**

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### **MATERIAL SPECIFICATIONS**

523	2/22	Rock for Riprap
539	2/22	Steel Reinforcement
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## Construction Specification 5—Pollution Control

### 1. Scope

The work consists of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air from construction activities.

The following BioPreferred® product categories are applicable to this specification: — mulch and compost materials

erosion control materials

fertilizers

dust suppressants

agricultural spray adjuvants

### 2. Material

Silt fence shall conform to the requirement of Materials Specification 592, Geotextile. All other material furnished shall meet the requirements of the material specifications listed in section 8 of this specification.

### 3. Erosion and sediment control measures and works

The measures and works shall include, but are not limited to, the following:

**Staging of earthwork activities**—The excavation and moving of soil materials shall be scheduled to minimize the size of areas disturbed and unprotected from erosion for the shortest reasonable time.

**Seeding**—Seeding to protect disturbed areas shall occur as soon as reasonably possible following completion of that earthwork activity.

**Mulching**—Mulching to provide temporary protection of the soil surface from erosion.

**Diversions**—Diversions to divert water from work areas and to collect water from work areas for treatment and safe disposition. They are temporary and shall be removed and the area restored to its near original condition when the diversions are no longer required or when permanent measures are installed.

**Stream crossings**—Culverts or bridges where equipment must cross streams. They are temporary and shall be removed and the area restored to its near original condition when the crossings are no longer required or when permanent measures are installed.

**Sediment basins**—Sediment basins collect, settle, and eliminate sediment from eroding areas from impacting properties and streams below the construction site(s). These basins are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

**Sediment filters**—Straw bale filters or geotextile silt fences trap sediment from areas of limited runoff. Sediment filters shall be properly anchored to prevent erosion under or around them. Silt fences shall be installed and maintained in accordance with ASTM D6462. These filters are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

**Waterways**—Waterways for the safe disposal of runoff from fields, diversions, and other structures or measures. These works are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

**Other**—Additional protection measures as specified in section 8 of this specification or required by Federal, State, or local government.

#### 4. Chemical pollution

The contractor shall provide watertight tanks or barrels or construct a sump sealed with plastic sheets to collect and temporarily contain chemical pollutants, such as drained lubricating or transmission fluids, grease, soaps, concrete mixer washwater, or asphalt, produced as a by-product of the construction activities. Pollutants shall be disposed of in accordance with appropriate state and Federal regulations. At the completion of the construction work, tanks, barrels, and sumps shall be removed and the area restored to its original condition as specified in section 8 of this specification. Sump removal shall be conducted without causing pollution.

Sanitary facilities, such as chemical toilets, or septic tanks shall not be located next to live streams, wells, or springs. They shall be located at a distance sufficient to prevent contamination of any water source. At the completion of construction activities, facilities shall be disposed of without causing pollution as specified in section 8 of this specification.

#### 5. Air pollution

The burning of brush or slash and the disposal of other materials shall adhere to state and local regulations.

Fire prevention measures shall be taken to prevent the start or spreading of wildfires that may result from project activities. Firebreaks or guards shall be constructed and maintained at locations shown on the drawings.

All public access or haul roads used by the contractor during construction of the project shall be sprinkled or otherwise treated to fully suppress dust. All dust control methods shall ensure safe construction operations at all times. If chemical dust suppressants are applied, the material shall be a commercially available product specifically designed for dust suppression and the application shall follow manufacturer's requirements and recommendations. A copy of the product data sheet and manufacturer's recommended application procedures shall be provided to the engineer 5 working days before the first application.

#### 6. Maintenance, removal, and restoration

All pollution control measures and temporary works shall be adequately maintained in a functional condition for the duration of the construction period. All temporary measures shall be removed and the site restored to near original condition.

#### 7. Measurement and payment

**Method 1**—For items of work for which specific unit prices are established in the contract, each item is measured to the nearest unit applicable. Payment for each item is made at the contract unit price for that item. For water or chemical suppressant items used for dust control for which items of work are established in section 8 of this specification, measurement for payment will not include water or chemical suppressants that are used inappropriately or excessive to need. Such payment will constitute full compensation for the completion of the work.

**Method 2**—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds and supported by invoices presented by the contractor that reflect actual costs. If the total of all progress payments is less than the lump sum contract price for this item, the balance remaining for this item will be included in the final contract payment. Payment of the lump sum contract price will constitute full compensation for completion of the work.

**Method 3**—For items of work for which lump sum prices are established in the contract, payment will be prorated and provided in equal amounts on each monthly progress payment estimate. The number of months used for prorating shall be the number estimated to complete the work as outlined in the contractor's approved construction schedule. The final month's prorate amount will be provided with the final contract payment. Payment as described will constitute full compensation for completion of the work.

**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 the items to which they are made subsidiary, are identified in section 8 of this specification.

## 8. Items of work and construction details

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

### a. Subsidiary Item, Pollution Control

- (1) The contractor shall exercise precaution throughout the duration of the Contract to prevent the pollution of rivers and streams. Chemicals, fuels, lubricants, raw sewage, and other harmful wastes shall not be discharged into or alongside any river, stream, or natural or man-made waterway leading thereto. Materials identified as chemical pollutants in Section 4 of this Specification shall be removed from the site and disposed of in compliance with applicable state and federal regulations. Any chemical pollutant spills shall be reported to the State Center for Pollution, Toxic Chemical and Oil Spills hotline at 1-(800)-642-3074.
- (2) The contractor shall schedule clearing and grubbing operations in a manner which will minimize the amount of erodible surface soil exposed at any time. Areas shall not be cleared and grubbed until immediately prior to actual need or use of the area.
- (3) Pollution control measures shall be installed in a timely manner to protect against erosion from areas to be exposed by excavation and fill operations.
- (4) Equipment shall not be operated in live streams except as may be required to construct stream bank stabilization measures and temporary structures located in live streams. Frequent fording of live streams with construction equipment will not be permitted.

Temporary bridges, culverts, or other structures shall be installed wherever an appreciable number of stream crossings are necessary.

- (5) Protective cover shall be applied to disturbed areas as soon as work has been completed in the area, and/or whenever work in the disturbed area will be delayed or stopped more than five (5) continuous days. Areas to be provided with protective cover will be staked and/or flagged in the field by the engineer. Protective cover shall be applied to disturbed areas by mulching with straw. Materials and workmanship for providing protective cover shall be in accordance with Construction Specification 6, Seeding, Sprigging and Mulching.

Straw mulch shall be applied uniformly to disturbed areas at the rate of 2 tons per acre.

- (6) Section 7, Measurement and Payment shall not apply. No separate payment will be made for Pollution Control. Compensation for Pollution Control will be made under **Bid Item 2, Wire Mesh Gabions**.

## Construction Specification 6—Seeding, Sprigging, and Mulching

### 1. Scope

The work consists of preparing the area for treatment; furnishing and placing seed, sprigs, mulch, fertilizer, inoculant, lime, and other soil amendments; and anchoring mulch in designated areas as specified.

The following BioPreferred® product categories are applicable to this specification:

- Mulch and compost materials
- Erosion control materials
- Fertilizers
- Agricultural spray adjuvants

### 2. Material

**Seed**—All seed must conform to the current rules and regulations of the State where it is being used and must be from the latest crop available. It must meet or exceed the standard for purity and germination listed in section 7.

Seed must be labeled in accordance with State laws and U.S. Department of Agriculture rules and regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures are evidence of purity and germination. No seed may be accepted with a test date of more than 9 months before the date of delivery to the site.

Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. The percent of noxious weed seed allowable must be as defined in the current State laws relating to agricultural seeds. Each type of seed must be delivered in separate sealed containers and fully tagged unless an exception is granted in writing by the contracting officer.

**Fertilizer**—Unless otherwise specified, the fertilizer must be a commercial-grade fertilizer. It must meet the standard for grade and quality specified by State law. Where fertilizer is furnished from bulk storage, the contractor must furnish a supplier's certification of analysis and weight. When required by the contract, a representative sample of the fertilizer must be furnished to the contracting officer for chemical analysis.

**Inoculants**—The inoculant for treating legume seeds must be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and must not be used later than the date indicated on the container or as otherwise specified. A mixing medium, as recommended by the manufacturer, must be used to bond the inoculant to the seed. Two times the amount of the inoculant recommended by the manufacturer must be used, except that four times the amount must be used when seed is applied using a hydraulic seeder. Seed must be sown within 24 hours of treatment and must not remain in the hydraulic seeder longer than 4 hours.

**Lime and other soil amendments**—Lime must consist of standard ground agriculture limestone, or approved equivalent. Standard ground agriculture limestone is defined as ground limestone meeting current requirements of the State department of agriculture. Other soil amendments must meet quality criteria and application requirements specified in section 7.

**Mulch tackifiers**—Asphalt emulsion tackifiers must conform to the requirements of ASTM D977, Specification for Emulsified Asphalt. The emulsified asphalt may be rapid setting, medium setting, or slow setting. Nonasphaltic tackifiers required because of environmental considerations must be as specified in section 7.

**Straw mulch material**—Straw mulch must consist of wheat, barley, oat or rye straw, hay, grass cut from native grasses, or other plants as specified in section 7. The mulch material must be air-dry, reasonably light in color, and must not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds is not permitted. The contractor must provide a method satisfactory to the contracting officer for determining weight of mulch furnished.

**Other mulch materials**—Mulching materials, such as wood cellulose fiber mulch, mulch tackifiers, synthetic fiber mulch, netting, and mesh may be required for specialized locations and conditions. These materials, when specified, must be accompanied by the manufacturer's recommendations for methods of application.

### 3. Seeding mixtures, sod, sprigs, and dates of planting

The application rate per acre for seed mixtures, sprigs, or sod and date of seeding or planting must be as shown on the plans or as specified in section 7.

#### 4. Seedbed preparation and treatment

Areas to be treated must be dressed to a smooth, firm surface. On sites where equipment can operate on slopes safely, the seedbed must be adequately loosened (4 to 6 inches deep) and smoothed. Depending on soil and moisture conditions, disking or cultipacking, or both, may be necessary to properly prepare a seedbed. Where equipment cannot operate safely, the seedbed must be prepared by hand methods by scarifying to provide a roughened soil surface so that broadcast seed will remain in place.

If seeding is to be accomplished immediately following construction operations, seedbed preparation may not be required except on a compacted, polished, or freshly cut soil surface.

Rocks larger than 6 inches in diameter, trash, weeds, and other debris that will interfere with seeding or maintenance operations must be removed or disposed of as specified in section 7.

Seedbed preparation must be discontinued when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the responsible engineer.

#### 5. Seeding, sprigging, fertilizing, mulching, and stabilizing

All seeding or sprigging operations must be performed in such a manner that the seed or sprigs are applied in the specified quantities uniformly in the designated areas. The method and rate of seed application must be as specified in section 7. Unless otherwise specified, seeding or sprigging must be accomplished within 2 days after final grading is completed and approved.

Fertilizer, lime, and other soil amendments must be applied as specified in section 7. When specified, the fertilizer and soil amendments must be thoroughly incorporated into the soil immediately following surface application.

The rate, amount, and kind of mulching or mesh must be as specified in section 7. Mulches must be applied uniformly to the designated areas. They must be applied to areas seeded not later than 2 working days after seeding has been performed. Straw mulch material must be stabilized within 24 hours of application using a mulch crimper or equivalent anchoring tool or by a suitable tackifier. When the mulch crimper or equivalent anchoring tool is used, it must have straight blades and be the type manufactured expressly for and capable of firmly punching the mulch into the soil. Where the equipment can be safely operated, it must be operated on the contour. Hand methods must be used where equipment cannot safely operate to perform the work required.

The tackifier must be applied uniformly over the mulch material at the specified rate, or it must be injected into the mulch material as it is being applied. Mesh or netting stabilizing materials must be applied smoothly but loosely on the designated areas. The edges of these materials must be buried or securely anchored using spikes or staples as specified in section 7.

The contractor must maintain the mesh or netting areas until all work under the contract has been completed and accepted. Maintenance must consist of the repair of areas damaged by water erosion, wind, fire, or other causes. Such areas must be repaired to reestablish the intended condition and to the design lines and grades required by the contract. The areas must be refertilized, reseeded, and remulched before the new application of the mesh or netting.

#### 6. Measurement and payment

**Method 1**—For items of work for which specific unit prices are established in the contract, each area treated is measured as specified in section 7 and the area is calculated to the nearest 0.1 acre. Payment for treatment is made at the contract unit price for the designated treatment, which will constitute full compensation for completion of the work.

When specified as an item of work, mesh or netting is measured to the nearest square yard of surface area covered and accepted. Payment is made at the contract unit price and will constitute full compensation for completion of the work.

**Method 2**—For items of work for which specific lump-sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for this item is made at the contract lump-sum price for the item and constitutes full compensation for the completion of the work.

**Method 3**—For items of work for which lump-sum prices are established in the contract, payment is made as the work proceeds. Progress payments are determined as specified in section 7. Payment of the lump sum contract price constitutes full compensation for completion of the work.

**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 the items to which they are made subsidiary are identified in section 7.

## 7. Items of work and construction details

The items of work and construction details to be performed in conformance with this specification are:

### a. General Requirements

- (1) No permanent seeding shall be done between October 1 and December 1 unless otherwise approved by the Contracting Officer.
- (2) The approved lines and grades for permanent seeding at the time of permanent seeding shall be maintained during and after the seeding and mulching operation. Any area that has been damaged or had part or all of the seeding material removed by any means shall be repaired before acceptance will be made. The area to be repaired shall be filled and/or graded as needed to bring it back to neat lines, fertilized, seedbed prepared, and then seeded and mulched at the specified rates.
- (3) Lime shall be applied at an application rate of 2 tons per acre.
- (4) The following minimum amounts of fertilizer shall be applied per acre prior to seeding:
  - (a)

Nitrogen (N)	40 Lb.
Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )	80 Lb.
Potash (K <sub>2</sub> O)	80 Lb.
  - (b) The required application can be achieved by applying fertilizer having an analysis of 10-20-20 at the rate of 400 pounds per acre or 9 pounds per 1000 square feet.
- (5) Seedbed Preparation.
  - (a) Lime and fertilizer shall be applied prior to final seedbed preparation.
  - (b) Seeding shall be accomplished immediately after achieving final grade. Seedbed preparation shall only be required on compacted, polished, or freshly cut soil surfaces. Where special seedbed preparation is required, the hardened soil shall be loosened to a depth of 1½ inches; either by equipment or manual methods.
- (6) Seed.
  - (a) Each seed species shall comply with the West Virginia Department of Agriculture's standards for purity and germination. The seed mixtures and application rates are:

<u>Seed</u>	<u>Rate,lb/ac.</u>
Bluegrass	8
Kentucky 31 Tall Fescue	10
Annual Ryegrass	15
Red Fescue	5
Perennial Ryegrass	5

- (b) When seeding is performed between April 15-August 1 or December 1-March 1, the specified rates of seed per acre shall be increased by 50 percent.

- (7) Mulch material shall be wheat, oat or rye straw only. Mulch shall be applied uniformly over all seeded areas at the specified rate per acre. Application shall be within 24 hours after seeding. A mechanical blower may be used to apply the mulch. Application rates and material requirements shall be in accordance with the following table:

Time Period vs. Mulching Requirements  
for  
Revegetation of Construction  
Sites

Time Period	Suitability	Mulch	Application tons/acre
March 1 – April 15 August 1 – October 1	Best Seeding Periods	Small grain straw*	2
April 15 – August 1	High Risk Period	Small grain straw	2.5
October 1 – December 1	Do Not Seed	Small grain straw	2.0
December 1 – March 1	Good Seeding Period	Small grain straw	2.5

\* Small grain straw shall consist of wheat, oat, or rye straw.

**b. Subsidiary Item, Seeding and Mulching**

- (1) This item shall consist of seeding and mulching to permanent cover all disturbed areas due to work associated with the job.
- (2) Section 6, Measurement and Payment shall not apply. No separate payment will be made for Seeding, Sprigging, and Mulching. Compensation for Seeding, Sprigging, and Mulching will be made under **Bid Item 2, Wire Mesh Gabions.**

## **Construction Specification 8 - Mobilization and Demobilization**

### **1. Scope**

The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

### **2. Equipment and Material**

Mobilization shall include all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and other items specified in section 4 of this specification.

Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this contract.

This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

### **3. Payment**

Payment will be made as the work proceeds, after presentation of paid invoices or documentation of direct costs by the contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump sum contract price, the balance remaining will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for completion of the work.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

#### **4. Items of Work and Construction Details**

The items of work and construction details to be performed in conformance with this specification are:

**a. Bid Item 1, Mobilization and Demobilization**

- (1) This item shall consist of the mobilization and demobilization of all work forces, materials, and equipment necessary to complete the work under this Bid Schedule.
- (2) The contractor shall contact MISS Utility before work on each site begins. The contractor shall provide the MISS Utility conformation number for the site to the engineer before commencement of the work.
- (3) Prior to construction the contractor shall verify that all utilities have been disconnected at each site.
- (4) The Contractor may use a portable sign for public notice and for posting documents as required by the permits and this contract. Signage may be prepared to accommodate frequent revisions for use at multiple sites.

## **Construction Specification 9—Traffic Control**

### **1. Scope**

The work shall consist of establishing traffic control and maintaining safe, convenient use of public roads and rights-of-way.

### **2. Traffic and access**

The contractor's operations shall cause no unnecessary inconvenience to the public. The public rights-of-way shall be maintained at all times unless interruption is authorized by proper local authority. Contractor's authorized closing or detour plans shall be provided to the engineer for approval.

Safe and adequate access shall be provided and maintained to all public protection devices and to all critical utility control locations. Facility access shall be continuous and unobstructed unless otherwise approved.

### **3. Storage of equipment and material in public streets**

Construction materials and equipment shall not be stored or parked on public streets, roads, or highways. During any material or equipment loading or unloading activities that may temporarily interfere with traffic, an acceptable detour shall be provided for the duration of the activity. Any associated expense for this activity is the responsibility of the contractor.

Excavated material, including suitable material that is intended for adjacent trench backfill or other earth backfill as specified in section 5 of this specification, shall not be stored on public streets, roads, or highways that remain in service for the public. Any waiver of this requirement must be obtained from the proper local authority and approved by the engineer. All excess and unsuitable material shall be removed from the site as soon as possible. Any spillage shall be removed from roadways before they are used by the public.

### **4. Street closures, detours, and barricades**

The contractor shall comply with the requirements of all applicable responsible units of government for closure of any street, road, or highway. The contractor shall provide the required barriers, guards, lights, signs, temporary bridges, and flaggers together with informing the public of any detours and construction hazards by the most suitable means available, such as local newspapers or radio stations. The contractor is also responsible for compliance with additional public safety requirements that may arise during construction. The contractor shall furnish, install, and, upon completion of the work, promptly remove all signs, warning devices, and other materials used in the performance of this work.

Unless otherwise specified, the contractor shall notify, in writing, the fire chief, police chief, county sheriff, state patrol, schools that operate school buses, or any other government official as may be appropriate no less than 7 days before closing, partly closing, or reopening any street, road, or highway.

Unless otherwise specified, the contractor shall furnish to the engineer a written plan showing the proposed method of signing, barricading for traffic control, and safety for street detours and closures.

All temporary detours will be maintained to ensure use of public rights-of-way is provided in a safe manner. This may include dust control, grading, and graveling as required in section 7 of this specification.

### **5. General and specific references**

All signs, signals, barricades, use of flaggers, and other traffic control and public safety devices shall conform to the general requirements set forth in the Manual of Uniform Traffic Control Devices (MUTCD) and the latest edition of Standard Highway Signs and Standard Alphabets for Highway Signs and/or OSHA Construction Industry Standards (29 CFR Part 1926), Subpart G, Signs, Signals, and Barricades unless otherwise specified in section 7 of this specification.

### **6. Measurement and payment**

For items of work for which specific lump sum prices are established in the contract, payment for the work is made at the contract lump sum price. Progress payments will be made based upon the percentage of estimated total time that traffic control will be required unless otherwise specified in section 7 of this specification. Payment will constitute full compensation for all flaggers, labor, materials, equipment, and all other items necessary and incidental to completion of the work.

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 items to which they are made subsidiary are identified in section 7 of this specification.

## **7. Items of work and construction details**

The items of work and construction details to be performed in conformance with this specification are:

### **a. Subsidiary Item, Traffic Control**

- (1) Temporary blockages of the road are permitted with proper flagging provisions. A minimum of one lane of traffic shall be maintained at all times, with two lane traffic restored after work hours.
- (2) Section 6, Measurement and Payment shall not apply. No separate payment will be made for Traffic Control. Compensation for this item will be included in the payment for **Bid Item 2, Wire Mesh Gabions**.

## **Construction Specification 11—Removal of Water**

### **1. Scope**

The work consists of the removal of surface water and ground water as necessary to perform the construction required by the contract in accordance with the specifications. It shall include: (1) constructing, installing, building, and maintaining all necessary temporary water containment facilities, channels, and diversions; (2) furnishing, installing, and operating all necessary pumps, piping, and other facilities and equipment; and (3) removing all such temporary works and equipment after their intended function is no longer required.

### **2. Diverting surface water**

The contractor shall install, maintain, and operate all cofferdams, channels, flumes, sumps, and all other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site. Control of surface water shall be continuous during the period that damage to construction work could occur. Unless otherwise specified and/or approved, the diversion outlet shall be into the same drainageway that the water would have reached before being diverted.

The contractor shall furnish the contracting officer, in writing, a proposed plan for diverting surface water before beginning any construction activities for which a diversion is required, unless waived in section 8 of this specification. Acceptance of this plan or the waiving of the plan requirement will not relieve the contractor of the responsibilities related to this activity during the process of completing the work as specified.

### **3. Dewatering the construction site**

Foundations, cutoff trenches, and all other parts of the construction site shall be dewatered and kept free of standing water and muddy conditions as necessary for the proper execution of the work. The contractor shall furnish, install, operate, and maintain all drains, sumps, pumps, casings, well points, and all other equipment required to properly dewater the site as specified. Dewatering systems that cause a loss of soil fines from the foundation areas will not be permitted.

The contractor shall furnish the contracting officer, in writing, a proposed plan for dewatering before commencing with any construction activity for which dewatering may be required, unless waived in section 8 of this specification. Acceptance of this plan or the waiving of the plan requirement will not relieve the contractor of the responsibilities for completing the specified work.

### **4. Dewatering borrow areas**

The contractor shall maintain all borrow areas free of surface water or otherwise provide for timely and effective removal of surface and subsurface water that accumulates within the borrow area, unless waived in section 8 of this specification. Borrow material shall be processed as necessary to achieve proper and uniform moisture content at the time of placement.

If pumping to dewater borrow areas is included as a bid item of work in the bid schedule, each pump discharge pipe shall be equipped with a water meter. The meter shall be such that the measured quantity of water is accurate within 3 percent of the true quantity. The contractor shall provide necessary support to perform accuracy tests of the water meter when requested by the contracting officer.

### **5. Erosion and pollution control**

Removal of water from the construction site, including the borrow areas, shall be accomplished so that erosion and the transporting of sediment and other pollutants are minimized. Dewatering activities shall be accomplished in a manner that the water table water quality is not altered. Pollution control activities shall not conflict with the requirements of Construction Specification 5, Pollution Control, if it is a part of this contract.

### **6. Removal of temporary works**

When temporary works are no longer needed, the contractor shall remove and return the area to a condition similar to that which existed before construction. Areas where temporary works were located shall be graded for slightly appearance with no obstruction to natural surface waterflows or the proper functioning and access to the works of improvement installed. The contractor shall exercise extreme care during the removal stages to minimize the loss of soil sediment and debris that was trapped during construction.

Pipes, casings, and any other material used to dewater the site shall be removed from temporary wells. The wells shall be filled to ground level with clean gravel or other suitable material approved by the contracting officer. The contractor shall exercise extreme care to prevent pollution of the ground water by these actions.

## 7. Measurement and payment

**Method 1**—Items of work listed in the bid schedule for removal of water, diverting surface water, and dewatering construction sites and borrow areas are paid for at the contract lump sum prices. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

**Method 2**—Items of work listed in the bid schedule for removal of water, diverting surface water, dewatering construction sites, and dewatering borrow areas are paid for at the contract lump sum prices. Such payment will constitute full compensation for furnishing, installing, operating, and maintaining the necessary trenches, drains, sumps, pumps, and piping and for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work. The exception is that additional payment for pumping to dewater borrow areas and the removal of water will be made as described in the following paragraph.

If pumping to dewater borrow areas is a contract bid item, payment is made at the contract unit price, which shall be the price per 1,000 gallons shown in the bid schedule. Such payment will constitute full compensation for pumping only. Compensation for equipment and preparation and for other costs associated with pumping is included in the lump sum payment for removal of water or the lump sum payment for dewatering the borrow areas. Payment is made only for pumping that is necessary to dewater borrow areas that cannot be effectively drained by gravity or that must have the water table lowered to be usable as a suitable borrow source. Pumping for other purposes will not be included for payment under this item.

**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 contract line item to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 8 of this specification.

## **8. Items of work and construction details**

Items of work to be performed according to this specification and the construction details are:

### **a. Subsidiary Item, Removal of Water**

- (1) This item shall consist of all work necessary to divert surface waters and dewater the work areas as required to perform the work.
- (2) Submittal of written plans for diverting surface water and dewatering the site are not required.
- (3) Section 7, Measurement and Payment shall not apply. No separate payment will be made for Removal of Water. Compensation for this item will be included in the payment for **Bid Item 2, Wire Mesh Gabions.**

## Construction Specification 21—Excavation

### 1. Scope

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

### 2. Classification

Excavation is classified as common excavation, rock excavation, or unclassified excavation in accordance with the following definitions.

**Common excavation** is defined as the excavation of all materials that can be excavated, transported, and unloaded using heavy ripping equipment and wheel tractor-scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by excavators having a rated capacity of one cubic yard or larger and equipped with attachments (shovel, bucket, backhoe, dragline, or clam shell) appropriate to the material type, character, and nature of the materials.

**Rock excavation** is defined as the excavation of all hard, compacted, or cemented materials that require blasting or the use of ripping and excavating equipment larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than 1 cubic yard encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.

For the purpose of these classifications, the following definitions shall apply:

*Heavy ripping equipment* is a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a track type tractor having a power rating of at least 250 flywheel horsepower unless otherwise specified in section 10.

*Wheel tractor-scraper* is a self-loading (not elevating) and unloading scraper having a struck bowl capacity of at least 12 cubic yards.

*Pusher tractor* is a track type tractor having a power rating of at least 250 flywheel horsepower equipped with appropriate attachments.

**Unclassified excavation** is defined as the excavation of all materials encountered, including rock materials, regardless of their nature or the manner in which they are removed.

### 3. Blasting

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person(s) of proven experience and ability who is authorized and qualified to conduct blasting operations.

Blasting shall be done in a manner as to prevent damage to the work or unnecessary fracturing of the underlying rock materials and shall conform to any special requirements in section 10 of this specification. When specified in section 10, the contractor shall furnish the engineer, in writing, a blasting plan before blasting operations begin.

#### **4. Use of excavated material**

*Method 1*—To the extent they are needed, all suitable material from the specified excavations shall be used in the construction of required permanent earthfill or rockfill. The suitability of material for specific purposes is determined by the engineer. The contractor shall not waste or otherwise dispose of suitable excavated material.

*Method 2*—Suitable material from the specified excavations may be used in the construction of required earthfill or rockfill. The suitability of material for specific purposes is determined by the engineer.

#### **5. Disposal of waste materials**

*Method 1*—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of at the locations shown on the drawings.

*Method 2*—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of by the contractor at sites of his own choosing away from the site of the work. The disposal shall be in an environmentally acceptable manner that does not violate local rules and regulations.

#### **6. Excavation limits**

Excavations shall comply with OSHA Construction Industry Standards (29CFR Part 1926) Subpart P, Excavations, Trenching, and Shoring. All excavations shall be completed and maintained in a safe and stable condition throughout the total construction phase. Structure and trench excavations shall be completed to the specified elevations and to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work. Excavations outside the lines and limits shown on the drawings or specified herein required to meet safety requirements shall be the responsibility of the contractor in constructing and maintaining a safe and stable excavation.

#### **7. Borrow excavation**

When the quantities of suitable material obtained from specified excavations are insufficient to construct the specified earthfills and earth backfills, additional material shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as specified in section 10 or as approved by the engineer.

Borrow pits shall be excavated and finally dressed to blend with the existing topography and sloped to prevent ponding and to provide drainage.

#### **8. Overexcavation**

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the engineer. Concrete that will be exposed to the atmosphere when construction is completed shall meet the requirements of concrete selected for use under Construction Specification 31, Concrete for Major Structures, or 32, Structure Concrete, as appropriate.

Concrete that will be permanently covered shall contain not less than five bags of cement per cubic yard. The concrete shall be placed and cured as specified by the engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved, compacted earthfill. The exception to this is that if the earth is to become the subgrade for riprap, rockfill, sand or gravel bedding, or drainfill, the voids may be filled with material conforming to the specifications for the riprap, rockfill, bedding, or drainfill. Before correcting an overexcavation condition,

the contractor shall review the planned corrective action with the engineer and obtain approval of the corrective measures.

## **9. Measurement and payment**

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas or by methods outlined in section 10 of this specification. Regardless of quantities excavated, the measurement for payment is made to the specified pay limits except that excavation outside the specified lines and grades directed by the engineer to remove unsuitable material is included. Excavation required because unsuitable conditions result from the contractor's improper construction operations, as determined by the engineer, is not included for measurement and payment.

**Method 1**—The pay limits shall be as designated on the drawings.

**Method 2**—The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.
- b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

**Method 3**—The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.
- b. The lower and lateral limits shall be the true surface of the completed excavation as directed by the engineer.

**Method 4**—The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.
- b. The lower limit shall be at the bottom surface of the proposed structure.
- c. The lateral limits shall be 18 inches outside of the outside surface of the proposed structure or shall be vertical planes 18 inches outside of and parallel to the footings, whichever gives the larger pay quantity, except as provided in d below.
- d. For trapezoidal channel linings or similar structures that are to be supported upon the sides of the excavation without intervening forms, the lateral limits shall be at the underside of the proposed lining or structure.
- e. For the purposes of the definitions in b, c, and d, above, any specified bedding or drainfill directly beneath or beside the structure will be considered to be a part of the structure.

**All methods**—The following provisions apply to all methods of measurement and payment.

Payment for each type and class of excavation is made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work except that extra payment for backfilling overexcavation will be made in accordance with the following provisions.

Payment for backfilling overexcavation, as specified in section 8 of this specification, is made only if the excavation outside specified lines and grades is directed by the engineer to remove unsuitable material and if the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.

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 the items to which they are made subsidiary are identified in section 10 of this specification.

## **10. Items of work and construction details**

Items of work to be performed according to this specification and the construction detail are:

### **a. Subsidiary Item, Excavation**

- (1) This item shall consist of all excavation necessary to install the stream bank protection, complete foundation preparation, perform the obstruction removal, and sub-channel construction, as shown on the drawings and staked in the field.
- (2) All excavation shall be unclassified.
- (3) Section 9, Measurement and payment, shall not apply. Compensation for Excavation will be made under **Bid Item 2, Wire Mesh Gabions**.

## **Construction Specification 23—Earthfill**

### **1. Scope**

The work consists of the construction of earth embankments, other earthfills, and earth backfills required by the drawings and specifications.

Earthfill is composed of natural earth materials that can be placed and compacted by construction equipment operated in a conventional manner.

Earth backfill is composed of natural earth material placed and compacted in confined spaces or adjacent to structures (including pipes) by hand tamping, manually directed power tampers or vibrating plates, or their equivalent.

### **2. Material**

All fill material shall be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of material in the various fills shall be subject to approval by the engineer.

Fill materials shall contain no frozen soil, sod, brush, roots, or other perishable material. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill.

The types of material used in the various fills shall be as listed and described in the specifications and drawings.

### **3. Foundation preparation**

Foundations for earthfill shall be stripped to remove vegetation and other unsuitable material or shall be excavated as specified.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earthfill, and the surface material of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of 2 inches in depth normal to the slope and shall be at such a moisture content that the earthfill can be compacted against them to produce a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose material by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earthfill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be no steeper than one horizontal to one vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earthfill conforming to the specifications for the earthfill to be placed upon the foundation.

### **4. Placement**

Earthfill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the engineer. Earthfill shall not be placed upon a frozen surface nor shall snow, ice, or frozen material be incorporated in the earthfill matrix.

Earthfill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified in section 10 or shown on the drawings. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted.

Hand compacted earth backfill shall be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of earth backfill compacted by manually directed power tampers.

Earth backfill shall be placed in a manner that prevents damage to the structures and allows the structures to assume the loads from the earth backfill gradually and uniformly. The height of the earth backfill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earthfill and earth backfill in dams, levees, and other structures designed to restrain the movement of water shall be placed to meet the following additional requirements:

- (a) The distribution of materials throughout each zone shall be essentially uniform, and the earthfill shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material. Zone earthfills shall be constructed concurrently unless otherwise specified.
- (b) The surface of each layer shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.
- (c) The top surface of embankments shall be maintained approximately level during construction with two exceptions: A crown or cross-slope of about 2 percent shall be maintained to ensure effective drainage, or as otherwise specified for drainfill or sectional zones.
- (d) Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of streamflow during construction are specifically authorized in the contract.
- (e) Embankments built at different levels as described under (c) or (d) above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all material not meeting the requirements of this specification and shall be scarified, moistened, and recompactd when the new earthfill is placed against it. This ensures a good bond with the new earthfill and obtains the specified moisture content and density at the contact of the in-place and new earthfills.

## **5. Control of moisture content**

During placement and compaction of earthfill and earth backfill, the moisture content of the material being placed shall be maintained within the specified range.

The application of water to the earthfill material shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the material after placement on the earthfill, if necessary. Uniform moisture distribution shall be obtained by disking.

Material that is too wet when deposited on the earthfill shall either be removed or be dried to the specified moisture content prior to compaction.

If the top surface of the preceding layer of compacted earthfill or a foundation or abutment surface in the zone of contact with the earthfill becomes too dry to permit suitable bond, it shall either be removed or scarified and moistened by sprinkling to an acceptable moisture content before placement of the next layer of earthfill.

## 6. Compaction

Earthfill—Earthfill shall be compacted according to the following requirements for the class of compaction specified:

**Class A compaction**—Each layer of earthfill shall be compacted as necessary to provide the density of the earthfill matrix not less than the minimum density specified in Section 10 or identified on the drawings. The earthfill matrix is defined as the portion of the earthfill material finer than the maximum particle size allowed in the reference compaction test method specified (ASTM D698 or ASTM D1557).

**Class B compaction**—Each layer of earthfill shall be compacted to a mass density not less than the minimum density specified.

**Class C compaction**—Each layer of earthfill shall be compacted by the specified number of passes of the type and weight of roller or other equipment specified or by an approved equivalent method. Each pass shall consist of at least one passage of the roller wheel or drum over the entire surface of the layer.

**Earth backfill**—Earth backfill adjacent to structures shall be compacted to a density equivalent to that of the surrounding in-place earth material or adjacent required earthfill or earth backfill. Compaction shall be accomplished by hand tamping or manually directed power tampers, plate vibrators, walk-behind, miniature, or self-propelled rollers. Unless otherwise specified heavy equipment including backhoe mounted power tampers or vibrating compactors and manually directed vibrating rollers shall not be operated within 3 feet of any structure. Towed or self-propelled vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist is not permitted.

The passage of heavy equipment will not be allowed:

- Over cast-in-place conduits within 14-days after placement of the concrete
- Over cradled or bedded precast conduits within 7 days after placement of the concrete cradle or bedding
- Over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 3 feet, whichever is greater, except as may be specified in section 10.

Compacting of earth backfill adjacent to structures shall not be started until the concrete has attained the strength specified in section 10 for this purpose. The strength is determined by compression testing of test cylinders cast by the contractor's quality control personnel for this purpose and cured at the work site in the manner specified in ASTM C 31 for determining when a structure may be put into service.

When the required strength of the concrete is not specified as described above, compaction of earth backfill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

Structure	Time interval (days)
Vertical or near-vertical walls with earth loading on one side only	14
Walls backfilled on both sides simultaneously	7
Conduits and spillway risers, cast-in-place (with inside forms in place)	7
Conduits and spillway risers, cast-in-place (inside forms removed)	14
Conduits, pre-cast, cradled	2
Conduits, pre-cast, bedded	1
Cantilever outlet bents (backfilled both sides simultaneously)	3

## 7. Reworking or removal and replacement of defective earthfill

Earthfill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable earthfill. The replacement earthfill and the foundation, abutment, and earthfill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control, and compaction.

## 8. Testing

During the course of the work, the contractor shall perform quality control tests, as applicable, to identify earthfill and earth backfill materials; determine the reference maximum density and optimum moisture content; and document that the moisture content of material at the time of compaction and the density of earthfill and earth backfill in place conform to the requirements of this specification.

*Determining Reference Maximum Density and Optimum Moisture Content*—For Class A compaction, the reference maximum density and optimum moisture content shall be determined in accordance with the compaction test and method specified on the drawings or in section 10.

*Documenting Specification Conformance*—In-place densities of earthfill and earth backfill requiring Class A compaction shall be measured in accordance with ASTM D1556, D2167, D2937, D6938 or D8167. Moisture contents of earthfill and earth backfill at the time of compaction shall be measured in accordance with ASTM D2216, D4643, or D6938. Values of moisture content determined by ASTM D2216 are considered the true value of the soil moisture. Values of moisture content determined by ASTM D4643 or D6938 shall be verified by comparison to values obtained by ASTM D2216. Values of in-place density and moisture content determined by these tests shall be compared to the minimum density and moisture content range specified on the drawings or in section 10.

*Correction for Oversize Particles*—If the materials to be used for earthfill or earth backfill contain more than 5 percent by dry weight of oversize rock particles (particles larger than those allowed in the specified compaction test and method), corrections for oversize particles shall be made using the appropriate procedures explained in ASTM D4718.

## 9. Measurement and payment

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earthfill and earth backfill within the specified zone boundaries and pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified in section 10, no deduction in volume is made for embedded items, such as, but not limited to, conduits, inlet structures, outlet structures, embankment drains, sand diaphragm and outlet, and their appurtenances.

The pay limits shall be as defined below, with the further provision that earthfill required to fill voids resulting from overexcavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only under the following conditions:

- Where such overexcavation is directed by the engineer to remove unsuitable material, and
- Where the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.

Earthfill beyond the specified lines and grades to backfill excavation required for compliance with OSHA requirements will be considered subsidiary to the earthfill bid item(s).

*Method 1*—The pay limits shall be as designated on the drawings.

*Method 2*—The pay limits shall be the measured surface of the foundation when approved for placement of the earthfill and the specified neat lines of the earthfill surface.

*Method 3*—The pay limits shall be the measured surface of the foundation when approved for placement of the earthfill and the measured surface of the completed earthfill.

**Method 4**—The pay limits shall be the specified pay limits for excavation and the specified neat lines of the earthfill surface.

**Method 5**—The pay limits shall be the specified pay limits for excavation and the measured surface of the completed earthfill.

**Method 6**—Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work.

**Method 7**—Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work except furnishing, transporting, and applying water to the foundation and earthfill material. Water applied to the foundation and earthfill material is measured and payment made as specified in Construction Specification 10.

**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 the items to which they are made subsidiary are identified in section 10 of this specification.

## 10. Items of work and construction details

Items of work to be performed according to this specification and the construction details are:

### a. Subsidiary Item, Earth Fill

- (1) This item shall consist of all work necessary to obtain and place earth and rock fill to the lines and grades specified on the drawings.
- (2) No foundation preparation is required beyond removing debris from within the designated fill area.
- (3) Material that will be used for fill shall come from an approved off-site borrow source. It is the contractor's responsible to obtain borrow from an off-site source to establish the line and grades shown on the drawing. The off-site borrow source shall be approved by NRCS before material is hauled and placed. Fill shall be free from trash, roots, stumps and other debris.
- (4) Except for the top 6 inches and around utilities, the maximum rock particle size shall be 6" and the max lift thickness shall be 12 inches. The top 6 inches shall be fine grain soil material suitable for establishing a seedbed. The maximum rock particle size in the top 6 inches and around utilities shall be 2 inches. The top 6 inches may be placed in one 6 inch lift. The maximum lift thickness around utilities shall be 4 inches.
- (5) The moisture content of the earth fill shall be such that a dense compact fill can be obtained. The moisture content shall be sufficient to permit molding a firm ball when firmly squeezed by hand. The earth fill shall not be so wet that water runs out of the ball when squeezed nor so dry that the ball easily crumbles when slightly deformed.
- (6) Compaction shall be Class C as defined in Section 6. Compaction shall be obtained by traversing the entire surface of each lift of fill four (4) times with the track of a crawler type tractor weighing not less than 20 tons. Fill placed around a water line and meter shall be hand compacted.
- (7) Care shall be taken when placing and compacting fill around utilities. Utility lines will be bedded in 2 feet of fine grain fill. No rock larger than 2 inches in diameter shall be in contact with a utility line.
- (8) Section 9, Measurement and payment, shall not apply. Compensation for Earthfill will be made under **Bid Item 2, Wire Mesh Gabions.**

## Construction Specification 34—Steel Reinforcement

### 1. Scope

The work consists of furnishing and placing steel reinforcement for reinforced concrete or pneumatically applied mortar.

### 2. Material

Steel reinforcement must conform to the requirements of Material Specification 539, Steel Reinforcement (for concrete). Before reinforcement is placed, the surface of the bars and fabric and any metal supports must be cleaned to remove any loose, flaky rust, mill scale, oil, grease, or other undesirable coatings or foreign substances. Epoxy-coated steel reinforcement must be free of surface damage. After placement, the reinforcement must be maintained in a clean and serviceable condition until it is completely embedded within the concrete.

### 3. Bar schedule, lists and diagrams

Any supplemental bar schedules, bar lists or bar-bending diagrams required in section 10 of this specification to accomplish the fabrication and placement of steel reinforcement must be provided by the contractor. Before reinforcement is placed, the contractor must furnish four copies of any such lists or diagrams to the contracting officer for approval. Acceptance of the reinforcement is not based on approval of these lists or diagrams, but on inspection of the steel reinforcement after it has been placed, tied, and supported and is ready to receive concrete.

### 4. Bending

Reinforcement must be cut and bent in compliance with the requirements of the American Concrete Institute Standard 315. Bars must not be bent or straightened in a manner that will injure or weaken the material. Bars with kinks, cracks, or improper bends must be rejected.

### 5. Splicing bar reinforcement

**Method 1**—Splices of reinforcement may only be made at locations shown on the drawings and provided by the steel schedule. Placement of bars at the lap splice locations shown, when not in contact, must not be farther apart than one-fifth the shown lap length and in any case no greater than 6 inches.

**Method 2**—Splices of reinforcement must be limited to those locations shown on the drawings. Splice lengths must be determined before fabrication and meet the requirements of ACI Standard 318, Building Code Requirements for Reinforced Concrete, based upon design information in section 10 of this specification. Bar placement drawings and schedules must be provided for approval before fabrication. The drawings must show all splice locations, layouts, and lap dimensions.

### 6. Splicing welded wire reinforcement

Unless otherwise specified, welded wire reinforcement must be spliced in the following manner:

**End-to-end**—Adjacent sections must be spliced end-to-end (longitudinal lap) by overlapping a minimum of one full mesh plus 2 inches plus the length of the two end overhangs. The splice length is measured from the end of the longitudinal wires in one piece of fabric to the end of the longitudinal wire in the lapped piece of fabric.

**Side-to-side**—Adjacent sections must be spliced side to side (transverse lap) a minimum of one full mesh plus 2 inches. The splice length must be measured from the centerline of the first longitudinal wire in one piece of fabric to the centerline of the first longitudinal wire in the lapped piece of fabric.

### 7. Placing

Reinforcement must be accurately placed and secured in position to prevent its displacement during the placement of concrete. Tack welding of bars is not permitted. Metal chairs, metal hangers, metal spacers, and concrete chairs may be used to support the reinforcement. Metal hangers, spacers, and ties must be placed in such a manner that they are not exposed in the finished concrete surface. The legs of metal chairs or side form spacers that may be exposed on any face of slabs, walls, beams, or other concrete surfaces must have a protective coating or finish. The coating or finish must be hot dip galvanized, epoxy coated, plastic coated, or stainless steel. Metal chairs and spacers not fully covered by a protective coating or finish must have a minimum cover of 0.75 inch of concrete over the unprotected metal part. The exception is that those with plastic coatings may have a minimum cover of 0.5 inch of concrete over the unprotected metal part. Precast concrete chairs must be

manufactured of the same class of concrete as specified for the structure and must have the tie wires securely anchored in the chair or a V-shaped groove at least 0.75 inch in depth molded into the upper surface to receive the steel bar at the point of support. Precast concrete chairs must be clean and moist at the time concrete is placed.

High-density or structural plastic rebar accessories designed to ensure maximum concrete bond may be substituted for metal or concrete accessories in spacer applications as approved by the contracting officer. Exposure of plastic rebar accessories at the finished concrete surface must be kept to a minimum. Plastic rebar accessories, when used, must be staggered along adjacent parallel bars and must be placed at intervals no closer than 12 inches. Plastic rebar accessories must not be used in concrete sections 6 inches or less in thickness.

Reinforcement must not be placed until the prepared site has been inspected and approved. After placement of the reinforcement, concrete must not be placed until the reinforcement has been inspected and approved by the responsible engineer.

## 8. Storage

Steel reinforcement stored at the work site must be placed on platforms, skids, or other supports. This is done so that contact with the ground is avoided and the material is protected from mechanical damage and/or corrosion.

## 9. Measurement and payment

**Method 1**—For items of work for which specific unit prices are established in the contract, the weight of steel reinforcement placed in the concrete in accordance with the drawings is determined to the nearest pound by computation from the placing drawings. Measurement of hooks and bends is based on the requirements of ACI Standard 315. Computation of weights of reinforcement is based on the unit weights established in tables 34–1 and 34–2 of this specification. Computation of weights for welded wire reinforcement not shown in table 34–2 must be based on ACI Standard 315. The area of welded wire reinforcement placed in the concrete in accordance with the drawings is determined to the nearest square foot by computation from the placing drawings with no allowance for required laps. The weight of steel reinforcing in extra splices or extra-length splices approved for the convenience of the contractor or the weight of supports and ties is not included in the measurement for payment.

Payment for furnishing and placing reinforcing steel is made at the contract unit price. Such payment constitutes full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work including preparing and furnishing bar schedules, lists, or diagrams; furnishing and attaching ties and supports; and furnishing, transporting, storing, cutting, bending, cleaning, and securing all reinforcements.

**Method 2**—For items of work for which specific unit prices are established in the contract, the weight of bar reinforcement placed in the concrete in accordance with the drawings is determined to the nearest pound by computation from the placing drawings. Measurement of hooks and bends is based on the requirements of ACI Standard 315. Computation of weights of bar reinforcement is based on the unit weights established in table 34–1 of this specification. The weight of steel reinforcing in extra splices or extra length splices approved for the convenience of the contractor or the weight of supports and ties is not included in the measurement for payment.

The area of welded wire reinforcement placed in the concrete in accordance with the drawings is determined to the nearest square foot by computation from the placing drawings with no allowance for required laps.

Payment for furnishing and placing bar reinforcing steel is made at the contract unit price for bar reinforcement. Payment for furnishing and placing welded wire reinforcing steel is made at the contract unit price for welded wire reinforcement. Such payment constitutes full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work including preparing and furnishing bar schedules, lists, or diagrams; furnishing and attaching ties and supports; and furnishing, transporting, cutting, bending, cleaning, and securing all reinforcement.

**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 to which they are made subsidiary are identified in section 10 of this specification.

Table 34-1 Standard reinforcing bars

-- Bar size designations --		Weight (lb/ft)
English	Metric	
3	10	0.376
4	13	0.668
5	16	1.043
6	19	1.502
7	22	2.044
8	25	2.670
9	29	3.400
10	32	4.303
11	36	5.313
14	43	7.650
18	57	13.600

1/ The bar diameter (inches) equals the bar size number divided by eight. For example, the diameter of a #4 bar is  $4 \div 8 = 0.5$  inch.2/ The metric bar size has been rounded to a whole number that represents the approximate diameter of the bar in millimeters.

**Table 34–2** Rectangular welded wire reinforcement

----- Style designation <sup>1/</sup> -----		Weight
by W-number	by steel wire gauge (former designation)	(lb/100 ft <sup>2</sup> )
6 × 6 - W1.4 × W1.4	6 × 6 - 10 × 10	21
6 × 6 - W2.1 × W2.1	6 × 6 - 8 × 8	30
6 × 6 - W2.9 × W2.9	6 × 6 - 6 × 6	42
6 × 6 - W4.0 × W4.0	6 × 6 - 4 × 4	58
4 × 4 - W1.4 × W1.4	4 × 4 - 10 × 10	31
4 × 4 - W2.1 × W2.1	4 × 4 - 8 × 8	44
4 × 4 - W2.9 × W2.9	4 × 4 - 6 × 6	62
4 × 4 - W4.0 × W4.0	4 × 4 - 4 × 4	85
4 × 12 - W2.1 × W0.9 <sup>2/</sup>	4 × 12 - 8 × 12	25
4 × 12 - W2.5 × W1.1 <sup>2/</sup>	4 × 12 - 7 × 11	31

1/ Style designation is defined in ACI Standard 315 of the American Concrete Institute.

2/ Welded smooth wire reinforcement with wires smaller than size W1.4 is manufactured from galvanized wire.

## 10. Items of work and construction details

Items of work to be performed according to this specification and the construction details are:

### a. **Bid Item 3A, Foundation Preparation on Shallow Bedrock (Rebar Anchoring)**

- (1) This item shall consist of providing the reinforcement bars, drilling the bedrock, and installing the reinforcement bars as shown on the drawings and staked in the field.
- (2) The NRCS representative in the field shall determine the extent of the Foundation Preparation.
- (3) Steel Reinforcement for the gabion foundation pinning shall be #10 bars, Grade 30.
- (4) The drill hole diameter shall be 1-3/8" to the specified depth.
- (5) Epoxy or grouting of the reinforcement bars is not required.
- (6) Section 9, Measurement and Payment shall not apply. Payment for **Bid Item 3A, Foundation Preparation on Shallow Bedrock (Rebar Anchoring)** will be made at the contract unit price of square feet of foundation preparation. The payment extents shall be the footprint of the gabion wall base that requires rebar placement.

## Construction Specification 61—Rock Riprap

### 1. Scope

The work consists of the construction of rock riprap revetments and blankets, including filter or bedding where specified.

### 2. Material

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

At least 30 days before rock is delivered from other than designated sources, the contractor must designate in writing the source from which rock material will be obtained and provide information satisfactory to the contracting officer that the material meets contract requirements. The contractor must provide the responsible engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock must be as specified in section 8.

Rock from approved sources must be excavated, selected, and processed to meet the specified quality and grading requirements at the time the rock is installed.

Based on a specific gravity of 2.65 (typical of limestone and dolomite) and assuming the individual rock is shaped midway between a sphere and a cube, typical size/weight relationships are:

Sieve size of rock	Approx. weight of rock	Weight of test pile
16 inches	300 pounds	6,000 pounds
11 inches	100 pounds	2,000 pounds
6 inches	15 pounds	300 pounds

When specified in section 8 or when it is necessary to verify the gradation of the rock riprap, a particle size analysis must be performed in accordance with ASTM D5519, Test Method A or B. The analysis must be performed at the work site on a test pile of representative rock. The mass of the test pile must be at least 20 times the mass of the largest rock in the pile. The results of the test are compared to the gradation required for the project. Test pile results that do not meet the construction specifications must be cause for the rock to be rejected. The test pile that meets contract requirements must be left on the job site as a sample for visual comparison. The test pile must be used as part of the last rock riprap to be placed.

**Filter or bedding aggregates** when required must conform to Material Specification 521, Aggregates for Drainfill and Filters, unless otherwise specified. Geotextiles must conform to Material Specification 592, Geotextile.

### 3. Subgrade preparation

The subgrade surface on which the rock riprap, filter, bedding, or geotextile is to be placed must be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it must consist of approved material and must conform to the requirements of the specified class of earthfill.

Rock riprap, filter, bedding, or geotextile must not be placed until the foundation preparation is completed and the subgrade surface has been inspected and approved.

### 4. Equipment-placed rock riprap

The rock riprap must be placed by equipment on the surface and to the depth specified. It must be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The rock for riprap must be delivered and placed in a manner that ensures the riprap in place is reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface.

Rock riprap must be placed in a manner to prevent damage to structures. Hand placing is required as necessary to prevent damage to any new and existing structures.

### **5. Hand placed rock riprap**

The rock riprap must be placed by hand on the surface and to the depth specified. It must be securely bedded with the larger rocks firmly in contact one to another without bridging. Spaces between the larger rocks must be filled with smaller rocks and spalls. Smaller rocks must not be grouped as a substitute for larger rock. Flat slab rock must be laid on its vertical edge except where it is laid like paving stone and the thickness of the rock equals the specified depth of the riprap course.

### **6. Filter or bedding**

When the contract specifies filter, bedding, or geotextile beneath the rock riprap, the designated material must be placed on the prepared subgrade surface as specified. Compaction of filter or bedding aggregate is not required, but the surface of such material must be finished reasonably smooth and free of mounds, dips, or windrows.

### **7. Measurement and payment**

**Method 1**—For items of work for which specific unit prices are established in the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest ton by actual weight. The volume of each type of filter or bedding aggregate is 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 riprap placed as specified, the contractor must furnish to the responsible engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

**Method 2**—For items of work for which specific unit prices are established in the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest 0.1 ton by actual weight. The quantity of each type of filter or bedding aggregate delivered and placed within the specified limits is computed to the nearest 0.1 ton. For each load of rock riprap placed as specified, the contractor must furnish to the engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton. For each load of filter or bedding aggregate, the contractor must furnish to the responsible engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

**Method 3**—For items of work for which specific unit prices are established by the contract, the volume of each type of rock riprap and filter or bedding aggregate is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

**Method 4**—For items of work for which specific unit prices are established by the contract, the volume of each type of rock riprap, including filter and bedding aggregate, is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap, including filter and bedding. Such payment is considered full compensation for completion of the work.

**Method 5**—For items of work for which specific unit prices are established by the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest ton by actual weight. For each load of rock for riprap placed as specified, the contractor must furnish to the responsible engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, and includes compensation for any aggregate or geotextile installed as specified for filter or bedding. Such payment is considered full compensation for completion of the work.

**Method 6**—For items of work for which specific unit prices are established by the contract, the volume of each type of rock riprap is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap and includes compensation for any aggregate or geotextile installed as specified for filter or bedding. Such payment is considered full compensation for completion of the work.

**All methods**—The following provision applies 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 the items to which they are made subsidiary are identified in section 8.

No separate payment is made for testing the gradation of the test pile. Compensation for testing is included in the appropriate bid item for riprap.

## **8. Items of work and construction details**

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

### **a. Bid Item 3B , Riprap Foundation Protection**

- (1) This item shall consist of furnishing and installing rock riprap for the protection of the gabion basket foundation as shown on the drawings and staked in the field. Use of this item will be at the discretion of the NRCS inspector in the field.
- (2) In Section 2, Material, Rock shall meet the requirements of Rock Type 1, Material Specification 523, or be from sources with current approval from the West Virginia Department of Transportation. The contractor shall provide a gradation test as specified with the material certification prior to delivery of riprap to the site.
- (3) The statement in Section 2 that begins with "At least 30 days prior to delivery..." is to be changed to read "2 days prior to delivery...".
- (4) Rock riprap shall be equipment placed.
- (5) The rock riprap shall be well-graded between the nominal sizes of **9** and **18** inches. Well-graded shall mean that a broad range of rock particle sizes are represented and that substantial amounts of each rock particle size are included.
- (6) In Section 7, Measurement and payment, method 5 will apply.

## Construction Specification 64—Gabions and Gabion Mattresses

### 1. Scope

The work consists of furnishing, assembling, and installing rock-filled wire-mesh gabions and gabion mattresses. Gabions are at least 12 inches high. Gabion mattresses are no more than 12 inches high.

### 2. Material Types

Gabions and gabion mattresses consist of rectangular wire mesh formed containers filled with rock. Gabions must conform to one of the following types. The wire coating must be as specified in section 7.

**Twisted-mesh**—Nonraveling, double twisted, hexagonal wire mesh consisting of two wires twisted together in two 180-degree turns. Twisted-mesh, fasteners, and stiffeners must conform to the requirements of ASTM A975.

Lacing wire is the standard fastener for twisted-mesh gabions and gabion mattresses. Ring fasteners may be used and must be made of stainless steel. Ring fasteners must provide the minimum strength per lineal foot that is specified in ASTM A975 for gabions and gabion mattresses.

**Welded mesh**—Welded mesh with a uniform square or rectangular pattern and a resistance weld at each intersection. Welded mesh and stiffeners must conform to the requirements of ASTM A974 with the exception that welded-mesh may be delivered in component form, either rolled or stacked, for assembly at the job site.

Spiral binders are the standard fastener for welded-mesh gabions and gabion mattresses. Spiral binders must conform to the requirements of ASTM A974. Alternate fasteners for use with welded-mesh gabions and gabion mattresses, such as ring fasteners or lacing wire, must be formed from wire meeting the same quality and coating thickness requirements as specified for the gabions and gabion mattresses. Ring fasteners must be made of stainless steel. Standard fasteners and alternate fasteners must provide the minimum strength per lineal foot that is specified in ASTM A974 for gabions and gabion mattresses.

**Rock**—Rock must conform to the quality requirements in Material Specification 523, Rock for Riprap, unless otherwise specified in section 7. At least 85 percent of the rock particles, by weight, must be within the predominant rock size range.

Gabion basket or mattress height	Predominant rock size (in)	Minimum rock dimension (in)	Maximum rock dimension (in)
12-, 18-, or 36-inch basket	4 to 8	4	8
6-, 9-, or 12-inch mattress	3 to 6	3	6

At least 30 days before delivery to the site, the contractor must inform the engineer in writing of the source from which the rock will be obtained. The test data, and other information by which the material was determined by the contractor to meet the requirements of this specification must be included. The contractor must provide the engineer free access to the source for the purpose of obtaining samples for testing and source approval.

**Bedding or filter material**—Bedding or filter material, when specified, must meet the gradation shown on the plans, or as specified in section 7, and the requirements of Material Specification 521, Aggregates for Drainfill and Filters. Geotextile, when specified, must conform to the requirements specified in section 7 and those of Material Specification 592, Geotextile.

### 3. Foundation preparation

The foundation on which the gabions and gabion mattresses are to be placed must be cut or filled and graded to the lines and grades shown on the drawings. Surface irregularities, loose material, vegetation, and all foreign matter must be removed from the foundation. When fill is required, it must consist of material conforming to the requirements specified in section 7. Fill must be compacted as

specified in section 7. Gabions, gabion mattresses, and bedding or specified geotextiles may not be placed until the foundation preparation is completed, inspected by the responsible engineer, and verified by the engineer to meet the requirements of this specification.

Compaction of bedding or filter material is required as specified in section 7. The surface of the finished material must be to grade and free of mounds, dips, or windrows. Geotextile must be installed in accordance with the requirements of Construction Specification 95.

#### 4. Assembly and placement

Where a gabion or gabion mattress unit must be modified, welded-mesh panels may be cut to fit. Twisted-mesh panels may be folded and neatly wired but must not be cut.

**Assembly**—Use ring-type fasteners or lacing wire for the assembly and placement of twisted-mesh panels. Wrap the lacing wire with alternating single and double half-hitches at 4- to 6-inch intervals and secure by tying a double half-hitch at each end. Use spiral or ring type fasteners for the assembly and placement of welded-mesh panels. Where spiral fasteners are used, crimp the ends to secure the spirals in place. Where ring type fasteners are used, install the fasteners at a maximum spacing of 6 inches.

Interior diaphragms are required where any inside dimension exceeds 3 feet. Use the same type fasteners and fastening procedures to install interior diaphragms and lids as used in the panel assembly. Diaphragms are installed to ensure that no open intervals are present that exceed 3 feet.

**Placement**—Place the empty gabions or gabion mattresses on the foundation and use lacing wire to connect all adjacent gabions along the top, bottom, and vertical edges. Wrap the wire with alternating single and double half-hitches at 4- to 6-inch intervals. Unless otherwise specified in section 7, lacing wire is the only fastener allowed for connecting twisted-mesh gabions. Welded-mesh gabions and gabion mattresses may be connected with spiral fasteners, ring-type fasteners, or lacing wire. Where spiral fasteners are used, crimp the ends to secure the spirals in place. Where ring-type fasteners are used, install the fasteners at a maximum spacing of 6 inches. Lacing-wire may be used as needed to supplement the interconnection of welded mesh gabions and the closing of lids.

Connect each layer of gabions and gabion mattresses to the underlying layer of gabions along the front, back, and sides. Stagger the vertical and horizontal joints between the gabions of adjacent rows and layers by at least one-fourth of a cell length.

#### 5. Filling operation

**Twisted-mesh**—After adjacent empty twisted-mesh units are set to line and grade and common sides properly connected, they must be placed in straight line tension and stretched to remove any kinks from the mesh and to gain a uniform alignment. Units may be staked to maintain the established proper alignment before the rock is placed. No stakes may be placed through geotextile material. Fasteners must be attached during the filling operation as needed to preserve the strength and shape of the structure.

Internal connecting crosstie wires must be placed in each unrestrained gabion and gabion mattress unit of more than 18 inches in height, including units left temporarily unrestrained. Two internal connecting wires must be placed concurrently with rock placement at each 12-inch interval of depth. These crossties must be evenly spaced along the front face and connected to the back face. All crosstie wires must be looped around two mesh openings and each wire end must be secured by a minimum of five 180-degree twists around itself after looping.

**Welded-mesh**—Welded-mesh units do not require stretching. Units may be staked to maintain the established proper alignment before the rock is placed. No stakes may be placed through geotextile material. Fasteners must be attached during the filling operation as needed to preserve the strength and shape of the structure.

Internal crossties or stiffeners must be placed in each unrestrained gabion and gabion mattress unit of more than 18 inches in height, including units left temporarily unrestrained. Crossties or stiffeners must be placed concurrently with rock placement at each 12-inch interval of depth. They must be placed across the corners of the gabions (at 12 inches from the corners) providing diagonal bracing. Lacing wire or preformed hooked wire stiffeners may be used.

**Twisted and welded-mesh**—The gabions and gabion mattresses must be carefully filled with rock in a manner that will ensure alignment, avoid bulges, and provide a compact mass that minimizes voids. Machine placement requires supplementing with hand work to ensure the desired results. The units or cells in any row must be filled in stages so that the depth of rock placed in any one cell does not exceed the depth of rock in any adjoining cell by more than 12 inches. Along the exposed faces, the outer layer of stone must be carefully placed and arranged by hand to ensure a neat, compact placement with a uniform appearance.

The last layer of rock must be uniformly leveled to the top edges of the cells. Lids must be stretched tight over the rock filling. The use of crowbars or other single point leverage bars for lid closing is prohibited as they may damage the baskets. The lid must be stretched until it meets the perimeter edges of the front and end panels. The gabion lid must then be secured to the sides, ends, and diaphragms with lacing wire, spiral binders, or approved alternate fasteners. Lacing wire must be wrapped with alternating single and double half-hitches at 4- to 6-inch intervals. Where spiral fasteners are used, crimp the ends to secure the spirals in place.

Any damage to the wire or coatings during assembly, placement, and or filling must be repaired promptly in accordance with the manufacturer's recommendations or replaced with undamaged gabion basket materials.

## **6. Measurement and payment**

**Method 1**—For items of work for which specific unit prices are established in the contract, the volume of rock is measured within the neat lines of the gabion structure and computed to the nearest cubic yard. Payment for gabions is made at the contract unit price and includes the wire mesh and rock. Such payment is considered full compensation for all labor, material, equipment, and all other items necessary and incidental to completion of the work.

**Method 2**—For items of work for which specific unit prices are established in the contract, the volume of the gabions is measured within the neat lines of the gabion structure and computed to the nearest cubic yard. Payment for the gabions is made at the contract unit price and includes the wire mesh, rock, and specified bedding material or geotextile. Such payment is considered full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work.

**Method 3**—For items of work for which specific unit prices are established in the contract, the surface area is measured within the neat lines of the gabion mattress structure and computed to the nearest square yard. Payment for the gabion mattress is made at the contract unit price and includes the wire mesh and rock. Such payment is considered full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work.

**Method 4**—For items of work for which specific unit prices are established in the contract, the surface area is measured within the neat lines of the gabion mattress structure and computed to the nearest square yard. Payment for the gabion mattress is made at the contract unit price and includes the wire mesh, rock, and specified bedding material or geotextile. Such payment is considered full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work.

**All methods**—The following provisions apply to all methods of measurement and payment. Unless otherwise specified in section 7, no deduction in volume is made for any void or embedded item (e.g., a pipe passing through a gabion wall). 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. Each item 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 according to this specification and the construction details are:

### a. Bid Item 2, Wire Mesh Gabions

- (1) This item shall consist of furnishing, assembling, and installing rock-filled wire mesh gabions as shown in the drawings and staked in the field. This item shall also include all excavation necessary to install the gabion wall protection to neat lines and grade.
- (2) Included in the item is the removal and disposal of trash and debris within the work area. Refuse material shall be hauled to an approved off-site landfill. Contractor shall be responsible for landfill tipping fees.
- (3) In Section 2, Types, gabions shall be either twisted or welded-mesh baskets. The gabion baskets shall also include Diaphragms.
- (4) In Section 2, Material:
  - a) Gabion basket wire and all other wire shall be coated with Gray PVC. Twisted-wire mesh shall be zinc-coated and coated with PVC (ASTM A975 Style 3). The welded-wire mesh shall be zinc-coated and coated with PVC (ASTM A974 Styles 1 and 5 or Styles 2 and 5).
  - b) All fastenings shall be made by lacing for twisted-mesh and spiral binders for welded-mesh. Ring fasteners or other alternative fastening methods are **prohibited**.
  - c) Rock shall conform to the requirements of Material Specification 523, Rock for Riprap, Type 1 or be from a source with current approval with the West Virginia Department of Highways.
  - d) In Section 2, Materials, Rock, "30 days" is hereby changed to "2 days."
- (5) In Section 4, Assembly and placement, twisted-mesh baskets shall be assembled using lacing wire and welded-mesh baskets shall be assembled using spiral binders.
- (6) In Section 5, Filling Operation, hand placement is required to assure no rocks smaller than 4 inches are exposed on visible faces. The rock on visible faces are also required to be placed such that flat edges are turned out to make a smooth surface. Hand placing is also required to remove voids around all edges of baskets and under the crosstie wires.
- (7) Gabions will be backfilled with coarse-grained materials obtained from required excavations. Where adequate material is not present, the contractor shall obtain a suitable supply from an off-site location. All backfill materials will be approved by the NRCS Technical Representative before placement.
- (8) In Section 6, Measurement and payment, method 2 will apply.
- (9) Items of work subsidiary to this bid item are:
  - (a) Pollution Control, Construction Specification 5
  - (b) Seeding, Sprigging and Mulching, Construction Specification 6
  - (c) Traffic Control, Construction Specification 9
  - (d) Removal of Water, Construction Specification 11
  - (e) Excavation, Construction Specification 21
  - (f) Earthfill, Construction Specification 23
  - (g) Contractor Quality Control, Construction Specification 94
  - (h) Geotextile, Construction Specification 95
  - (i) Obstruction Removal, Construction Specification 401

## Construction Specification 94—Contractor Quality Control

### 1. Scope

The work consists of developing, implementing, and maintaining a quality control system to ensure that the specified quality is achieved for all materials and work performed.

### 2. Equipment and materials

Equipment and material used for quality control shall be of the quality and condition required to meet the test specifications cited in the contract. Testing equipment shall be properly adjusted and calibrated at the start of operations and the calibration maintained at the frequency specified. Records of equipment calibration tests shall be available to the engineer at all times. Equipment shall be operated and maintained by qualified operators as prescribed in the manufacturer's operating instructions, the references specified, and as specified in section 10 of this specification. All equipment and materials used in performing quality control testing shall be as prescribed by the test standards referenced in the contract or in section 10.

All equipment and materials shall be handled and operated in a safe and proper manner and shall comply with all applicable regulations pertaining to their use, operation, handling, storage, and transportation.

### 3. Quality control system

*Method 1*—The contractor shall develop, implement, and maintain a system of quality control to provide the specified material testing and verification of material quality before use. The system activities shall include procedures to verify adequacy of completed work, initiate corrective action to be taken, and document the final results. The identification of the quality control personnel and their duties and authorities shall be submitted to the contracting officer in writing within 15 calendar days after notice of award.

*Method 2*—The contractor shall develop, implement, and maintain a system adequate to achieve the specified quality of all work performed, material incorporated, and equipment furnished before use. The system established shall be documented in a written plan developed by the contractor and approved by the contracting officer. The system activities shall include the material testing and inspection needed to verify the adequacy of completed work and procedures to be followed when corrective action is required. Daily records to substantiate the conduct of the system shall be maintained by the contractor. The quality control plan shall cover all aspects of quality control and shall address, as a minimum, all specified testing and inspection requirements. The plan provided shall be consistent with the planned performance in the contractor's approved construction schedule. The plan shall identify the contractor's onsite quality control manager and provide an organizational listing of all quality control personnel and their specific duties. The written plan shall be submitted to the contracting officer within 15 calendar days after notice of award. The contractor shall not proceed with any construction activity that requires inspection until the written plan is approved by the contracting officer.

*All methods*—The quality control system shall include, but not be limited to, a rigorous examination of construction material, processes, and operation, including testing of material and examination of manufacturer's certifications as required, to verify that work meets contract requirements and is performed in a competent manner.

### 4. Quality control personnel

*Method 1*—Quality control activities shall be accomplished by competent personnel. A competent person is: One who is experienced and capable of identifying, evaluating, and documenting that materials and processes being used will result in work that complies with the contract; and, who has authority to take prompt action to remove, replace, or correct such work or products not in compliance. Off-site testing laboratories shall be certified or inspected by a nationally recognized entity. The Contractor shall submit to the Contracting Officer, for approval, laboratory certification or inspection information. The Contractor shall submit to the

Contracting Officer, for approval, the names, qualifications, authorities, certifications, and availability of the competent personnel who will perform the quality control activities.

**Method 2**—Quality control activities shall be accomplished by competent personnel who are separate and apart from line supervision and who report directly to management. A competent person is one who is experienced and capable of identifying, evaluating, and documenting that material and processes being used will result in work that complies with the contract, and who has authorization to take prompt action to remove, replace, or correct such work or products not in compliance. Offsite testing laboratories shall be certified or inspected by a nationally recognized entity. The Contractor shall submit to the Contracting Officer, for approval, laboratory certification or inspection information. The contractor shall submit to the contracting officer, for approval, the names, qualifications, authorities, certifications, and availability of the competent personnel who will perform the quality control activities.

## 5. Post-award conference

The contractor shall meet with the contracting officer before any work begins and discuss the contractor's quality control system. The contracting officer and the contractor shall develop a mutual understanding regarding the quality control system, including procedures for correcting quality control issues.

## 6. Records

The contractor's quality control records shall document both acceptable and deficient features of the work and corrective actions taken. All records shall be on forms approved by the contracting officer, be legible, and be dated and signed by the competent person creating the record.

Unless otherwise specified in section 10 of this specification, records shall include:

- a. Documentation of shop drawings including date submitted to and date approved by the contracting officer, results of examinations, any need for changes or modifications, manufacturer's recommendations and certifications, if any, and signature of the authorized examiner.
- b. Documentation of material delivered including quantity, storage location, and results of quality control examinations and tests.
- c. Type, number, date, time, and name of individual performing quality control activities.
- d. The material or item inspected and tested, the location and extent of such material or item, and a description of conditions observed and test results obtained during the quality control activity.
- e. The determination that the material or item met the contract provisions and documentation that the engineer was notified.
- f. For deficient work, the nature of the defects, specifications not met, corrective action taken, and results of quality control activities on the corrected material or item.

## 7. Reporting results

The results of contractor quality control inspections and tests shall be communicated to the engineer immediately upon completion of the inspection or test. Unless otherwise specified in section 10, the original plus one copy of all records, inspections, tests performed, and material testing reports shall be submitted to the engineer within one working day of completion. The original plus one copy of documentation of material delivered shall be submitted to the engineer before the material is used.

## 8. Access

The contracting officer and the engineer shall be given free access to all testing equipment, facilities, sites, and related records for the duration of the contract.

## 9. Payment

**Method 1**—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds, after presentation by the contractor of invoices showing related costs and evidence of charges by suppliers, subcontractors, and others for furnishing supplies and work performed. If the total of such payments is less than the lump sum contract price for this item, the remaining balance is included in the final contract payment. Payment of the lump sum contract price constitutes full compensation for completion of the work.

Payment is not made under this item for the purchase cost of material and equipment having a residual value.

**Method 2**—For items of work for which lump sum prices are established in the contract, payment is prorated and paid in equal amounts on each monthly estimate. The number of months used for prorating shall be the number estimated to complete the work. The final month's prorate amount is made with the final payment. Payment as described above constitutes full compensation for completion of the work.

Payment is not made under this item for the purchase cost of material and equipment having a residual value.

**All methods**—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 the items to which they are made subsidiary are identified in section 10.

## 10. Items of work and construction details

Items of work to be performed according to this specification and the construction details are:

### a. Subsidiary Item, Contractor Quality Control

- (1) This item shall consist of all work and activities necessary to ensure work meets the specified lines, grades and quality for all sites in this contract.
- (2) In Section 3, Quality control system, Method 1 will apply. Quality control personnel will be identified within 2 calendar days after notice to proceed.
- (3) In Section 4, Quality control personnel, Method 1 will apply.
- (4) Section 9, Payment, shall not apply. No separate payment will be made for Contractor Quality Control. Compensation for this item will be included in the payment for **Bid Item 2, Wire Mesh Gabions.**

## Construction Specification 95—Geotextile

### 1. Scope

This work consists of furnishing all material, equipment, and labor necessary for the installation of geotextiles.

### 2. Quality

Geotextiles shall conform to the requirements of Material Specification 592 and this specification.

### 3. Storage

Before use, the geotextile shall be stored in a clean, dry location out of direct sunlight, not subject to extremes of either hot or cold temperatures, and with the manufacturer's protective cover undisturbed. Receiving, storage, and handling at the job site shall be in accordance with the requirements listed in ASTM D 4873.

### 4. Surface preparation

The surface on which the geotextile is to be placed shall be graded to the neat lines and grades as shown on the drawings. It shall be reasonably smooth and free of loose rock and clods, holes, depressions, projections, muddy conditions, and standing or flowing water (unless otherwise specified in section 7 of this specification).

### 5. Placement

Before the geotextile is placed, the soil surface will be reviewed for quality assurance of the design and construction. The geotextile shall be placed on the approved prepared surface at the locations and in accordance with the details shown on the drawings and specified in section 7 of this specification. It shall be unrolled along the placement area and loosely laid, without stretching, in such a manner that it conforms to the surface irregularities when material or gabions are placed on or against it. The geotextile may be folded and overlapped to permit proper placement in designated area(s).

*Method 1*—The geotextile shall be joined by machine sewing using thread material meeting the chemical requirements for the geotextile fibers or yarn. Thread shall be polypropylene, polyester, or Kevlar™ aramid thread, unless a specific thread type is specified. The thread shall consist of two parallel stitched rows at a spacing of about 1 inch and shall not cross (except for any required re-stitching). The stitching shall be a lock-type stitch. Each row of stitching shall be located a minimum of 2 inches from the geotextile edge. Unless otherwise specified, the seam tensile strength as measured according to ASTM D4884 shall be a minimum of 90 percent of the geotextile tensile strength in the weakest principal direction as measured according to ASTM D4632.

The geotextile shall be temporarily secured during placement of overlying material to prevent slippage, folding, wrinkling, or other displacement of the geotextile. Unless otherwise specified, methods of securing shall not cause punctures, tears, or other openings to be formed in the geotextile.

*Method 2*—The geotextile shall be joined by overlapping a minimum of 18 inches (unless otherwise specified) and secured against the underlying foundation material. Securing pins, approved and provided by the geotextile manufacturer, shall be placed along the edge of the panel or roll material to adequately hold it in place during installation. Pins shall be steel or fiberglass formed as a U, L, or T shape or contain "ears" to prevent total penetration through the geotextile. Steel washers shall be provided on all but the U-shaped pins. The upstream or upslope geotextile shall overlap the abutting downslope geotextile. At vertical laps, securing pins shall be inserted through the bottom layers along a line through approximately the mid-point of the overlap. At horizontal laps and across slope laps, securing shall be inserted through the bottom layer only. Securing pins shall be placed along a line about 2 inches in from the edge of the placed geotextile at intervals not to exceed 12 feet unless otherwise specified. Additional pins shall be installed as necessary and where appropriate to prevent any undue slippage or movement of the geotextile. The use of securing pins will be held to the minimum necessary. Pins are to remain in place unless otherwise specified.

Should the geotextile be torn or punctured, or the overlaps or sewn joint disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or grade distortion, the backfill around the damaged or displaced area shall be removed and restored to the original approved condition. The repair shall consist of a patch of the same type of geotextile being used and overlaying the existing geotextile. When the geotextile seams are required to be sewn, the overlay patch shall extend a minimum of 1 foot beyond the edge of any damaged area and joined by sewing as required for the original geotextile except that the sewing shall be a minimum of 6 inches from the edge of the damaged geotextile. Geotextile panels joined by overlap shall have the patch extend a minimum of 2 feet from the edge of any damaged area.

Geotextile shall be placed in accordance with the following applicable specification according to the use indicated in section 7:

*Slope protection*—The geotextile shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. In no case shall material be dropped on uncovered geotextile from a height of more than 3 feet.

*Subsurface drains*—The geotextile shall not be placed until drainfill or other material can be used to provide cover within the same working day. Drainfill material shall be placed in a manner that prevents damage to the geotextile. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet.

*Road stabilization*—The geotextile shall be unrolled in a direction parallel to the roadway centerline in a loose manner permitting conformation to the surface irregularities when the roadway fill material is placed on its surface. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet. Unless otherwise specified, the minimum overlap of geotextile panels joined without sewing shall be 24 inches. The geotextile may be temporarily secured with pins recommended or provided by the manufacturer, but they shall be removed before the permanent covering material is placed.

## **6. Measurement and payment**

*Method 1*—For items of work for which specific unit prices are established in the contract, the quantity of geotextile for each type placed within the specified limits is determined to the nearest specified unit by measurements of the covered surfaces only, disregarding that required for anchorage, seams, and overlaps. Payment is made at the contract unit price. Such payment constitutes full compensation for the completion of the work.

*Method 2*—For items of work for which specific unit prices are established in the contract, the quantity of geotextile for each type placed with the specified limits is determined to the nearest specified unit by computing the area of the actual roll size or partial roll size installed. The computed area will include the amount required for overlap, seams, and anchorage as specified. Payment is made at the contract unit price. Such payment constitutes full compensation for the completion of the work.

*Method 3*—For items of work for which specific lump sum prices are established in the contract, the quantity of geotextile is not measured for payment. Payment for geotextiles is made at the contract lump sum price and constitutes full compensation for the completion of the work.

*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 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 according to this specification and the construction details are:

### a. Subsidiary Item, Geotextile

- (1) This item shall consist of furnishing all labor, equipment, and materials required to install the geotextile as shown on the drawings.
- (2) The geotextile shall be Class I, non-woven, and shall be supplied according to Material Specification 592. The apparent opening size (AOS) shall range from a maximum of #40 to a minimum of #80 (U.S. standard sieve size according to ASTM D4751).
- (3) Place cover material over the geotextile in a manner that prevents damage to the geotextile. Geotextile damaged during placement or by equipment crossovers shall be replaced or repaired at no additional cost to the government. All repairs shall be by replacement or by placing an additional sheet of geotextile over the damaged area, ensuring a minimum 1-foot overlap on undamaged geotextile. Place geotextile so that no edges of the fabric are exposed outside the limits of the area to be covered.
- (4) Method 2 of Section 5 will apply.
- (5) At the toe of the slope, the geotextile shall be secured a minimum of 2 feet under the bottom of the rock riprap in the keyway or 2 feet under the gabion wall.
- (6) Section 6, Measurement and Payment, shall not apply. No separate payment will be made for Geotextile. Compensation for this item will be included in the payment for **Bid Item 2, Wire Mesh Gabions**.

## **Construction Specification 401- Obstruction Removal**

### **1. Scope**

The work consists of debris removal, structure removal, clearing & snagging, deposition removal, reconstruction of channels, and sloping of streambanks within the designated areas as shown on the drawings.

### **2. Debris and Structure Removal and Disposal**

Debris, marked structures, marked trees, and rubbish within the designated channel and floodplain areas will be removed. Burnable materials may be burned in accordance with local and state regulations.

Non-burnable material and material from regulated burning areas shall be disposed of offsite and outside the floodplain limits. Disposal shall be in accordance with all local, state, and federal regulations. The locations of offsite disposal areas and the manner of disposal will require approval of the Contracting Officer.

### **3. Deposition Removal, Channel Reconstruction, and Streambank Sloping**

All Deposition removal, channel reconstruction and streambank sloping shall be excavated to the lines and grades designated in the drawings. Deposition removal shall include, but not be limited to, the removal of silt, sand and boulders. All excavation shall be conducted in a manner, which will not restrict flow in the existing channel.

Soil and rock material from the required excavations shall be used to reconstruct the streambanks as shown on the drawings. Debris, rubbish, trees, brush, or any other foreign material shall not be buried in the reconstructed streambanks. The reconstructed streambank shall be shaped to facilitate positive drainage.

Excess soil and rock materials from the required excavations shall be disposed of at the locations shown on the drawings.

If no disposal area is shown on the drawings, the Contractor shall be responsible for obtaining an offsite disposal area. The disposal area must be located outside the floodplain. The offsite disposal area must be graded to allow positive drainage and be seeded as required by the property owner. The Contractor shall provide a copy of his written agreement with the property owner to the Contracting Officer.

The manner of disposal will require approval of the Contracting Officer. Disposal shall be in accordance with all local, state and federal regulations.

### **4. Measurement and Payment**

No separate payment will be made for Obstruction Removal. Compensation for this item will be included in payment for **Bid Item 2, Wire Mesh Gabions**. Such payment constitutes full compensation for all labor, equipment material and all other item necessary and incidental to the completion of the work including the cost for landfill disposal.

## 5. Items of work and construction details

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

### a. Subsidiary Item, Obstruction Removal

- (1) This item shall consist of all the obstruction removal as shown on the drawings and staked in the field. It shall also consist of shaping and grading the channel and sub-channel as shown on the drawings and staked in the field by the engineer.

## Part 642 – Specifications

### Chapter 3 – National Standard Material Specifications

#### Material Specification 523—Rock for Riprap

##### A. Scope

This specification covers the quality of rock to be used in the construction of rock riprap.

##### B. Quality

- (1) Individual rock fragments shall be dense, sound, and free from cracks, seams, and other defects conducive to accelerated weathering. Except as otherwise specified, the rock fragments shall be angular to subrounded. The least dimension of an individual rock fragment shall be not less than one-third the greatest dimension of the fragment. ASTM D4992 provides guidance on selecting rock from a source.
- (2) Except as otherwise provided, the rock shall be tested and shall have the following properties:
  - (i) Rock type 1
    - Bulk specific gravity (saturated surface-dry basis)—Not less than 2.5 when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
    - Absorption—Not more than 2 percent when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
    - Soundness—The weight loss in 5 cycles shall not be more than 10 percent when sodium sulfate is used or more than 15 percent when magnesium sulfate is used.
  - (ii) Rock type 2
    - Bulk specific gravity (saturated surface-dry basis)—Not less than 2.5 when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
    - Absorption—Not more than 2 percent when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
    - Soundness—The weight loss in 5 cycles shall be not more than 20 percent when sodium sulfate is used or more than 25 percent when magnesium sulfate is used.
  - (iii) Rock type 3
    - Bulk specific gravity (saturated surface-dry basis)—Not less than 2.3 when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
    - Absorption—Not more than 4 percent when tested in accordance with ASTM D6473 on samples prepared as described for soundness testing.
    - Soundness—The weight loss in 5 cycles shall be not more than 20 percent when sodium sulfate is used or more than 25 percent when magnesium sulfate is used.

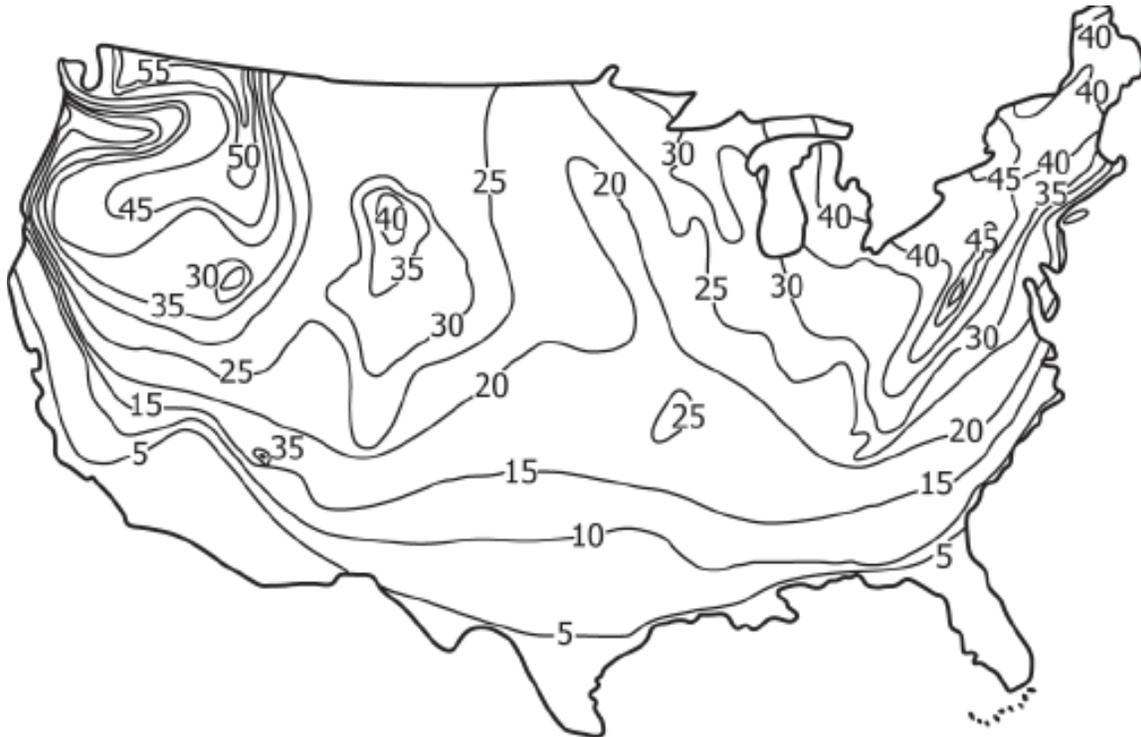
##### C. Methods of Soundness Testing

- (1) Rock cube soundness—
  - (i) The sodium or magnesium sulfate soundness test for all rock types (1, 2, or 3) shall be performed on a test sample of  $5,000 \pm 300$  grams of rock fragments, reasonably uniform in size and cubical in shape, and weighing, after sampling, about 100 grams each. They shall be obtained from rock samples that are representative of the total rock mass, as noted in ASTM D4992, and that have been sawed into slabs as described in ASTM D5121. The samples shall further be reduced in size by sawing the slabs into cubical

blocks. The thickness of the slabs and the size of the sawed fragments shall be determined by the size of the available test apparatus and as necessary to provide, after sawing, the approximate 100-gram samples. The cubes shall undergo five cycles of soundness testing in accordance with ASTM D1512.

- (ii) Internal defects may cause some of the cubes to break during the sawing process or during the initial soaking period. Do not test any of the cubes that break during this preparatory process. Such breakage, including an approximation of the percentage of cubes that break, shall be noted in the test report.
  - (iii) After the sample has been dried following completion of the final test cycle and washed to remove the sodium sulfate or magnesium sulfate, the loss of weight shall be determined by subtracting from the original weight of the sample the final weight of all fragments that have not broken into three or more fragments.
  - (iv) The test report shall show the percentage loss of the weight and the results of the qualitative examination.
- (2) Rock slab soundness—
- (i) When specified, the rock shall also be tested in accordance with ASTM D5240. Deterioration of more than 25 percent of the number of blocks shall be cause for rejection of rock from this source. Rock shall also meet the requirements for average percent weight loss stated below.
  - (ii) For projects located north of the Number 20 Freeze-Thaw Severity Index Isoline (fig. 523–1 below). Unless otherwise specified, the average percent weight loss for Rock Type 1 shall not exceed 20 percent when sodium sulfate is used or 25 percent when magnesium sulfate is used. For Rock Types 2 and 3, the average percent weight loss shall not exceed 25 percent for sodium sulfate soundness or 30 percent for magnesium sulfate soundness.
  - (iii) For projects located south of the Number 20 Freeze-Thaw Severity Index Isoline, unless otherwise specified, the average percent weight loss for Rock Type 1 shall not exceed 30 percent when sodium sulfate is used or 38 percent when magnesium sulfate is used. For Rock Types 2 and 3, the average percent weight loss shall not exceed 38 percent for sodium sulfate soundness or 45 percent for magnesium sulfate soundness.

Figure 523–1 Isoline Map of the Freeze Thaw Severity Index for Contiguous 48 United States (Map is from ASTM D5312)



#### D. Field Durability Inspection

- (1) Rock that fails to meet the material requirements stated above (if specified), may be accepted only if similar rock from the same source has been demonstrated to be sound after 5 years or more of service under conditions of weather, wetting and drying, and erosive forces similar to those anticipated for the rock to be installed under this specification.
- (2) A rock source may be rejected if the rock from that source deteriorates in 3 to 5 years under similar use and exposure conditions expected for the rock to be installed under this specification, even though it meets the testing requirements stated above.
- (3) Deterioration is defined as the loss of more than one-quarter of the original rock volume, or severe cracking that would cause a block to split. Measurements of deterioration are taken from linear or surface area particle counts to determine the percentage of deteriorated blocks. Deterioration of more than 25 percent of the pieces shall be cause for rejection of rock from the source.

#### E. Grading

The rock shall conform to the specified grading limits after it has been placed within the matrix of the rock riprap. Grading tests shall be performed, as necessary, according to ASTM D5519, Method A, B, C or D, as applicable.

## Part 642 – Specifications

### Chapter 3 – National Standard Material Specifications

#### Material Specification 539—Steel Reinforcement (for concrete)

A. Scope

This specification covers the quality of steel reinforcement for reinforced concrete.

B. Quality

- (1) All reinforcement shall be free from loose or flaky rust, soil, oil, grease, paint, or other deleterious matter.
- (2) Steel bars for concrete reinforcement shall be grade 40, 50, or 60 deformed bars conforming to one of the following specifications:
  - (i) Deformed and plain billet-steel bars for concrete reinforcement—ASTM A615.
  - (ii) Rail-steel deformed bars for concrete reinforcement—ASTM A996.
  - (iii) Axle-steel deformed bars for concrete reinforcement—ASTM A996.
- (3) Dowels shall be plain round bars conforming to the same specifications listed above for steel bars.
- (4) Fabricated deformed steel bar mats for concrete reinforcement shall conform to the requirements of ASTM A184.
- (5) Deformed steel welded wire reinforcement shall conform to the requirements of ASTM A1064.
- (6) Epoxy-coated steel bars for concrete reinforcement shall conform to the requirements of ASTM A775.

C. Dimensions of Welded Wire Reinforcement

Gauges, diameters, spacing, and arrangement of wires for welded steel wire fabric shall be as defined for the specified style designations.

D. Storage

Steel reinforcement inventories at the site of the work shall be stored above the ground surface on platforms, skids, or other supports and shall be kept clean and protected from mechanical injury and corrosion.

## Part 642 – Specifications

### Chapter 3 – National Standard Material Specifications

#### Material Specification 592—Geotextile

A. Scope

This specification covers the quality of geotextile, including geotextile for temporary silt fence.

B. General Requirements

- (1) Fibers (threads and yarns) used in the manufacture of geotextile must consist of synthetic polymers composed of a minimum of 85 percent by weight polypropylenes, polyesters, polyamides, polyethylene, polyolefins, or polyvinylidene-chlorides. They must be formed into a stable network of filaments or yarns retaining dimensional stability relative to each other. The geo-textile must be free of defects, such as holes, tears, and abrasions. The geotextile must be free of any chemical treatment or coating that significantly reduces its porosity. Fibers must contain stabilizers, inhibitors, or both to enhance resistance to ultraviolet light. Geotextile other than for temporary silt fence must conform to the requirements in tables 592–1 or 592–2, as applicable. Geotextile for temporary silt fence must conform to the requirements in table 592–3.
- (2) Thread used for factory or field sewing must be of a color contrasting to the color of the fabric and made of high-strength polypropylene, polyester, or polyamide thread. Thread must be as resistant to ultraviolet light as the geotextile being sewn.

C. Classification

- (1) Geotextiles are classified based on the method used to place the threads or yarns forming the fabric. The geotextiles will be grouped into woven and nonwoven types. Geotextile for temporary silt fence may be either woven or nonwoven. Silt fence shall meet the requirement of ASTM D6461. Slit film woven geotextile may not be used except for temporary silt fence.
- (2) Woven—Fabrics formed by the uniform and regular interweaving of the threads or yarns in two directions. Woven fabrics must be manufactured from monofilament yarn formed into a uniform pattern with distinct and measurable openings, retaining their position relative to each other. The edges of fabric must be selvaged or otherwise finished to prevent the outer yarn from unraveling.
- (3) Nonwoven—Fabrics formed by a random placement of threads in a mat and bonded by needle punching, heat bonding, or resin bonding. Nonwoven fabrics must be manufactured from individual fibers formed into a random pattern with distinct but variable small openings, retaining their position relative to each other when bonded by needle punching, heat bonding, or resin bonding. The use of heat- or resin-bonded nonwovens is restricted as specified in note 2 of table 592-2.

D. Sampling and Testing

- (1) The geotextile must meet the specified requirements (tables 592–1, 592–2, or 592–3, as applicable) for the product type shown on the label. Product properties as listed in the latest edition of the "Specifiers Guide," Geosynthetics (Industrial Fabrics Association International, 1801 County Road B, West Roseville, MN 55113-4061 or at

<http://www.geosindex.com>), and that represent minimum average roll values, are acceptable documentation that the product style meets the requirements of these specifications.

- (2) For products that do not appear in the above directory or do not have minimum average roll values listed, typical test data from the identified production run of the geotextile is required for each of the specified tests (tables 592–1, 592–2, or 592–3, as applicable) as covered under clause AGAR 452.236-76.

E. Shipping and Storage

- (1) The geotextile must be shipped and transported in rolls wrapped with a cover for protection from moisture, dust, dirt, debris, and ultraviolet light. The cover must be maintained undisturbed to the maximum extent possible before placement.
- (2) Each roll of geotextile must be labeled or tagged to clearly identify the brand, class, and the individual production run in accordance with ASTM D4873.

Table 592-1 Requirements for Woven Geotextiles<sup>1/</sup>

Property	Test method	Class I	Class II	Class III	Class IV
Grab tensile strength (pounds)	ASTM D4632	247 minimum	180 minimum	180 minimum	315
Elongation at failure (percent)	ASTM D4632	<50	<50	<50	<50
Trapezoidal tear strength (pounds)	ASTM D4533	90 minimum	67 minimum	67 minimum	112 minimum
Puncture strength pounds	ASTM D6241	495 minimum	371 minimum	371 minimum	618 minimum
Ultraviolet stability (retained strength) (percent)	ASTM D4355	50 minimum	50 minimum	50 minimum	70 minimum
Permittivity (sec <sup>-1</sup> )	ASTM D4491		0.7 minimum or as specified		
Apparent opening size (AOS) <sup>2/</sup>	ASTM D4751		0.22 maximum or as specified		
Percent open area (POA) (percent)	USACE CWO-02215-86		4.0 minimum		
Grab tensile strength (lb)	ASTM D4632 grab test	202 minimum	157 minimum	112 minimum	202 minimum
Elongation at failure (%)	ASTM D4632	50 minimum	50 minimum	50 minimum	50 minimum
Trapezoidal tear strength (lb)	ASTM D4533	79 minimum	56 minimum	40 minimum	79 minimum
Puncture strength (lb)	ASTM D6241	433 minimum	309 minimum	223 minimum	433 minimum

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Property	Test method	Class I	Class II	Class III	Class IV
Ultraviolet light (retained strength) (%)	ASTM D4355	50 minimum	50 minimum	50 minimum	50 minimum
Permittivity sec <sup>-1</sup>	ASTM D4491	50 minimum	0.70 minimum or as specified		
Apparent opening size (AOS) (mm)	ASTM D4751		0.22 maximum or as specified		

<sup>1/</sup> All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.

<sup>2/</sup> Minimum average roll value (weakest principal direction).

**Notes:** CWO is a USACE reference.

All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.

Needle punched geotextiles may be used for all classes. Heat-bonded or resin bonded geotextiles may be used for classes III and IV only. They are particularly well suited to class IV.

Minimum average roll value (weakest principal direction).