



U.S. Army Corps  
of Engineers  
Memphis District

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INSTALLATION OF DISCHARGE PIPE  
STA 13+50 TO STA 22+00

Grand Prairie Area Demonstration Project  
Prairie County, Arkansas

(OPTION #1 TO GRAND PRAIRE PUMPING STATION SUPERSTRUCTURE  
AND INSTALLATION OF EQUIPMENT CONTRACT)

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SECTION 01 22 00.00 10

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

1.2 JOB PAYMENT ITEMS

Payment items for the work of this contract for which contract job payments will be made are listed in the BIDDING SCHEDULE and described below. All costs for items of work, which are not specifically mentioned to be included in a particular job or unit price payment item, shall be included in the listed job item most closely associated with the work involved. The job price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for which separate payment is not otherwise provided.

1.2.1 Mobilization and Demobilization (Line Item 1001)

Payment will be made for costs associated with mobilization and demobilization, as defined in Section 00 70 00.00 11 - CONTRACTING CLAUSES, (BASE BID), Paragraph entitled PAYMENT FOR MOBILIZATION AND DEMOBILIZATION.

Unit of Measure: Job (JA)

1.2.2 Environmental Protection (Line Item 1002)

Payment will be made for the costs associated with operations necessary for environmental protection as specified in Section 01 57 20.00 10 - ENVIRONMENTAL PROTECTION. The Contractor shall be responsible for payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor. The Contractor shall be responsible for payment of all fines/fees arriving from violation or non-compliance with Federal, State, Regional, and local laws or regulations. The Government will not provide any compensation for payments of fines/fees, in the event that fines/fees are incurred by the Contractor.

Unit of Measure: Job (JA)

1.2.3 Cathodic Protection (Line Item 1004)

Payment for the cathodic protection system shall include all wiring, test stations, cabinets, miscellaneous hardware, primary and secondary services

for the system as specified in Section SECTION 26 42 17.00 10 - CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT). This item shall include the operation and maintenance manual, and the training, testing, and inspection personnel required to install a complete and adjusted system. This item also includes coordination with the local utility company. The Contractor shall pay the utility company the initial cost of the installation. This pay item also includes testing of the system.

Unit of Measure: Job (JA)

#### 1.2.4 Discharge Pipes and Accessories (Line Item 1005)

Payment will be made for costs associated with the fabrication, delivery, and placement of the dual pipeline, including all fittings, valves, coupling, end caps, manways, heat tracing, protective bollards and associated items required for a complete installation, as specified in Section SECTION 05 50 04.00 10 - STEEL PIPE MATERIALS AND ACCESSORIES. All electrical requirements will be as specified in SECTION 33 71 02.00 20 - UNDERGROUND ELECTRICAL DISTRIBUTION.

Unit of Measure: Job (JA)

#### 1.2.5 Fiber Optic System-48 Fiber Count (Line Item 1006)

Payment for the fiber optic system shall include fiber optic cable and optical cable cabinets, including all fittings, marking tape, machines, methods, restoration of surfaces, pad, conduits, grounds, splice enclosures, splice trays and associated items required for the complete installation, as specified in Section 27 21 10.00 10 - FIBER OPTIC CABLE INSTALLATION-UNDERGROUND. This item shall include the operation and maintenance manual, and the training, testing, and inspection personnel required to install a complete and adjusted system. This pay item also includes testing of the system.

Unit of Measure: Job (JA)

#### 1.2.6 Fencing (Line Item 1007)

Payment for the Fencing shall include chainlink fence, security gate, cabinets, including all fittings, splices, ties, bolts and associated items required for the complete installation, as specified in Section 32 31 13 - CHAIN LINK FENCE AND GATES.

Unit of Measure: Job (JA)

### 1.3 UNIT PRICE PAYMENT ITEMS

Payment items for the work of this contract on which the contract unit price payments will be made are listed in the BIDDING SCHEDULE and described below. The unit price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for each of the unit price items.

#### 1.3.1 Silt Fence/Erosion Control Berm (Line Item 1003AA)

#### 1.3.1.1 Payment

Payment for Silt Fences/Erosion Control Berm as specified herein will be made at the contract unit price per linear foot for "Silt Fences/Erosion Control Berm". Price and payment shall constitute full compensation for furnishing all plant, labor, materials and equipment, including geotextile fabric, and performing all operations necessary for the placement and maintenance of Silt Fences throughout the contract period, including final dressing and cleanup.

#### 1.3.1.2 Measurement

Measurement for Silt Fences satisfactorily placed will be made by the linear foot.

Unit of measure, Linear Foot: LF.

#### 1.3.2 Check Dams (Line Item 1003AB)

##### 1.3.2.1 Payment

Payment for Check Dams as specified herein will be made at the contract unit price per linear foot for "Check Dams". Price and payment shall constitute full compensation for furnishing all plant, labor, materials and equipment, and performing all operations necessary for the installation and maintenance of the Check Dams throughout the contract period, including final dressing and cleanup. Riprap for check dams shall be as specified in Section 35 31 19.00 11- STONE PROTECTION.

##### 1.3.2.2 Measurement

Measurement for Rock Check Dams satisfactorily placed will be made by the linear foot.

Unit of measure, Linear Foot: LF.

#### 1.3.3 Thrust Blocks with Piling (Line Item 1008)

##### 1.3.3.1 Payment

Payment for the Thrust Blocks with associated piling supporting the thrust blocks, as specified herein, will be made at the contract unit price per each for "Thrust Blocks w/ Piling". Price and payment shall constitute full compensation for furnishing all plant, labor, materials and equipment, including all concrete, rebar, and support piles, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for each of the unit price items. Concrete for thrust block is specified in SECTION 03 30 53 - MISCELLANEOUS CAST IN PLACE CONCRETE and the piles are specified in SECTION 31 62 16.16 - STEEL H-PILES

##### 1.3.3.2 Measurement

Measurement for Thrust Blocks with Piling will be made based on each of the two pile supported thrust blocks located at the surge tanks and accessories.

Unit of measure, Each: EA.

1.3.4 Surge Tanks and Accessories (Line Item 1009)

1.3.4.1 Payment

Payment for Surge Tanks and Accessories, as specified herein, will be made at the contract unit price per each for "Surge Tanks and Accessories". Price and payment shall constitute full compensation for furnishing all plant, labor, materials and equipment, including all concrete, rebar, embedded pipe, valves, access hatches, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for each of the unit price items.

1.3.4.2 Measurement

Measurement for Surge Tanks and Accessories will be made based for the tanks.

Unit of measure, Each: EA.

1.3.5 Clearing and Grubbing (Line Item 1010)

1.3.5.1 Payment

Payment will be made for costs associated with clearing and grubbing of the construction right-of-way from pipeline Station 13+50 to 22+00 as specified in Section 31 11 00 - CLEARING AND GRUBBING.

1.3.5.2 Measurement

Clearing and grubbing will be measured in acres of clearing and grubbing actually performed.

Unit of Measure: Acre (AC)

1.3.6 Excavation (Line Item 1011)

1.3.6.1 Payment

Payment will be made for costs associated with excavation to grade, including all backfill and fill around the storage tanks, as specified in Section 31 23 00.00 20 - EXCAVATION, FILL, BACKFILL AND EMBANKMENT FOR STRUCTURES and to the lines and grades shown on the drawings.

1.3.6.2 Measurement

The unit of measurement for excavation of the pipe trench will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation operations. The volume to be paid for will be the number of cubic yards of material measured in its original position and removed by the trench excavation to the lines and grades shown on the drawings. The Contractor will only be paid for the required excavation of the pipe trench only. All other excavations necessary within the Right-of-Way to construct the embankment to the lines and grades as shown on the drawings and provide positive drainage throughout the Right-of-Way limits including excavation for surface water removal from the excavation trench will be incidental and not computed for pay quantities. Over excavation is the responsibility of the Contractor per Section 31 23 00.00 20 - EXCAVATION, FILL, BACKFILL AND EMBANKMENT FOR STRUCTURES

Unit of Measure: Cubic Yard (CY)

1.3.7 Compacted Embankment (Line Item 1012)

1.3.7.1 Payment

Payment will be made for costs associated with compacted embankment and backfilling the trench including all low areas along pipeline and fill required along the access road, as specified in Section 31 23 00.00 20 - EXCAVATION, FILL, BACKFILL AND EMBANKMENT FOR STRUCTURES.

1.3.7.2 Measurement

The unit of measurement for the placement of compacted fill for this item will be the cubic yard and quantities will be determined by the average end area method. The basis for the measurement will be cross sections of the areas to be filled taken after the trench excavation operations and placement of the pipe bedding, versus the final surveyed gross section of the completed embankment. The volume to be paid will be the number of cubic yards of material measured in its final position and placed in the embankment, less the volume occupied by the 2 (121-inch OD) pipes.

Unit of Measure: Cubic Yard (CY)

1.3.8 Pipe Bedding (Line Item 1013)

1.3.8.1 Payment

Payment will be made for costs associated with furnishing and placement of the bedding for the pipeline, as specified in Section 31 23 00.00 20 - EXCAVATION, FILL, BACKFILL AND EMBANKMENT FOR STRUCTURES.

1.3.8.2 Measurement

Bedding for the pipes will be measured for payment by the ton (TN) (2,000 pounds) by weighing each truckload to the nearest 0.1 ton, and the final quantity of the whole sum will be rounded to the nearest whole ton. The bedding will be measured for payment by being weighed on approved scales before being placed in the work.

Unit of Measure: Ton (TN) (2,000 pounds).

1.3.9 Aggregate Surface Course (Line Item 1014)

1.3.9.1 Payment

Payment will be made for costs associated with furnishing and placement of the aggregate surface course for the access road, access road at the manways, and access road to the surge tanks, as specified in Section 32 11 23 - AGGREGATE COURSE.

1.3.9.2 Measurement

The aggregate surfacing will be measured by the ton (2000 pounds) by weighing each truckload to the nearest 0.1 ton, and the final quantity of the whole sum will be rounded to the nearest whole ton. The aggregate surfacing will be measured for payment by being weighed on approved scales before being placed in the work.

Unit of measure: Ton(2,000 pounds) .

1.3.10 Geotextile (Line Item 1015)

1.3.10.1 Payment

Payment will be made for the costs associated with the furnishing and placement of the geotextile for the aggregate surfacing, as specified in Section 31 05 22- GEOTEXTILES USED AS FILTERS.

1.3.10.2 Measurement

The unit of measurement for the placement of this item will be the square yard. The area to be paid for will be the number of square yards of material measured in its final position.

Unit of Measure: Square Yard (SY)

1.3.11 Turfing (Line Item 1016)

1.3.11.1 Payment

Payment will be made for costs associated with the seeding and fertilizing and mulching of embankments and disturbed portions of the right-of-way, as specified in Section 32 92 19 - SEEDING AND FERTILIZING. Separate excavation, hauling, and spreading or piling of topsoil and related miscellaneous operations will be considered subsidiary obligations of the Contractor, covered under the contract unit price for turfing.

1.3.11.2 Measurement

Turfing will be measured in acres of areas actually seeded and fertilized and mulched.

Unit of Measure: Acre (AC)

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals." Submittals requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Submittals which are required prior to start of construction (work) issuance of contract notice to proceed or commencing work on site or the start of the next major phase of the construction on a multi-phase contract, includes schedules, tabular list of data, or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

Certificates of insurance

Surety bonds

List of proposed Subcontractors

List of proposed products

Construction Progress Schedule

Network Analysis Schedule (NAS)

Submittal register

Schedule of prices

Health and safety plan

Work plan

Quality Control (QC) plan

Environmental protection plan

Accident Prevention Program

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

#### SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

#### SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

Design submittals, design substantiation submittals and extensions of design submittals.

#### SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

#### 1.1.2 Approving Authority

Approving authority rests with the Contracting Officer and his/her Authorized Representative(s). Approval actions and correspondence with the Contractor shall be made through the Wynne Area Office.

#### 1.1.3 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, except those SD-01 Pre-Construction Submittals noted above, construction, materials,

products, equipment, and systems incorporated or to be incorporated in such construction.

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with this section.

### SD-01 Preconstruction Submittals

#### Submittal Register; G

## 1.3 SUBMITTAL REGISTER

Submit the submittal register at least seven days prior to the prework conference. Verify that all submittals required for the project are listed and add any missing submittals. Complete the following on the register:

Column (g) Contractor Submit Date: Scheduled date for approving authority to receive submittals.

Column (h) Contractor Approval Date: Date Contractor needs approval of submittal.

### 1.3.1 Government Approved G

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Government approval is required for any deviations from the Solicitation or Accepted Proposal and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled, "Specifications and Drawings for Construction," they are considered to be "shop drawings."

### 1.3.2 Designer of Record Approved/Government Conformance Review (DA/CR)

#### 1.3.2.1 Deviations to the Accepted Design

Designer of Record approval and the Government's concurrence are required for any proposed deviation from the accepted design which still complies with the contract before the Contractor is authorized to proceed with material acquisition or installation. Within the terms of the Contract Clause entitled, "Specifications and Drawings for Construction", they are considered to be "shop drawings." If necessary to facilitate the project schedule, the Contractor and the DOR may discuss a submittal proposing a deviation with the Contracting Officer's Representative prior to officially submitting it to the Government. However, the Government reserves the right to review the submittal before providing an opinion, if deemed necessary. In any case, the Government will not formally agree to or provide a preliminary opinion on any deviation without the DOR's approval or recommended approval. The Government reserves the right to non-concur with any deviation from the design, which may impact furniture, furnishings, equipment selections or operations decisions that were made, based on the reviewed and concurred design.

### 1.3.3 Designer of Record Approved/Government Approved (DA/GA)

In addition to the above stated requirements for proposed deviations to the accepted design, both Designer of Record and Government Approval and, where applicable, a contract modification are required before the Contractor is authorized to proceed with material acquisition or installation for any proposed variation to the contract (the solicitation and/or the accepted proposal), which constitutes a change to the contract terms. Within the terms of the Contract Clause entitled, "Specifications and Drawings for Construction," they are considered to be "shop drawings." The Government reserves the right to accept or reject any such proposed deviation at its discretion.

#### 1.3.4 Information Only

Submittals not requiring Government approval will be for information only. For Design-build construction all submittals not requiring Designer of Record or Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

#### 1.4 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

Submittals Required from the Contractor

Update the following fields.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code

Column (k): Date of action used to record Contractor's review when forwarding submittals to Area Engineer.

Column (l) List date of submittal transmission.

Column (q) List date approval received.

#### 1.5 PREPARATION

##### 1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels to office of approving authority. Transmit submittals with transmittal form prescribed by Contracting Officer and standard for project. On the transmittal form identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled, "Identifying Submittals," of this section.

Use the attached sample transmittal form (ENG Form 4025) for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms [will be furnished to the Contractor] [are included in the QCS software that the Contractor is required to use for this contract]. Properly complete this form by filling out all the heading blank spaces and identifying each item submitted. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item.

### 1.5.2 Identifying Submittals

When submittals are provided by a Subcontractor, the Prime Contractor is to prepare, review and stamp with Contractor's approval all specified submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

- a. Project title and location.
- b. Construction contract number.
- c. Date of the drawings and revisions.
- d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other subcontractor associated with the submittal.
- e. Section number of the specification section by which submittal is required.
- f. Submittal description (SD) number of each component of submittal.
- g. When a resubmission, add alphabetic suffix on submittal description, for example, submittal 18 would become 18A, to indicate resubmission.
- h. Product identification and location in project.

### 1.5.3 Format for SD-02 Shop Drawings

Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Drawings are to be suitable for reproduction and be of a quality to produce clear, distinct lines and letters with dark lines on a white background.

Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled, "Identifying Submittals," of this section.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, no smaller than 4" inches on the right hand side of each sheet for the Government disposition stamp.

Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Include the nameplate data, size and capacity on drawings. Also include

applicable federal, military, industry and technical society publication references. The contractor shall submit all submittals in PDF format in addition to hard copies.

#### 1.5.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.

Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project, with information and format as required for submission of SD-07 Certificates.

Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will [not] be accepted for expedition of construction effort.

Submit manufacturer's instructions prior to installation.

#### 1.5.5 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

#### 1.5.6 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.

Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

#### 1.5.7 Format of SD-01 Preconstruction Submittals and SD-11 Closeout

## Submittals

When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

### 1.6 QUANTITY OF SUBMITTALS

#### 1.6.1 Number of Copies of SD-02 Shop Drawings

Submit six copies of submittals of shop drawings requiring review and approval only by QC organization and seven copies of shop drawings requiring review and approval by Contracting Officer.

#### 1.6.2 Number of Copies of SD-03 Product Data

Submit in compliance with quantity requirements specified for shop drawings.

#### 1.6.3 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

#### 1.6.4 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

#### 1.6.5 Number of Copies of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

Unless otherwise specified, submit three sets of administrative submittals.

### 1.7 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

### 1.8 VARIATIONS

Variations from contract requirements require both Designer of Record (DOR) and Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

#### 1.8.1 Considering Variations

Discussion with Contracting Officer prior to submission, after consulting with the DOR, will help ensure functional and quality requirements are met

and minimize rejections and re-submittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

#### 1.8.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government, including the DOR's written analysis and approval. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

Check the column "variation" of ENG Form 4025 for submittals which include proposed deviations requested by the Contractor. Set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

#### 1.8.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor, including its Designer(s) of Record, warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

#### 1.8.4 Review Schedule Is Modified

In addition to normal submittal review period, a period of 10 working days will be allowed for consideration by the Government of submittals with variations.

### 1.9 SUBMITTAL REGISTER AND DATABASE

Prepare and maintain submittal register, as the work progresses. Use electronic submittal register program furnished by the Government or any other format. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by Government; retain data which is output in columns (a), (g), (h), and (i) as approved. A submittal register showing items of equipment and materials for which submittals are required by the specifications is provided as an attachment. This list may not be all inclusive and additional submittals may be required. Maintain a submittal register for the project in accordance with Section 01 45 02.00 11 QUALITY CONTROL SYSTEM (QCS) (BASE BID). The Government will provide the initial submittal register in electronic format with the following fields completed, to the extent that will be required by the Government during subsequent usage.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD No. and type,

e.g. SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting project requirements.

Column (f): Indicate approving authority for each submittal.

The database and submittal management program will be furnished to Contractor on a Writable Compact Disk (CD-R), for operation on Windows based personal computer.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Government.

The Designer of Record shall develop a complete list of submittals during design and identify required submittals in the specifications, and use the list to prepare the Submittal Register. The list may not be all inclusive and additional submittals may be required by other parts of the contract. The Contractor is required to complete the submittal register and submit it to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The approved submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period. Coordinate the submit dates and need dates with dates in the Contractor prepared progress schedule. Submit monthly or until all submittals have been satisfactorily completed, updates to the submittal register showing the Contractor action codes and actual dates with Government action codes. Revise the submittal register when the progress schedule is revised and submit both for approval.

#### 1.9.1 Use of Submittal Register

Submit submittal register as an electronic database, using submittals management program furnished to Contractor. Submit with QC plan and project schedule. Verify that all submittals required for project are listed and add missing submittals. Coordinate and complete the following fields on the register database submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for approving authority to receive submittals.

Column (h) Contractor Approval Date: Date Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

#### 1.9.2 Contractor Use of Submittal Register

Update the following fields[ in the Government-furnished submittal register program or equivalent fields in program utilized by Contractor] with each submittal throughout contract.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) List date of submittal transmission.

Column (q) List date approval received.

#### 1.9.3 Approving Authority Use of Submittal Register

Update the following fields[ in the Government-furnished submittal register program or equivalent fields in program utilized by Contractor].

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (l) List date of submittal receipt.

Column (m) through (p) List Date related to review actions.

Column (q) List date returned to Contractor.

#### 1.9.4 Action Codes

Entries for columns (j) and (o), are to be used are as follows (others may be prescribed by Transmittal Form):

##### 1.9.4.1 Government Review Action Codes

"A" - "Approved as submitted"; "Completed"

"B" - "Approved, except as noted on drawings"; "Completed"

"C" - "Approved, resubmission required"; "Resubmit"

"D" - "Returned by correspondence"; "Completed"

"E" - "Disapproved (See attached)"; "Resubmit"

"F" - "Receipt acknowledged"; "Completed"

"G" - "Other (Specify)"; "Resubmit"

"X" - "Receipt acknowledged, does not comply"; "Resubmit"

##### 1.9.4.2 Contractor Action Codes

NR - Not Received

AN - Approved as noted

A - Approved

RR - Disapproved, Revise, and Resubmit

#### 1.9.5 Copies Delivered to the Government

Deliver one copy of submittal register updated by Contractor to Government with each invoice request. Deliver in electronic format, unless a paper copy is requested by Contracting Officer.

#### 1.10 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

- a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirements.
- b. Submittals called for by the contract documents will be listed on the register. If a submittal is called for but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but which have been omitted from the register or marked "N/A."
- c. Re-submit register and annotate monthly by the Contractor with actual submission and approval dates. When all items on the register have been fully approved, no further re-submittal is required.
- d. Carefully control procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."
- e. Except as specified otherwise, allow review period, beginning with receipt by approving authority, that includes at least 15 working days for submittals for QC Manager approval and 20 working days for submittals for Contracting Officer approval. Period of review for submittals with Contracting Officer approval begins when Government receives submittal from QC organization.
- f. For submittals requiring review by fire protection engineer, allow review period, beginning when Government receives submittal from QC organization, of 30 working days for return of submittal to the Contractor.
- g. Period of review for each resubmittal is the same as for initial submittal.

Within 15 calendar days of notice to proceed at the Preconstruction conference, provide, for approval by the Contracting Officer, the following schedule of submittals:

- h. A schedule of shop drawings and technical submittals required by the specifications and drawings. Indicate the specification or drawing reference requiring the submittal; the material, item, or process for which the submittal is required; the "SD" number and identifying title of the submittal; the Contractor's anticipated submission date and the approval need date.
- i. A separate schedule of other submittals required under the contract but

not listed in the specifications or drawings. Schedule will indicate the contract requirement reference; the type or title of the submittal; the Contractor's anticipated submission date and the approved need date (if approval is required).

#### 1.10.1 Reviewing, Certifying, Approving Authority

The QC organization is responsible for reviewing and certifying that submittals are in compliance with contract requirements. Approving authority on submittals is QC Manager unless otherwise specified for specific submittal. At each "Submittal" paragraph in individual specification sections, a notation "G," following a submittal item, indicates Contracting Officer is approving authority for that submittal item.

#### 1.10.2 Constraints

Conform to provisions of this section, unless explicitly stated otherwise for submittals listed or specified in this contract.

Submit complete submittals for each definable feature of work. Submit at the same time components of definable feature interrelated as a system.

When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.

Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

#### 1.10.3 QC Organization Responsibilities

- a. Note date on which submittal was received from Contractor on each submittal.
- b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.
- c. Review submittals for conformance with project design concepts and compliance with contract documents.
- d. Act on submittals, determining appropriate action based on QC organization's review of submittal.
  - (1) When QC Manager is approving authority, take appropriate action on submittal from the possible actions defined in paragraph entitled, "Approved/Accepted Submittals," of the section."
  - (2) When Contracting Officer is approving authority or when variation has been proposed, forward submittal to Government with certifying statement or return submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of submittal determines appropriate action.
- e. Ensure that material is clearly legible.
- f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first

sheet only.

- (1) When approving authority is Contracting Officer, QC organization will certify submittals forwarded to Contracting Officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with contract Number \_\_\_\_\_, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer \_\_\_\_\_, Date \_\_\_\_\_  
(Signature when applicable)

Certified by QC Manager \_\_\_\_\_, Date \_\_\_\_\_"  
(Signature)

- (2) When approving authority is QC Manager, QC Manager will use the following approval statement when returning submittals to Contractor as "Approved" or "Approved as Noted."

"I hereby certify that the (material) (equipment) (article) shown and marked in this submittal and proposed to be incorporated with contract Number \_\_\_\_\_, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is approved for use.

Certified by Submittal Reviewer \_\_\_\_\_, Date \_\_\_\_\_  
(Signature when applicable)

Approved by QC Manager \_\_\_\_\_, Date \_\_\_\_\_"  
(Signature)

- g. Sign certifying statement or approval statement. The QC organization member designated in the approved QC plan is the person signing certifying statements. The use of original ink for signatures is required. Stamped signatures are not acceptable.
  - h. Update submittal register [database ]as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by Contracting Officer.
  - i. Retain a copy of approved submittals at project site, including Contractor's copy of approved samples.
- 1.11 GOVERNMENT APPROVING AUTHORITY

When approving authority is Contracting Officer, the Government will:

- a. Note date on which submittal was received from QC Manager.
- b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.
- c. Identify returned submittals with one of the actions defined in paragraph entitled, "Review Notations," of this section and with markings appropriate for action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date approved submittals. 4 copies of the approved submittal will be retained by the Contracting Officer and two copies of the submittal will be returned to the Contractor. If the Government performs a conformance review of other Designer of Record approved submittals, the submittals will be so identified and returned, as described above.

#### 1.11.1 Review Notations

Contracting Officer review will be completed within 30 calendar days after date of submission. Submittals will be returned to the Contractor with the following notations:

- a. Submittals marked "approved" or "accepted" authorize the Contractor to proceed with the work covered.
- b. Submittals marked "approved as noted" "or approved except as noted, resubmittal not required," authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.
- c. Submittals marked "not approved" or "disapproved," or "revise and resubmit," indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.
- d. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

#### 1.12 DISAPPROVED OR REJECTED SUBMITTALS

Contractor shall make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the clause entitled, "Changes," is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

#### 1.13 APPROVED/ACCEPTED SUBMITTALS

The Contracting Officer's approval or acceptance of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing and other information are satisfactory. Design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal.

Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work design, dimensions, all design extensions, such as the design of adequate connections and details, etc., and the satisfactory construction of all work.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

#### 1.14 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained. No payment for materials incorporated in the work will be made if all required Designer of Record or required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

#### 1.15 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR  (Firm Name)
_____ Approved
_____ Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

For design-build construction, both the Contractor Quality Control System Manager and the Designer of Record are to stamp and sign to certify that the submittal meets contract requirements.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

## SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Grand Prairie Discharge Pipe Sta 13+50 To Sta 22+00

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR A/E REVIEWER CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		MAILED TO CONTR/ DATE RCD FRM APPR AUTH
		01 33 00	SD-01 Preconstruction Submittals														
			Submittal Register	1.9	G												
		01 57 25.00 11	SD-07 Certificates														
			Mill Certificate or Affidavit	4.2.4.1	G												
		03 15 13.00 10	SD-02 Shop Drawings														
			Waterstops	2.1	G												
			SD-03 Product Data														
			Waterstops	2.1													
			SD-07 Certificates														
			Waterstops	2.1													
		03 30 53	SD-03 Product Data														
			Air-Entraining Admixture; GA														
			Reinforcing Steel; GA														
			Mix Design Data; GA														
			Accessories	2.5													
			Concrete														
			SD-06 Test Reports														
			Aggregates; GA														
			Concrete Mixture Proportions;														
			GA														
			Compressive Strength Testing;														
			GA														
			Slump														
			SD-07 Certificates														
			Cementitious Materials; FIO														

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Grand Prairie Discharge Pipe Sta 13+50 To Sta 22+00

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		MAILED TO CONTR/ DATE RCD FRM APPR AUTH
		03 30 53	CPG for recycled materials or appropriate Waiver Form; FIO														
			Aggregates	2.1.2													
			Bill of Lading; FIO														
		05 50 04.00 10	SD-03 Product Data														
			Miscellaneous Metals and Standard Metal Articles		G												
			Shop Fabricated Metal Items		G												
			SD-06 Test Reports														
			Miscellaneous Metals and Standard Metal Articles														
			GA														
			Shop Fabricated Metal Items		G												
		05 50 13	SD-04 Samples														
			Miscellaneous Metal Items		G												
		23 03 00.00 20	SD-03 Product Data														
			Certification														
		27 21 10.00 10	SD-02 Shop Drawings														
			Fiber Optic System		G												
			Installation		G												
			Record Drawings; G		G												
			SD-03 Product Data														
			Acceptance Tests; G														
			SD-06 Test Reports														
			Acceptance Tests; G														
			SD-07 Certificates														

## SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Grand Prairie Discharge Pipe Sta 13+50 To Sta 22+00

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVTOR CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		27 21 10.00 10	Fiber Optical Cable; G Qualifications; G														
		31 05 22	SD-04 Samples Geotextile	2.1.1													
			SD-07 Certificates Geotextile	2.1.1													
		31 11 00	SD-03 Product Data Nonsaleable Materials	3.6.2	G												
			SD-04 Samples Tree wound paint	2.1													
			Herbicide	2.2													
		31 23 00.00 20	SD-06 Test Reports Laboratory Density Test (ASTM D698)														
			Field Density tests Moisture Content Tests														
		31 62 16.16	SD-02 Shop Drawings H Pile Handling and Storage Plan FIO Control of Placement Plan														
			SD-03 Product Data Pile Driving Hammer and Driving System Components;		G												
		32 11 23	SD-03 Product Data Plant, Equipment, and Tools Waybills and Delivery Tickets														

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Grand Prairie Discharge Pipe Sta 13+50 To Sta 22+00

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		32 11 23	SD-06 Test Reports														
			Sampling and Testing		G												
			Field Density Tests		G												
		32 31 13	SD-02 Shop Drawings														
			Fence Assembly														
			FIO														
			Location of Gate, Corner, End, and Pull Posts	3.18.1													
			Gate Assembly														
			SD-07 Certificates														
			Certificates of Compliance	1.5.2													
			FIO														
		33 71 02.00 20	SD-01 Preconstruction Submittals														
			Manufacturer's Catalog Data														
			Materials and Equipment; G														
		35 31 19.00 11	SD-04 Samples														
			Representative Sample	2.2.2													
			SD-05 Design Data														
			Gradation Data	2.1.5													
			SD-06 Test Reports														
			Records and Tests	1.4													
			Test & Service Records	2.1.2													
			Plots on the Gradation Graph	2.1.5	GConst												
			Certified Test Report	2.2.2													

SECTION 01 57 25.00 11

STORM WATER POLLUTION PREVENTION PLAN

GRAND PRAIRIE AREA DEMONSTRATION PROJECT  
DISCHARGE PIPES FROM PIPELINE STATION 13+50 TO STATION 22+00  
OPTION 1  
STORM WATER POLLUTION PREVENTION PLAN  
FOR STORM WATER GENERAL PERMIT  
U.S. ARMY CORPS OF ENGINEERS, MEMPHIS DISTRICT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 4439	(2004) Geosynthetics
ASTM D 4491	(1999; R 2004e1) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(2004) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 2003) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM D 4873	(2002) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

1.2 GENERAL

In the event that this Option 1 is awarded along with the Base Bid, then the Contractor shall include the additional area and job specific requirements contained in this document within the storm water pollution prevention plan as required under Section 01 57 20.00 11 ENVIRONMENTAL PROTECTION of the Base Bid. These requirements will also be included with the Base Bid requirements in the National Pollution Discharge Elimination System (NPDES) permit.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

## SD-07 Certificates

Mill Certificate or Affidavit; G

Certificate attesting that the Contractor has met all specified requirements.

### 1.4 EROSION AND SEDIMENT CONTROLS

The controls and measures required by the Contractor are described below.

#### 1.4.1 Stabilization Practices

The stabilization practices to be implemented shall include silt fences, and check dams, etc. On his daily CQC Report, the Contractor shall record the dates when the major grading activities occur, (e.g., excavation and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Where construction activities have temporarily or permanently ceased, except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, stabilization practices shall be initiated within 14 days.

##### 1.4.1.1 Unsuitable Conditions

Where the initiation of stabilization measures is precluded by unsuitable conditions caused by the weather, stabilization practices shall be initiated as soon as practicable (at least by the 14th day) after conditions become suitable.

##### 1.4.1.2 No Activity for Less Than 21 Days

Where construction activity will resume on a portion of the site within 21 days from when activities ceased (e.g., the total time period that construction activity is temporarily ceased is less than 21 days), then stabilization practices do not have to be initiated on that portion of the site by the fourteenth day after construction activity temporarily ceased.

## PART 2 LOCATION AND NATURE OF ACTIVITY

The Contractor shall implement and diligently pursue all measures required by this Storm Water Pollution Prevention Plan (SWPPP). The purpose of the SWPPP is to control soil erosion and the resulting sediment to the extent necessary to prevent sediment from leaving the contract rights-of-way and prevent pollution of any water body caused by the runoff from the areas of construction activities under this contract. The Contractor shall review the SWPPP to determine requirements for compliance. In addition, the Contractor shall ascertain that his subcontractors have reviewed the plan, and that they comply with its provisions. The Contractor shall ensure that all subcontractors sign the appropriate certification form(s) located at the end of this section.

This project consists of approximately 30 acres in Prairie County, City of Devalls Bluff, Arkansas. Work on this project shall consist of: construction of discharge pipeline consisting of two 120 ID pipelines; cathodic protection, fiber optics and miscellaneous construction items including an aggregate access road along the pipeline and seeding and fertilizing. A set of construction drawings showing the project location,

details of the pipeline installation, and the details of installation of the environmental protection measures will be located on the construction site at all times.

No endangered species or their habitat will be adversely impacted by the project.

#### PART 3 AREA AFFECTED

The total area of the site, within the right-of-way limits, is approximately thirty acres, of which twenty-eight acres may be disturbed during construction.

#### PART 4 CONTROL OF POLLUTANTS DURING CONSTRUCTION

Non-structural and/or structural measures shall be identified and constructed in a timely manner to minimize the introduction of sediment into the receiving water body as a result of storm water runoff. Controls shall be put in place prior to disturbance of soil and maintained until soils are stabilized.

##### 4.1 NON-STRUCTURAL MEASURES

###### 4.1.1 General

Prior to the beginning of any construction, the Contracting Officer will identify all land resources to be preserved within the right-of-way. The Contractor shall provide effective protection for land, water and vegetation resources at all times. The Contractor shall construct or install temporary and/or permanent erosion and sedimentation control features as indicated herein, and as shown on the plans, to minimize pollutants entering ditch, other water bodies, or wetlands. The Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms outside the construction right-of-way and in areas designated not to be disturbed on the construction drawings. Trees, shrubs, vines, grasses, landforms and other landscape features indicated and defined on the contract drawings or as directed by the Contracting Officer to be preserved shall be clearly identified by marking, fencing, wrapping with boards, or other approved techniques.

###### 4.1.2 Reduction of Exposure of Unprotected Erodible Soils

All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Vegetative ground cover shall not be destroyed, removed or disturbed more than 20 calendar days prior to grading or earth moving. Clearing shall progress in reasonably sized increments as needed to use the areas developed. To the extent feasible, material embankments, side slopes, back slopes, berms and any other exposed surfaces shall be stabilized by temporary seeding, mulching, fabric mats or other approved stabilization methods, as soon as possible after material placement, or within 14 days on areas that will remain unfinished more than 21 calendar days. Should construction be halted, for any reason, temporarily or permanently, for more than 21 days, in any portion of the site, temporary or permanent turfing measures, or other approved temporary stabilization of exposed areas, such as mulching, shall be accomplished within 14 days after construction is halted.

##### 4.2 STRUCTURAL MEASURES

#### 4.2.1 General

Structural practices shall be implemented to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Temporary erosion and sediment control measures such as silt fences, erosion control berms, check dams, and sedimentation basins shall be constructed and maintained until permanent drainage and erosion control facilities are complete and operative. Placement of perimeter controls shall commence with initiation of construction and shall remain in effect during the remainder of construction until final stabilization of those portions of the site upward of the perimeter control. Temporary erosion controls shall be maintained until final stabilization of exposed areas, after which they shall be removed. All structural devices shall be constructed in accordance with the standard drawing, TEMPORARY EROSION CONTROL DEVICES. The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures.

#### 4.2.2 Erosion Control Berm

The Contractor shall provide an erosion control berm as a temporary structural measure to minimize erosion and sediment runoff. Soil shall be placed along right top bank to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, grading) in each independent runoff area. Erosion control berms shall be adequately compacted to prevent failure. The minimum height measured from the top of the berm to top bank shall be 2 feet. The minimum base width shall be 6 feet and the minimum top width shall be 2 feet. The Contractor shall ensure that the erosion control berms are not damaged by construction operations or traffic. The erosion control berm shall be erected as work progresses. Erosion control berms shall be removed as needed for work to progress in the drainage area. Final removal of erosion control berms shall be upon approval by the Contracting Officer.

##### 4.2.2.1 Installation of Erosion Control Berm

The erosion control berm shall be constructed to the lines and grades as indicated in the paragraph entitled EROSION CONTROL BERM above; however, a tolerance of two-tenths of one foot above or below the prescribed grade and section will be allowed unless otherwise directed by the Contracting Officer. At no time shall there be any abrupt humps or depressions in the surface of the berm. No brush, tree roots, sod or other objectionable material shall be placed in the berm. The Contractor shall remove any material that the Contracting Officer considers to be objectionable. Holes shall be backfilled with suitable material compacted to the density of the adjoining berm. The berm shall be placed in layers not to exceed one foot. It is intended that the fill material shall be placed in the embankment at its natural moisture content. Each layer of permanent embankment placed shall be compacted by at least three passes of a crawler-type tractor weighing at least 20,000 pounds and exerting a unit tread pressure of not less than six pounds per square inch, or other

approved compacting equipment. A pass shall consist of one complete treatment of the surface of a layer by the treads of the tractor or other approved compacting equipment. Within 14 days following the placement of the erosion control berm, the berm shall be seeded in accordance with Section 32 92 32.00 11 ESTABLISHMENT OF TURF.

#### 4.2.2.2 Erosion Control Maintenance

Erosion control berms shall be inspected in accordance with the paragraph entitled INSPECTIONS. Close attention shall be paid to the repair of damaged erosion control berms and necessary repairs shall be accomplished promptly. When erosion control berms are no longer required, they shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section 32 92 32.00 11 ESTABLISHMENT OF TURF. In the event that the erosion control berms begin to erode into the channel, the Contractor shall take action on the day that the erosion is noted, and protect the channel by installing straw bales at such locations as are necessary.

#### 4.2.3 Check Dams

The Contractor shall provide check dams made of sand bags and/or riprap as a temporary structural measure to minimize erosion and sediment runoff. Check dams shall be installed to effectively retain sediment immediately after completing each phase of work in each independent runoff area. Check dams shall be placed as work progresses, and shall be removed/replaced/relocated as needed for work to progress in the drainage area. Final removal of the check dams shall be upon approval by the Contracting Officer. Check dams shall be provided perpendicular to the flow in the bottom of existing and new drainage ditches, channels, swales, etc. that traverse disturbed areas or carry runoff from disturbed areas. Check dam rows shall be spaced a maximum of 200 feet apart when slopes are equal to or less than 5 percent and 100 feet apart when slopes are steeper than 5 percent.

##### 4.2.3.1 Check Dams Constructed of Sand Bags or Riprap

The number and arrangement of sand bags or riprap may vary with on-site conditions; however, check dams shall be placed with ends of adjacent sand bags tightly abutting one another lengthwise. When a second vertical row of sand bags is warranted, they shall be installed in such a way that the joints overlap. At the end of each row, a group of sand bags shall be turned uphill to retain sediment. The sand bag barrier shall be entrenched and backfilled. A trench shall be excavated the width of a sand bag and the length of the proposed barrier to a minimum depth of 4 inches. After the sand bags are in place, the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier.

##### 4.2.3.2 Installation of Check Dam

Check dams shall be installed to effectively retain sediment. Check dams shall be provided perpendicular to the flow in the bottom of existing and new drainage ditches, channels, swales, etc. that traverse disturbed areas or carry runoff from disturbed areas. Check dam rows shall be spaced a maximum of 200 feet apart when slopes are equal to or less than 5 percent and 100 feet apart when slopes are steeper than 5 percent.

#### 4.2.4 Silt Fences

Silt fences shall be constructed as a temporary structural measure to minimize erosion and sediment runoff. Silt fences shall be properly installed to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). All necessary efforts shall be employed to minimize the entry of excavated material into ditch, other water bodies, or wetlands. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. Sediment removal shall include removal and disposition in a location where it will not erode into construction areas, watercourses or wetlands. When a silt fence is no longer required, it shall be removed. Final removal of silt fence barriers shall be upon approval by the Contracting Officer. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with the paragraph ESTABLISHMENT OF TURF below.

##### 4.2.4.1 Components for Silt Fences

###### a. Filter Fabric

The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

###### FILTER FABRIC FOR SILT FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile Elongation (%)	ASTM D 4632	100 lbs. min. 30 % max.
Trapezoid Tear	ASTM D 4533	55 lbs. min.
Permittivity	ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D 4751	20-100

###### b. Silt Fence Stakes and Posts

The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction shall have a minimum cross section of 2 inches by 2 inches when oak is used and 4 inches by 4 inches when pine is used, and shall have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized

for silt fence construction shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 5 feet.

c. Mill Certificate or Affidavit

A mill certificate or affidavit shall be provided attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

d. Identification Storage and Handling

Filter fabric shall be identified, stored and handled in accordance with ASTM D 4873.

4.2.4.2 Installation of Silt Fences

Silt fences shall extend a minimum of 16 inches above the ground surface and shall not exceed 34 inches above the ground surface. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 6 inch overlap, and securely sealed. A trench shall be excavated approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4-inch by 4-inch trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

4.2.4.3 Maintenance of Silt Fences

Silt fences shall be inspected in accordance with the paragraph entitled INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with the paragraph ESTABLISHMENT OF TURF below.

4.2.5 Construction Entrance/Exit

A stabilized construction entrance/exit is implemented to reduce the tracking of sediment onto public rights of way or streets by construction vehicles. The construction entrance/exit is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving the construction site to or from a public right of way, street, alley, sidewalk or parking area. Reducing tracking of sediments and other pollutants onto paved roads helps prevent disposition of sediments into local storm drains and waterways as well as the production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance shall be used. NPDES permits require that

appropriate measures be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments derived from mud and dirt carried out from unpaved roads and construction sites.

The construction entrance/exit shall be near the intersection of Webb Lake Road and the existing project access road.

#### 4.2.6 Other Measures

Other temporary erosion and sediment control measures such as dikes, swales, and drains may be used with, or in lieu of, the above-mentioned measures provided they are consistent with Best Management Practices (BMPs). They shall be maintained until permanent drainage and erosion control facilities are complete and operative. Earthen erosion control features shall be compacted and stabilized immediately with vegetation in accordance with the paragraph ESTABLISHMENT OF TURF below.

#### 4.2.7 Velocity Dissipation Devices

Should drains or swales be used, they shall be constructed with velocity dissipation devices (check dams) to reduce the need for more stringent erosion control practices in the swale or drain. These devices shall be removed after the erosive areas have been stabilized.

#### 4.3 ALLOWABLE NON-STORMWATER DISCHARGES

The following non-stormwater discharges during construction may be authorized by the storm water permit:

- a. Fire fighting activities
- b. Fire hydrant flushings
- c. Water used to wash vehicles (where detergents or other chemicals are not used)
- d. Water used to control dust
- e. Potable water sources including uncontaminated waterline flushings
- f. Landscape Irrigation
- g. Routine external building wash down which does not use detergent or chemicals
- h. Pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled materials have been removed) and where detergents or other chemicals are not used
- i. Uncontaminated air conditioning, compressor condensate
- j. Uncontaminated springs, excavation dewatering and groundwater
- k. Foundation or footing drains where flows are not contaminated with process material such as solvents

### PART 5 CONTROL OF POLLUTANTS AFTER CONSTRUCTION

#### 5.1 ESTABLISHMENT OF TURF

##### 5.1.1 General

Turf shall be established as a permanent erosion control measure along any areas which are disturbed during construction, except where other erosion control measures are specified. All material embankments, all berm areas, and any other disturbed areas shall be turfed. Turf shall be established in accordance with Section 32 92 32.00 11 ESTABLISHMENT OF TURF.

## 5.2 STATE AND LOCAL CONTROLS

There are no known State or local erosion and sediment control requirements applicable to this work other than those met by the requirements of this permit. In the event that there are State or local erosion and sediment control requirements, it shall be the responsibility of the Contractor to identify and comply with all applicable requirements. Chemical and solid waste units shall be used at the site, with disposal in accordance with State and local regulations. Measures shall be in place to ensure compliance with State and local waste disposal, sanitary sewer, or septic system regulations. Water Quality Standards of receiving streams shall be maintained during and after construction in accordance with requirements of the State Water Quality Certification.

## PART 6 RUNOFF COEFFICIENT, IMPERVIOUS AREAS, SOILS

The Rational Method runoff coefficient immediately prior to construction is estimated to range between 0.10 and 0.30. Once the material embankment and other disturbed areas have been re-vegetated, the runoff coefficient should remain in approximately the same range with no increase in impervious areas. Soils in the area are a sand-silt material. For further information regarding soil borings contact the Memphis District Office of the U.S. Army Corps of Engineers. POC: Cory Williams (901-544-0667)

## PART 7 RECEIVING WATER

The receiving water is the White River in Prairie County, Arkansas. The only existing surface waters within construction right-of-way limits are waters in low lying areas. There are no TMDLs applicable for the immediate receiving waters and since control measures will be in place to minimize sediment discharge, the impact upon the ultimate receiving stream will be negligible. No non-storm water discharges are anticipated to be combined with storm water runoff.

## PART 8 INSPECTIONS

### 8.1 GENERAL

The Contractor's Quality Control Representative shall inspect disturbed areas of the construction site, areas used for storage of materials that are exposed to precipitation that have not been finally stabilized, stabilization practices, structural practices, other controls, and area where vehicles exit the site twice every calendar week and at least 72 hours apart. The site shall also be inspected within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Where sites have been finally stabilized, inspections shall be conducted at least once every month. Inspections will be documented on state forms provided to the Contractor. The Contractor shall, at his own expense, utilize a technically competent person that has successful training in SWPP requirements and possesses a certification from a state course (such as Fundamentals of Erosion Prevention and Sediment Control provided through Tennessee) or a national SWPPP course. The certification shall suffice that this person is technically proficient in the practice of erosion prevention and sediment control. The Contractor may meet this requirement through an employee that is certified or by hiring an individual or company that possesses said certification. A copy of the individual's certification must be provided to the Contracting Officer at the time of the Contractor's submittal of the SWPPP.

## 8.2 DISTURBED AREAS AND AREAS USED FOR MATERIAL STORAGE

Disturbed areas and areas used for material storage that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the plan shall be observed to ensure correct operation. Discharge locations or discharge points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impact to receiving waters. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site sediment tracking.

## 8.3 MODIFICATION OF POLLUTION PLAN

Based on the results of the inspection referenced in the paragraph entitled DISTURBED AREAS AND AREAS USED FOR MATERIAL STORAGE, the site description identified in Part 1 and Part 2 of this plan shall be revised as appropriate, but in no case more than seven calendar days following the inspection. Such modification shall provide for timely implementation of any changes to the plan within seven calendar days following the inspection. Contractor shall modify the SWPPP based on the inspection report, state recognized Best Management Practices, and in efforts to remain in consistent compliance

## 8.4 REPORTS

For each inspection conducted, the Contractor shall prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the SWPPP, maintenance performed, and actions taken. The report shall be furnished to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's Daily CQC REPORT. A copy of the inspection report shall be maintained on the job site. Further, the Contracting Officer shall retain a copy of the report for at least three years from the date the site is finally stabilized.

## PART 9 OTHER CONSIDERATIONS

### 9.1 LOCATION OF CONSTRUCTION IN REGARD TO WATERS CLASSIFIED IN 10 CSR 20-7.013

Construction is not within 1,000 feet of waters classified in 10 CSR 20-7.013, Water Quality Standards, as:

- a. Public drinking water supply lakes
- b. Outstanding National Resource Waters
- c. Outstanding State Resource Waters
- d. Streams designated for cold water sport fishery
- e. A lake in EPA's Clean Lakes Program

### 9.2 PROXIMITY OF SITE TO MAJOR RESERVOIRS

Construction is not within 100 feet of waters classified as major reservoirs.

## PART 10 DEFINITIONS

### 10.1 BEST MANAGEMENT PRACTICES (BMPs)

Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. BMPs also include treatment requirements, operation procedures and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

#### 10.2 COMMENCEMENT OF CONSTRUCTION

The initial disturbance of soils associated with clearing and grubbing, or other construction activities.

#### 10.3 DRAINAGE SWALE

A drainage way with a lining of grass, riprap, asphalt, concrete, or other material installed to convey runoff without causing erosion.

#### 10.4 FINAL STABILIZATION

All soil-disturbing activities at the site have been completed, and a uniform perennial vegetative cover with a density of 85 percent of the cover for the area has been established or equivalent stabilization measures (such as the use of mulches or geo-textiles) have been employed.

-- End of Section --

SECTION 03 15 13.00 10

WATERSTOPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 471 (2006; R 2008) Standard Test Method for Rubber Property - Effect of Liquids

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 572 (1974) Specifications for Polyvinylchloride Waterstops

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

SD-02 Shop Drawings

Waterstops; G

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

SD-03 Product Data

Waterstops

Manufacturer's literature, including safety data sheets and waterstops. Manufacturer's recommended instructions for installing waterstops and for splicing non-metallic waterstops.

SD-07 Certificates

Waterstops

Certificates of compliance stating that the waterstops conform to the requirements specified.

1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants.

## PART 2 PRODUCTS

### 2.1 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

#### 2.1.1 Non-Metallic Materials`

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

### 2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

#### 2.2.1 Non-Metallic Waterstops

Contractor shall submit certificate to Contracting Officer from manufacturer verifying compliance with specification requirements.

#### 2.2.2 Splicing Waterstops

##### 2.2.2.1 Non-Metallic Waterstops

Procedure and performance qualifications for splicing non-metallic waterstops shall be demonstrated by the manufacturer at the factory and the Contractor at the job site by each making three spliced samples of size and type of finished waterstop.

## PART 3 EXECUTION

### 3.1 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm in each joint. Allow clearance between waterstop and reinforcing steel of a minimum of two times the largest aggregate size. Prevent rock pockets and air voids caused by aggregate bridging. Ensure centerbulb is not embedded at expansion joints. Install in accordance with manufacturers instruction. Secure waterstop with wire ties to adjacent reinforcing.

Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced at the Contractor's expense. Exposed waterstops shall be protected during application of form release agents to avoid being coated. The concrete shall be thoroughly consolidated in the vicinity of the waterstop. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures. Field butt splices shall be heat fused. Lapping of waterstops, use of adhesives or solvents for splicing will not be allowed. Installation shall be observed by the Contracting Officer prior to placing concrete.

#### 3.1.1 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

#### 3.1.1.1 Polyvinyl Chloride Waterstop

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

#### 3.1.1.2 Quality Assurance

Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

### 3.2 CONSTRUCTION JOINTS

Construction joints are specified in Section 03 30 53 CAST-IN-PLACE CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

-- End of Section --

SECTION 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

Perform all work in accordance with ACI MCP SET Parts 2 and 3.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI MCP SET (2009) Manual of Concrete Practice

ASTM INTERNATIONAL (ASTM)

ASTM A 615/A 615M (2009b) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM C 1260 (2007) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

ASTM C 143/C 143M (2009) Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C 150/C 150M (2009) Standard Specification for Portland Cement

ASTM C 1567 (2008) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

ASTM C 171 (2007) Standard Specification for Sheet Materials for Curing Concrete

ASTM C 172 (2008) Standard Practice for Sampling Freshly Mixed Concrete

ASTM C 231 (2009a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 260 (2006) Standard Specification for Air-Entraining Admixtures for Concrete

ASTM C 309 (2007) Standard Specification for Liquid Membrane-Forming Compounds for Curing

## Concrete

ASTM C 31/C 31M	(2009) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33/C 33M	(2008) Standard Specification for Concrete Aggregates
ASTM C 39/C 39M	(2009) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94/C 94M	(2009a) Standard Specification for Ready-Mixed Concrete
ASTM D 75/D 75M	(2009) Standard Practice for Sampling Aggregates

### U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
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### U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials
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## 1.3 SYSTEM DESCRIPTION

The Government retains the option to sample and test aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with ASTM D 75/D 75M. Sample concrete in accordance with ASTM C 172. Determine slump and air content in accordance with ASTM C 143/C 143M and ASTM C 231, respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with ASTM C 31/C 31M. Test compression test specimens in accordance with ASTM C 39/C 39M. Take samples for strength tests not less than once each shift in which concrete is produced. Provide a minimum of three specimens from each sample; two to be tested at 28 days for acceptance, and one will be tested at 7 days for information.

### 1.3.1 Strength

Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength of 4000 psi, f'c, and no individual acceptance test result falls below f'c by more than 500 psi. The lean concrete shown in bottom of Surge Tank shall have a specified compressive strength of 2000 psi.

### 1.3.2 Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed. Surface requirements for the

classes of finish required are as specified in Part 4 of ACI MCP SET.

### 1.3.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions shall include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per cubic yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. Specified compressive strength f'c shall be 4,000 psi at 28 days. The maximum nominal size coarse aggregate is 1-1/2 inch, in accordance with ACI MCP SET Part 3. The air content shall be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water cement ratio is 0.50.

### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

#### SD-03 Product Data

- Air-Entraining Admixture; GA
- Reinforcing Steel; GA
- Mix Design Data; GA
- Accessories
- Concrete

#### SD-06 Test Reports

- Aggregates; GA
- Concrete Mixture Proportions; GA
- Compressive Strength Testing; GA
- Slump

#### SD-07 Certificates, FIO

- Cementitious Materials; FIO
- CPG for recycled materials or appropriate Waiver Form; FIO
- Aggregates
- Bill of Lading; FIO

### 1.5 QUALITY ASSURANCE

Indicate specific locations of concrete placement, steel reinforcement, accessories on installation drawings and include, but not limited to, square feet of concrete placements, thicknesses and widths, plan dimensions, and arrangement of cast-in-place concrete section.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Submit manufacturer's literature from suppliers which demonstrates

compliance with applicable specifications for the specified materials.

#### 2.1.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

##### 2.1.1.1 Portland Cement

ASTM C 150/C 150M, Type II

##### 2.1.2 Aggregates

Fine and coarse aggregates shall meet the quality and grading requirements of ASTM C 33/C 33M Class Designations 4M or better and be tested and evaluated for alkali-aggregate reactivity in accordance with ASTM C 1260. Perform evaluation of fine and coarse aggregates separately and in combination, matching the proposed mix design proportioning. All results of the separate and combination testing shall have a measured expansion less than 0.10 percent at 16 days after casting. If the test data indicates an expansion of 0.10 percent or greater, reject the aggregate(s) or perform additional testing using ASTM C 1260 and ASTM C 1567.

##### 2.1.3 Admixtures

Admixtures to be used, when required or approved, shall comply with the appropriate specification listed. Retest chemical admixtures that have been in storage at the project site, for longer than 6 months or that have been subjected to freezing, at the expense of the Contractor at the request of the Contracting Officer and will be rejected if test results are not satisfactory.

##### 2.1.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of ASTM C 260.

##### 2.1.4 Water

Use fresh, clean, potable water for mixing and curing, free from injurious amounts of oil, acid, salt, or alkali, except that unpotable water may be used if it meets the requirements of COE CRD-C 400.

##### 2.1.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A 615/A 615M, Grade 60. Details of reinforcement not shown shall be in accordance with ACI MCP SET Part 3, Chapters 7 and 12.

##### 2.1.6 Formwork

The design and engineering of the formwork as well as its construction, will be the responsibility of the Contractor.

##### 2.1.7 Form Coatings

Coat forms, for exposed surfaces, with a nonstaining form oil to be applied shortly before concrete is placed.

#### 2.1.8 Curing Materials

Provide curing materials conforming to the following requirements.

##### 2.1.8.1 Impervious Sheet Materials

Impervious sheet materials, ASTM C 171, type optional, except polyethylene film, if used, shall be white opaque.

#### 2.2 READY-MIX CONCRETE

- a. Concrete shall be ready-mix concrete with mix design data conforming to ACI MCP SET Part 2.
- b. Non-exposed concrete elements: 4000 psi minimum compressive strength.
- c. Direct-exposed concrete elements: 4000 psi minimum compressive strength as determined in 28 calendar days.
- d. Slump: 1 to 4 inch according to ASTM C 143/C 143M and ACI MCP SET Part 1.
- e. Portland Cement conforming to ASTM C 150/C 150M, Type II
- f. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.
- g. Air-Entraining Admixtures conforming to ASTM C 260. Exterior concrete exposed to freezing needs to be air-entrained 5 to 6 percent by volume. Nonair-entrained interior concrete shall have a total air content of 2 to 4 percent by volume.

#### 2.3 STEEL REINFORCEMENT

##### 2.3.1 Deformed Steel Bars

Provide steel bars conforming to ASTM A 615/A 615M, Grade .60 ksi ACI MCP SET Parts 2 and 3.

#### 2.4 FORMS

Forms shall be of wood, steel, or other approved material and conform to ACI MCP SET, Parts 2 and 3.

Provide form release conforming to ACI MCP SET, Part 4.

#### 2.5 ACCESSORIES

##### 2.5.1 Embedded Conduit

Provide conduit in accordance with Electrical Requirements.

#### PART 3 EXECUTION

### 3.1 PREPARATION

Prepare construction joints to expose coarse aggregate. The surface shall be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Earth foundations shall be satisfactorily compacted. Ensure spare vibrators are available. The entire preparation shall be accepted by the Government prior to placing.

#### 3.1.1 Embedded Items

Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Embedded items shall be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. All equipment needed to place, consolidate, protect, and cure the concrete shall be at the placement site and in good operating condition.

#### 3.1.2 Formwork Installation

Forms shall be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints and edges, unless otherwise indicated.

#### 3.1.3 Production of Concrete

##### 3.1.3.1 Ready-Mixed Concrete

Provide ready-mixed concrete conforming to ASTM C 94/C 94M except as otherwise specified.

### 3.2 CONVEYING AND PLACING CONCRETE

Concrete placement is not permitted when weather conditions prevent proper placement and consolidation without approval. When concrete is mixed and/or transported by a truck mixer, deliver the concrete to the site of the work completing the discharge within 1-1/2 hours or 45 minutes when the placing temperature is 86 degrees F or greater unless a retarding admixture is used. Convey concrete from the mixer to the forms as rapidly as practicable by methods which prevent segregation or loss of ingredients. Concrete shall be in place and consolidated within 15 minutes after discharge from the mixer. Deposit concrete as close as possible to its final position in the forms and regulate it so that it may be effectively consolidated in horizontal layers 18 inches or less in thickness with a minimum of lateral movement. Carry on the placement at such a rate that the formation of cold joints will be prevented.

#### 3.2.1 Consolidation

Consolidate each layer of concrete by internal vibrating equipment. Systematically accomplish internal vibration by inserting the vibrator through the fresh concrete in the layer below at a uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator and overlay

the adjacent, just-vibrated area by approximately 4 inches. Ensure that the vibrator penetrates rapidly to the bottom of the layer and at least 6 inches into the layer below, if such a layer exists. Hold vibrator stationary until the concrete is consolidated and then withdraw it slowly at the rate of about 3 inches per second.

### 3.2.2 Cold-Weather Requirements

No concrete is to be mixed or placed when the ambient temperature is below 36 degrees F or if the ambient temperature is below 41 degrees F and falling. Provide suitable covering and other means as approved for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing and at a temperature above freezing for the remainder of the curing period. Do not mix salt, chemicals, or other foreign materials with the concrete to prevent freezing. Remove and replace concrete damaged by freezing at the expense of the Contractor.

### 3.2.3 Hot-Weather Requirements

When the rate of evaporation of surface moisture, as determined by use of Figure 1 of ACI MCP SET Part 2, is expected to exceed 0.2 psf per hour, provisions for windbreaks, shading, fog spraying, or covering with a light-colored material shall be made in advance of placement, and such protective measures taken as quickly as finishing operations will allow.

## 3.3 FORM REMOVAL

Do not remove forms before 24 hours after concrete placement, except as otherwise specifically authorized. Do not remove supporting forms and shoring until the concrete has cured for at least 5 days. When conditions require longer curing periods, forms shall remain in place.

## 3.4 FINISHING

### 3.4.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below 50 degrees F.

### 3.4.2 Finishing Formed Surfaces

Remove all fins and loose materials, and surface defects including filling of tie holes. Repair all honeycomb areas and other defects. Remove all unsound concrete from areas to be repaired. Surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete shall be reamed or chipped and filled with dry-pack mortar. Brush-coat the prepared area with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filling with mortar or concrete. The cement used in mortar or concrete for repairs to all surfaces permanently exposed to view shall be a blend of portland cement and white cement so that the final color when cured is the same as adjacent concrete.

### 3.4.3 Finishing Unformed Surfaces

Float finish all unformed surfaces, that are not to be covered by additional concrete or backfill, to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface.

Slope exterior surfaces for drainage unless otherwise shown. Carefully make joints with a jointing tool. Finish unformed surfaces to a tolerance of 3/8 inch for a float finish as determined by a 10 foot straightedge placed on surfaces shown on the drawings to be level or having a constant slope. Do not perform finishing while there is excess moisture or bleeding water on the surface. No water or cement is to be added to the surface during finishing.

#### 3.4.3.1 Float Finish

Provide float finished surfaces, screeded and darbied or bullfloated to eliminate the ridges and to fill in the voids left by the screed. In addition, the darby or bullfloat shall fill all surface voids and only slightly embed the coarse aggregate below the surface of the fresh concrete. When the water sheen disappears and the concrete supports a person's weight without deep imprint, complete floating. Floating shall embed large aggregates just beneath the surface, remove slight imperfections, humps, and voids to produce a plane surface, compact the concrete, and consolidate mortar at the surface.

### 3.5 CURING AND PROTECTION

Beginning immediately after placement, and continuing for at least 7 days, cure and protect all concrete from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to rain or flowing water. Provide all materials and equipment needed for adequate curing and protection at the site of the placement prior to the start of concrete placement. Accomplish moisture preservation of moisture for concrete surfaces not in contact with forms by one of the following methods:

- a. Continuous sprinkling or ponding.
- b. Application of absorptive mats or fabrics kept continuously wet.
- c. Application of sand kept continuously wet.
- d. Application of impervious sheet material conforming to ASTM C 171.
- e. Application of membrane-forming curing compound conforming to ASTM C 309, Type 1-D, on surfaces permanently exposed to view. Accomplish Type 2 on other surfaces in accordance with manufacturer's instructions.

Accomplish the preservation of moisture for concrete surfaces placed against wooden forms by keeping the forms continuously wet for 7 days. If forms are removed prior to end of the required curing period, use other curing methods for the balance of the curing period. Do not perform protection removal if the temperature of the air in contact with the concrete may drop more than 60 degrees F within a 24 hour period.

### 3.6 TESTS AND INSPECTIONS

#### 3.6.1 Field Testing Technicians

The individuals who sample and test concrete, as required in this specification, shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

### 3.6.2 Inspection Details and Frequency of Testing

#### 3.6.2.1 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement by the Contractor to certify that it is ready to receive concrete.

#### 3.6.2.2 Slump

Check slump once during each shift that concrete is produced for each class of concrete required. Obtain samples in accordance with ASTM C 172 and tested in accordance with ASTM C 143/C 143M.

#### 3.6.2.3 Consolidation and Protection

Ensure that the concrete is properly consolidated, finished, protected, and cured.

### 3.6.3 Action Required

#### 3.6.3.1 Slump

Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. The adjustments are to be made so that the water-cement ratio does not exceed that specified in the submitted concrete mixture proportion.

### 3.7 FORM WORK

Form work shall conform to ACI MCP SET Parts 2 through 5.

#### 3.7.1 Preparation of Form Surfaces

Forms shall be true to line and grade, mortar-tight, and sufficiently rigid to prevent objectionable deformation under load. Form surfaces for permanently exposed faces shall be smooth, free from irregularities, dents, sags, or holes. Chamfer exposed joints and exposed edges. Arrange internal ties so that when the forms are removed, the form ties are not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structure.

#### 3.7.2 Form Coating

Coat forms, for exposed surfaces, with a nonstaining form release coating applied shortly before concrete is placed. Forms for unexposed surfaces may be wetted in lieu of coating immediately before the placing of concrete, except that in freezing weather form release coating shall be used.

#### 3.7.3 Removal of Forms

Remove forms carefully to prevent damage to the concrete. Do not remove forms before 24 hours, minimum.

### 3.8 STEEL REINFORCING

Reinforcement shall be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

#### 3.8.1 Fabrication

Shop fabricate steel reinforcement in accordance with ACI MCP SET Parts 2 and 3. Shop details and bending shall be in accordance with ACI MCP SET Parts 2 and 3.

#### 3.8.2 Splicing

Perform splices in accordance with ACI MCP SET Parts 2 and 3.

#### 3.8.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

#### 3.9 EMBEDDED ITEMS

Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

-- End of Section --

SECTION 05 50 04.00 10

STEEL PIPE MATERIALS AND ACCESSORIES

PART 1 GENERAL

1.1 SCOPE

The Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the welded steel pipe system as shown on the drawings including all fittings, tees, end caps, manways, access hatches, fiberglass manholes, couplings, valves, and interior and exterior coatings described herein. Two 10 foot diameter steel pipes will be installed between Station 13+50 and Station 22+00 as indicated on the contract drawings, complete with all accessories specified herein. The discharge pipe system will include all piping up to and including the 84" nipples on the surge tanks. The Contractor will be responsible for attaching this new section of pipe to the existing sections of pipe ending at Station 22+00 and station 13+50. The Contractor shall remove the end caps (2) at each end from the existing pipes.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C200	Steel Water Pipe 6 inches and larger
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Service, 4" - 144"
AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C210	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C214	Tape Coating Systems for the Exterior of Steel Water Pipelines
AWWA C222	Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings
AWWA C504	Rubber-Sealed Butterfly Valves: Standard covers rubber-seated butterfly valves, 3 in. through 72 in. in diameter
AWWA M11	Steel Pipe - A Guide for Design and Installation

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2006) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A139/A 139M (2004; R 2010) Standard Specification for Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and over)

ASTM A572/A 572M (2007) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

SD-01 DATA

- a. Calculations showing wall thickness of the pipeline is adequate to withstand an internal working pressure of 44 psi and a transient pressure 75 psi and an H2O external load, and any additional construction loads.
- b. Process of manufacturing pipe.
- c. Interior and exterior coating system supplied by manufacturer.
- d. Mill test reports including ladle analysis, check analysis, physical properties, hydrostatic test and dimensional properties.
- e. Certification that pipe has been designed for conditions outlined under "a".
- f. Qualifications of pipe manufacturer.

SD-02 Shop Drawings

Steel Pipe Materials and Accessories; G  
Shop Fabricated Metal Items; G

No shop drawings required.

SD-03 Product Data

Miscellaneous Metals and Standard Metal Articles; G  
Shop Fabricated Metal Items; G

Lists of materials, and records which identify the disposition of approved material and fabricated items in the work, shall be submitted for approval. No samples required.

SD-06 Test Reports

Miscellaneous Metals and Standard Metal Articles; GA  
Shop Fabricated Metal Items; GA

SD-07 SCHEDULES

- a. Materials Orders: FIO.

Copies of purchase orders, mill orders, shop orders and work orders for materials shall be submitted prior to the use of the materials in the work.

- b. Materials List: FIO.

Materials list for fabricated items shall be submitted at the time of submittal of detail drawings.

- c. Shipping Bill: FIO

Certified test reports for materials tests and analyses shall be submitted for approval.

SD-08 STATEMENTS (G)

- a. Welding procedures for field welding lap joint, butt strap or other approved steel water pipe joints.

- b. Method of coating interior and exterior field joints and coating repairs.

- c. Method of maintaining roundness, protecting coating during shipment, storage and installation.

- d. Welding repairs of steel pipe joints.

- e. Welding repair plans for steel pipe shall be submitted and approved prior to making repairs.

SD-09 REPORTS

- a. Tests, Inspections and Verifications: FIO.

Certified test reports for materials shall be submitted with all materials delivered to the site. All pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of ANSI/AWWA coating and lining standard as supplemented by the requirements herein. All materials, except as modified herein used in the manufacture of the pipe shall be tested in accordance with the requirements of ANSI/AWWA C200 and ANSI/AWWA coating and lining standards. The Contractor shall perform said material tests at no additional cost to the Contracting Officer. The Contracting Officer shall have the right to witness all testing conducted by the Contractor provided that the Contractor's schedule is not delayed for the convenience of the Contracting Officer. All welding procedures used to fabricate pipe shall be qualified under the provision of ANSI/AWS B2.1 or

ASME Section IX. Welding procedures shall be required for, but not limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections. The Contractor shall furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this section of the Specifications, as specified in ANSI/AWWA C200 and the following supplemental requirements:

1. Physical and chemical properties of all steel.
2. Results of production weld test.

b. Qualification of Welders and Welding Operators: FIO.

Certifications for welders and welding operators shall be submitted prior to commencing fabrication.

#### SD-18 RECORDS

a. Materials Disposition Records: FIO.

b. Materials disposition records shall be submitted before completion of contract

#### 1.4 QUALIFICATIONS OF WELDERS

The Contractor shall certify that the qualification of welders and welding operators and tack welders who will perform steel pipe welding have been qualified for the particular type of work to be done in accordance with the requirements of AWS B2.1 or ASME Section IX and AWS D1.1/D1.1M prior to commencing fabrication. The certificate shall list the qualified welders by name and shall specify the code and procedures under which each qualified and the date of qualification. Prior qualification will be accepted if welders have performed satisfactory work under the code for which they have been qualified within the preceding three months. The Contractor shall require welders to repeat the qualifying tests when their work indicates a reasonable doubt as to proficiency. Those passing the requalification tests will be recertified. Those not passing will be disqualified until passing. All expenses in connection with qualification and requalification shall be borne by the Contractor.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

#### PART 2 PRODUCTS

##### 2.1 MATERIALS

##### 2.1.1 Materials Orders

The Contractor's Quality Control Manager shall maintain on file within the

Construction Field Office copies of purchase orders, mill orders, shop orders and work orders for all material orders and items used in the work. Where mill tests are required, purchase orders shall contain the test site address and the name of the testing agency. This information shall be available for review by Corps personnel, upon request.

#### 2.1.2 Materials List

The Contractor shall furnish a materials list of the materials to be used in the fabrication of each item.

#### 2.1.3 Shipping Bill

The Contractor shall furnish a shipping bill or memorandum of each shipment of finished pieces or members to the project site giving the designation mark and weight of each item, the number of items, the total weight, and the car initial and number if shipped by rail in carload lots. Duplicate copies of shipping bills shall be mailed promptly to the Contracting Officer.

### 2.2 FABRICATION

#### 2.2.1 Pipe Fabrication

Steel pipe shall conform to Welded Steel Pipe - ASTM A139/A 139M GR C or ASTM A572/A 572M GR 42 in accordance AWWA C200.

All steel pipe and fittings shall be furnished by manufacturers who are fully experienced, either SPFA or ISO 9001 certified, reputable, and qualified in the manufacture of the products to be furnished. Also, the plant in which the pipe is manufactured shall be SPFA or ISO 9001 certified. The pipe and fittings shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

Pipe and fittings shall be the product of one manufacturer that has not less than five (5) years successful experience manufacturing pipe of the particular type and size indicated.

a. Pipeline shall be 121 inch outside diameter, 0.5 inch wall, tape coated on the outside, coal tar epoxy or polyurethane lined on the inside. Pipe may have straight or spiral seams.

b. Each joint of pipe shall be hydrostatically tested prior to application of coating. The internal test pressure shall be that which results in a fiber stress equal to 75% of the minimum yield strength to be used. This results in a test pressure of 260 psi for the pipe material specified herein. Each joint of pipe tested shall be completely watertight under maximum test pressure. The manufacturer shall maintain a recording pressure gauge, reference number of pipe tested, etc. The pipe shall be numbered in order that this information can be recorded.

c. Fittings shall be fabricated from hydrostatically tested pipe. Fittings shall be tested by any of the following means: hydrostatic test, air test, magnetic particle test, or dye penetration test. If an air test is used, it shall be made by applying air at 10 psi pressure and checking for leaks around and through welds with a soap solution.

### 2.2.2 Joints

- a. Lap field-welded or butt strap joints shall be used unless otherwise approved. Ends of the pipe, fittings, and specials for field welded joints shall be prepared with one (1) end expanded in order to receive a plain end, making a bell and plain end type joint, or by the use of a butt strap. Clearances between the surfaces of lap joints shall not exceed 1/8 inch at any point around the periphery of the pipe.
- b. In addition to the provisions for a minimum lap of 1-1/2 inch as specified in AWWA C206-97 the depth of bell shall be such as to provide for a minimum distance of 1 inch between the weld and the nearest tangent of the bell radius when welds are to be located on the inside of the pipe.

### 2.2.3 Fittings

- a. Unless otherwise shown on the plans, all specials and fittings shall conform to the dimensions of AWWA C208. Fittings shall be of the same material and minimum thickness as the pipe. The minimum radius of elbows shall be 2.5 times the pipe diameter, and the maximum miter angle on each section of the elbow shall not exceed 11-1/4 degrees. If elbow radius is less than 2.5 x pipe diameter, stresses shall be checked per AWWA M11 and wall thickness or yield strength increased if necessary. Fittings shall be equal in pressure design strength and shall have the same lining and coating as the abutting pipe. Specials and fittings, unless otherwise shown on the plans, shall be made of segmentally welded sections from hydrostatically tested pipe, with ends compatible with the type of joint or coupling specified for the pipe. Fabricator shall "punch mark" the cardinal lines of all angle fittings to ensure fittings are installed at the proper orientation.
- b. Flanges, if required, shall be ring type in accordance with AWWA C207 Class B.

### 2.2.4 Mechanical Couplings

Mechanical compression couplings designed to provide a stress relieving flexible joint shall consist of a cylindrical sleeve, two gaskets, two follower rings and a set of bolts and nuts.

- a. Sleeve: ASTM A 53, ASTM A 512 or carbon steel having a minimum yield of 30,000 psi. Minimum sleeve length shall be 5 inches for pipe 12 inches and smaller, 7 inches for pipe sizes 14 inches through 24 inches, and 10 inches for pipe larger than 24 inches.
- b. Follower Rings: Malleable iron ASTM A 47, Grade 23510. Ductile Iron ASTM A 536, AISI C 1015 Steel or AISI C 1018 Steel.
- c. Bolts and Nuts: High strength low-alloy steel with heavy, semi-finished hexagon nuts.
- d. Gaskets: Shall be synthetic rubber suitable for operating conditions.
- e. Finish: Manufacturer's standard finish.
- f. Manufacturer: Dresser, Style 38 or equivalent 150 psi minimum pressure rating.

### 2.2.5 Joint Harnesses

Joint harnesses to provide lateral restraint at mechanical compression couplings shall be designed per the requirements of AWWA M11 for operating pressures indicated herein.

### 2.2.6 Shop Welding

All welding procedures used to fabricate pipe shall be qualified under the provision of ANSI/AWS B2.1 or ASME Section IX. Welding procedures shall be required for, but not limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

#### 2.2.6.1 Shop Welder Qualifications

Skilled welders, welding operators and tackers who have had adequate experience in the methods and materials to be used shall do all welding. Welders shall maintain current qualifications under the provisions of ANSI/AWS B2.1 or ASME Section IX. Machines and electrodes similar to those in the work shall be used in qualification test. The Contractor shall furnish all materials and bear all cost of qualifying welders.

### 2.2.7 Exterior Pipe Coating

#### 2.2.7.1 General

Before coating, pipe shall be blast cleaned to achieve a surface preparation at least equivalent to SSPC-SP6. The protective coating system shall consist of a prefabricated cold-applied tape and primer applied to the exterior surface of the pipe, including bends and fittings. This system shall be in accordance with AWWA C214 and shall include a minimum of four (4) layers consisting of the following:

- a. Primer layer
- b. Inner layer tape-mechanical protective tape (20 mils) with black exterior.
- c. Outer layer tape-mechanical protective tape (30 mils) with gray exterior.
- d. A second outer layer tape-mechanical protective tape (30 mils) protective tape with white exterior.

The total thickness of the tape coating shall be a minimum of 80 mils.

#### 2.2.7.2 Coating Repair

Coating shall be repaired with tape and primer conforming to ANSI/AWWA C209, Type II. The tape and primer shall be compatible with the tape system used under 2.2.6.1.

#### 2.2.7.3 Coating of Fittings, Specials and Joints

All buried fittings, specials, and joints that cannot be machine coated in accordance with the above shall be coated in accordance with ANSI/AWWA Standard C209. The system shall consist of the following:

- a. Primer layer
- b. Inner layer tape-corrosion protective tape (35 mils).
- c. Outer layer tape-corrosion protective tape (35 mils).
- d. Alternately, the joints may be coated with a shrink-wrap per ANSI/AWWA C216.

The total thickness of the tape coating shall be at least 70 mils.

Exposed fittings, specials, and joints shall be coated in accordance with paragraph 2.2.7.

#### 2.2.7.4 Coating Repair for Fittings

The coating repair for fittings and specials shall be in accordance with the procedure described above for straight line pipe.

#### 2.2.7.5 Coated Pipe Test

The thickness of the coating system shall be checked in accordance with SSPC PA2. The thickness shall be a minimum of 80 mils and shall be checked at the pipe fabrication shop.

Each coated pipe section shall be electrically tested for flaws in the coating by means of a suitable holiday detector. The detector shall impress a minimum of 6,000 V. Reference should be made to NACE RP-02-74. The electrical inspection shall take place on the inner-layer tape before the outer-layer tape is applied. If a holiday is detected, it shall be repaired in accordance with pipe manufacturer's recommendations.

#### 2.2.7.6 Rejection

- a. The Contracting Officer may reject pipe if the surface condition does not comply with the requirements of ANSI/AWWA C214. Pipe rejected because of inadequate cleaning shall be recleaned and reinspected for coating at no cost to the Government.
- b. If any sample of coating material is found not to conform to this standard, then the coating material represented by such sample shall be rejected. If samples of the Contractor's coating materials that have been previously approved are found not to conform to the standard, then all such coating material shall be rejected.

#### 2.2.8 Exterior Pipe Coating Alternate - Polyurethane

2.2.8.1 AWWA C222 polyurethane can be used as an alternate to tape on the exterior coating of discharge pipe and accessories. The polyurethane shall conform to AWWA C222 with a minimum of 25 mils DFT.

2.2.8.2 The exterior of pipe shall be checked for thickness and defects. Any problem areas shall be prepared and coated in accordance with the requirements of AWWA C222.

2.2.8.3 All welded joints shall be prepared and coated, after welding, in accordance with the requirements in AWWA C222.

## 2.2.9 Interior Pipe Coating

### 2.2.9.1 General

Before coating, pipe shall be blast cleaned to achieve a surface preparation at least equivalent to SSPC-SP10 Near White Blast Cleaned. The coating system shall consist of either coal tar epoxy coating or polyurethane coating. If coal tar epoxy coating is used, it shall conform to AWWA C210 and shall be shop applied in one or two coats having a total of 16 to 20 mils DFT. Coating thickness shall be measured in accordance with SSPC PA2. If polyurethane is used, it shall conform to AWWA C222 and shall be shop applied in one or two coats having a total of 16 to 20 mils DFT. Coating thickness shall be measured in accordance with SSPC PA2.

### 2.2.9.2 Fittings

Fittings shall be shop coated in the same manner as the pipe.

## 2.3 HANDLING, STORAGE AND SHIPMENT

a. Pipe shall be studded as required to maintain roundness of plus or minus one percent during shipping and handling.

b. Coated pipe shall be shipped on padded skids with nylon belt tie-down straps or padded bundling located approximately over studding.

c. Coated pipe shall be stored on padded skids, sand or dirt berms, sandbags, old tires, or other suitable means so that coating will not be damaged.

d. Coated pipe shall be handled with wide belt slings. Chains, cables, or other equipment likely to cause damage to the pipe or coating shall not be used.

e. Prior to shipment, dielectrically coated pipe shall be visually inspected for damage to the coating by the following procedures:

i) When the visual inspection shows that a dielectric coating has sustained physical damage, the area in question may be subjected to an electrical holiday test.

ii) When the area is tested and there are no holidays or no tearing of the material (wrinkling or bruising of tape may be permitted), then the area shall be noted "acceptable" and shipped with no patching required.

iii) When the damaged area does show damage exposing the steel pipe from either a visual inspection or a "jeep" from a holiday detector, the area shall be repaired.

## 2.4 ENTRANCE MANWAYS

### 2.4.1 General

The Contractor shall provide 30 inch manways as detailed on Drawing M104 and with a reinforcing pad around the manway connection to the pipeline, not less than ¼" thick and 8" wide, shall be welded to the pipeline and

manway. Each manway shall consist of a tee provided on the 120 inch inside diameter pipe, a T-Bolt Hinged Closure for 150 psi as manufactured by Tube Turn or approved equal, a 6 foot diameter fiberglass manhole as manufactured by Fluid Containment or approved equal and a double leaf drainable hatch as manufactured by Thompson Fabricating or approved equal. The T-Bolt Hinged Cover and the double hatch covers shall include a spring assist to facilitate opening by one man, and shall be provided with a locking device.

#### 2.4.2 T-Hinged Closure

The T-Hinged Closure to be mounted on the steel tees shall be a 150 psi vertical hinged closure with a vertical spring assist with a head stop arm and shall be manufactured from carbon steel. The T-hinged closure shall have a locking device. After installation, the T-Hinged Closures shall be either epoxy coated or polyurethane coated in the same manner as the interior of the pipe.

#### 2.4.3 Fiberglass Manhole

Each fiberglass manhole shall be provided by Fluid Containment Flowtite Products, Jefferson Chemical Road, Conroe, Texas 77301, or approved equal and shall conform to the following specifications:

ASTM C 581 Practice for Determining Chemical Resistance of Chemical Thermosetting Resins Used in Glass-Fiber Reinforced Structures Intended for Liquid Service

ASTM D 695 Test Methods for Compressive Properties of Rigid Plastics

ASTM D 2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading

ASTM D 3753 Standard Specification of Glass-Fiber Reinforced Polyester Manholes

The manufacturer of the fiberglass manholes shall have a minimum of five years experience in the manufacturing of manholes of this type. Each fiberglass manhole shall be able to withstand a lateral hydrostatic pressure (with water at grade) with a minimum factor of safety of 2.5. Each manhole shall be resistant to buckling when the water table is at grade and shall be capable of withstanding the weight of concrete slab and frame plus an H-20 load.

#### 2.4.4 Hatch Cover

Floor access doors shall be type "THG" (WATERTIGHT, ODORTIGHT AND GASTIGHT) as manufactured by Thompson Fabricating, LLC (Birmingham, AL), or approved equal. Door leaf shall be 1/4" aluminum checkered plate reinforced with structural aluminum channels and shall be capable of withstanding a 300 pound/s.f. uniform load with minimal deflection. The following items shall be type 316 stainless steel: slam locks, brackets, hinges and hardware. The double leaf access doors shall have two interconnected slam locks with latch at both ends of the plate and can be un-latched from a single point. The door shall have a 316 stainless steel gas spring with integral hold open device which will assist in opening the door and shall lock automatically in the open position. The door shall open a minimum of 90 degrees. The aluminum gutter frame shall be provided with a 1 1/2" threaded drain fitting and shall have a thickness not less than 1/4" and shall incorporate a neoprene gasket

that will reduce air leakage to less 1 CFM per lineal foot of frame when the interior of the hatch is subjected to a 2 inch water column vacuum. All fasteners which penetrate into the "Dry" area of the hatch shall be sealed with "O" Ring Seals to prevent incidental water and gas leakage. The portion of the frame which is in contact with the concrete shall receive a protective bituminous coating. The hatch cover shall have a locking device.

## 2.5 COMBINATION AIR/VACUUM RELIEF VALVES

Valves shall be designed for evacuation of air when filling of pipeline and provide positive vacuum relief when pipe is draining. The discharge orifice area shall be equal to or greater than the inlet of the valve. The valve shall consist of a body, cover, baffle, float and seat. The baffles shall be designed to protect the float from direct contact of the rushing air and water to prevent the float from closing prematurely in the valve. The seat shall be fastened into the valve cover, without distortion, and shall be easily removed, if necessary. The float shall be stainless steel hermetically sealed to withstand a maximum pressure of 1000 psi. The float shall be center guided for positive shut-off into the seat. Valve sizes ½ thru 3 inches shall have NPT threaded outlets and sizes 4 thru 30 inches shall have plain outlet with steel protector hood unless indicated otherwise on the drawings. Valve materials of construction shall include cast iron body and cover per ASTM A126, Grade B, stainless steel float per ASTM A240, and Buna-N rubber seat. The valve shall be rated for 125-psi minimum operating pressure. The valve shall be APCO Series 140/150 or approved equal.

The air/vacuum valve shall also be provided with an automatic air release valve designed to allow entrapped air to escape the pipeline under pressure after the air/vacuum valve has closed. The materials of construction for the air release valve shall be the same as the air/vacuum valve. The valve shall be mounted to the air/vacuum valve with steel piping and be provided with an isolation gate valve. The valve shall be APCO Series 200A or approved equal.

The combination air and vacuum release valve shall be furnished completely assembled and pressure tested from the factory as a complete unit, ready for installation on the pipeline. Each unit shall be installed with an isolation butterfly valve at the connection to the pipeline. Adequate clearance between the butterfly valve disc and the air/vacuum valve stem shall be maintained for the installation.

## 2.6 HEAT TRACING

The combination air/vacuum relief valves located at the surge tanks shall be provided with electric heating cable to provide freeze protection. Heating cable shall be a self-regulating type with a 3 watts/foot output. The heating cable construction shall include twin 16 AWG copper bus wires, a semiconductive polymer core matrix, and a thermoplastic rubber material jacket. Power and controls shall be as installed under SECTION 33 71 02.00 20, UNDERGROUND ELECTRICAL DISTRIBUTION.

## 2.7 PIPE COATING ON SURGE TANK ACCESSORIES

The access hatch and 36" access tube, the 12" overflow pipe and the 6" drain pipe shall all be coated with polyurethane paint in accordance with AWWA C222, prior to being embedded in the form for the concrete surge tank.

## 2.8 BUTTERFLY VALVES

The butterfly valves and operators located below the combination air/vacuum relief valves shall conform to AWWA C504, Class B, except as hereinafter specified. The manufacturer shall submit an affidavit of compliance stating that the valves have been manufactured and tested in accordance with AWWA C504 and specifically listing all exceptions. Valves shall have a minimum 150 psi pressure rating or higher and shall be manufactured by Henry Pratt, DeZurick, or approved equal. Butterfly valves shall be flanged end with face to face dimensions in accordance with Table 2 of AWWA C504 Standard for short-body valves. Valve seats shall be full resilient seats retained in the body in accordance with AWWA C504. Valve discs shall be constructed of cast iron, ASTM A 48, Class 40; Ni-resist, ASTM A 436, Type 1; or ductile iron, ASTM A 536, Grade 64-45-12, and shall be furnished with a 316 stainless steel seating edge to mate with a rubber seat.

- a. For valves 24-inch and larger, when resilient seats are attached to the body, discs shall have Type 304 stainless steel seating edges.
- b. Resilient seats shall be Hycor or equal. Seats shall be fully adjustable and replaceable with the valves in place for all valves 24-inch and larger.

The valve body shall be constructed of closegrain cast iron per ASTM A 126, Class B with integrally cast hubs for shaft bearing housings of the through boss-type. Permanently self-lubricating body bushings shall be provided and shall be sized to withstand bearing loads. Stuffing boss of liberal dimensions shall be provided at the operator end of the vane shaft.

- a. Packing shall be of the self compensating v-type. A sealing element utilizing O-rings shall also be acceptable for up to and including 24-inch valve.
- b. Packing shall be held in place by a bolted corrosion resistant retainer plate or gland, retainer clips are not acceptable.
- c. Replacement of seals, for all size butterfly valves, shall not require removal of the valve from the line. The valve shaft shall be of Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. No reduction of shaft diameter will be allowed except at the operator connection. Any reduction shall have a full radius fillet.

The butterfly valve actuator shall conform to the requirements of AWWA C504. Gearing for the actuators, where required, shall be totally enclosed in a gear case in accordance with AWWA C504, and shall be designed to withstand an input torque of 450 ft/lbs against the stop. Actuators shall have permanent indicators with raised or engraved marks to show position of the valve disc.

## PART 3 EXECUTION

### 3.1 GENERAL

#### 3.1.1 Installation Requirements

Install steel pipe, fittings, specials, and appurtenances as specified and required for the proper functioning of the completed pipe line. Install

pipe, fittings, and specials in accordance with the Manufacturer's recommendations and AWWA Manual M11. Pipe shall be laid to the lines and grade indicated. Just before each joint is lowered into the trench it is to be inspected and tested for holidays. All damaged areas shall be checked for holidays and where located repaired before the pipe is lowered into the trench.

### 3.1.2 Pipe Deflection

The requirements of the specifications under Section 31 23 00.00 20 - EXCAVATION, FILL, BACKFILL AND EMBANKMENT FOR STRUCTURES govern for the excavation and backfilling of trenches for laying steel pipe, fittings, and specials. Place and consolidate embedment and backfill prior to removing pipe stulls. Maximum allowable pipe deflection or offset shall be a 1 inch joint pull or 0.477 degrees.

### 3.1.3 Pipe Installation

Keep the pipe clean during the laying operation and free of sticks, dirt, animals, and trash, and at the close of each operating day, effectively seal the open end of the pipe against the entrance of water using a gasketed night cap. Do not lay pipe in water.

## 3.2 PIPE HANDLING

Pipe shall be handled at all times with a minimum of two wide non-abrasive slings, belts or other equipment designed to prevent damage to the coating or lining. The equipment shall be kept in such repair that its continued use is not injurious to the coating. The spacing of pipe supports required to handle the pipe shall be adequate to prevent cracking or damage to the coating.

## 3.3 LINE UP AND BENDS

- a. Line up pipe for joining so as to prevent damage thereto. Thoroughly clean the bell and spigot ends of each joint of pipe of foreign matter, rust and scale before placing spigot into bell.
- b. Where abrupt changes in grade and direction occur, the Contractor shall employ special shop fabricated fittings for the purpose. Field cutting the ends of the steel pipe to accomplish angular changes in grade or direction of the line shall not be permitted.

## 3.4 PIPE LAYING - FIELD WELDED JOINTS

- a. Weld joints in accordance with the AWWA C-206 for Field Welding of Steel Water Pipe. Contractor shall provide adequate ventilation for welders and for Contracting Officer to observe welds. Unless otherwise specified, welds shall be full circle fillet welds. Welding shall be completed before application of field applied joint coating.
- b. Adequate provisions for reducing temperature stresses shall be the responsibility of the Contractor.
- c. After the pipes have been joined and properly aligned and prior to the start of the welding procedure, the spigot and bell shall be made essentially concentric by shimming or tacking to obtain clearance tolerance around the periphery of the joint. The clearance tolerance shall not exceed one-eighth (1/8) of an inch.

d. Furnish labor, equipment, tools and supplies, including shielded type welding rod. Protect welding rod from any deterioration prior to its use. If any portion of a box or carton is damaged, reject the entire box or carton.

e. In all hand welding, the metal shall be deposited in successive layers. For hand welds, not more than 1/8" of metal shall be deposited in each pass. Each pass except the final one, whether in butt or fillet welds, shall be thoroughly bobbed or peened to relieve shrinkage stresses and to remove dirt, slag, or flux before the succeeding bead is applied. Each pass shall be thoroughly fused into the plates at each side of the welding groove or fillet and shall not be permitted to pile up in the center of the weld. Undercutting along the side shall not be permitted.

f. The welding process used shall be a process designed to (1) produce a joint meeting the minimum strength requirements of the base metals and (2) meet the welding procedure qualification required.

g. Prior to welding, ends of the pipe to be welded shall be in conformance with the requirements for end preparation for field joints in accordance with ANSI/AWWA C200. Any linings or coatings shall be held back in an amount that is appropriate for the type of joint.

h. Welds shall be free from pinholes, non-metallic inclusions, air pockets, undercutting and/or any other defects.

i. If the ends of the pipe are laminated, split or damaged to the extent that satisfactory welding contact cannot be obtained, remove the pipe from the line.

j. Furnish each welder employed with a steel stencil for marking the welds, so that the work for each welder may be identified. Have each welder stencil the pipe adjacent to the weld with the stencil assigned to him. In the event any welder leaves the job, his stencil shall be voided and not duplicated if another welder is employed.

k. Use only competent, skilled and qualified workmen. Each welder employed by the Contractor shall be required to satisfactorily pass a welding test in accordance with ANSI/AWWA C-206 before being allowed to weld on the line.

l. After each welder has qualified in the preliminary tests referred to above, inspections shall be made of joints in the line. Any welder making defective welds shall not be allowed to continue to weld.

m. Dye penetrant tests in accordance with ASTM E165, or magnetic particles test shall be performed by the Contractor under the supervision and inspection of an independent testing laboratory, on all full welded joints. Welds that are defective will be replaced or repaired, whichever is deemed necessary by the Contracting Officer, at the Contractor's expense.

n. If the Contractor disagrees with the Contracting Officer's interpretation of welding tests, test sections may be cut from the joint for physical testing. The Contractor shall bear the expense of repairing the joint if found to be defective by physical test. The

procedure for repairing the joint shall be approved by the Contracting Officer before proceeding.

o. Manufacturer will provide a complete laying schedule that will show length of each pipe, location of fittings, etc. This information will be provided with design data.

### 3.5 WELDED LAP-JOINTS OR BUTT STRAP JOINTS

a. Field joints shall be assembled so that seams in the adjacent pipe sections are off-set from each other by at least 5 times the wall thickness of the pipe.

b. Lap joints shall be of the "bell and spigot" or butt strap type, and shall be designed and fabricated so that, when properly assembled in the field, the maximum clearance of the faying surfaces and weld location restrictions specified elsewhere will not be exceeded.

### 3.6 QUALIFICATION OF WELDING PROCEDURES, WELDERS, AND WELDING OPERATORS FOR FIELD WELDING

a. Joint-welding procedures and the welders or welding operators using the procedures shall be qualified by testing. General requirements for qualification shall be in accordance with ANSI/AWS D.1.1, Section 4, Qualification, Part 4.

b. Welding Procedure Qualifications: Certain joint-welding procedures as outlined in ANSI/AWS D.1.1, Section 3, Pre Qualification of Welding Procedure Specifications, are pre-qualified and are exempt from test. Other procedures shall be qualified in accordance with ANSI/AWS D 1.1, Section 4, Part B, Welding Procedure Specifications. Written procedures shall be prepared by the Contractor and shall be made available to welders at the job-site and to those authorized to examine the welds.

c. Welder and Welding Operator Qualifications: Welders and welding operator shall be qualified by tests as prescribed in ANSI/AWS D 1.1 Section 4, Part C.

d. ANSI/AWS D.1.1 qualifications for welders and welding operators shall be considered as remaining in effect indefinitely unless (1) the welder or welding operator has not been engaged in a similar process of welding for which he has been qualified, for a period exceeding (6) months prior to work on a product involving this welding standard; and (2) there is some specific reason to question a welder's or welding operator's ability.

e. Records of all test results shall be maintained regarding the qualification of procedures and the qualification of welders using the qualified procedure. Such records shall be made available to the Contracting Officer.

### 3.7 WELDING PROCEDURES

#### 3.7.1 Preparation of Welding Surfaces

Surfaces to be welded shall be free from water, scale, slag, heavy rust, grease, coatings, paint, cement, or any other foreign material. Joint surfaces shall be smooth, uniform and free from defects that adversely

affects proper welding. Surfaces to be wrapped should be wire brushed clean or ground to remove slag or oxidation from torch cuts.

### 3.7.2 Weather conditions

Welding shall not be performed when the ambient temperature is less than 0 F (-18 C), or when surfaces are wet from rain, condensation, snow, or ice, or during periods of high wind, unless the operator and the work are properly protected. Regardless of the ambient conditions, the metal temperature in the pipe wall shall not be less than 50 F (10 C) at any point within 3 in. (76 mm) of the point of welding or four times the pipe wall thickness, whichever is greater. Preheating shall be done according to the following Section 3.7.3.

### 3.7.3 Preheating

Preheating of the joints to be welded shall be performed in accordance with ANSI/AWS D1.1, Table 3.2, Prequalified: Minimum Preheat and Interpass Temperature. When preheating is required, it shall extend ahead of the point of welding a minimum distance of four times the plate thickness, but not less than 3 in. (76 mm), on each side of the seam. Proper preheat temperature shall be determined periodically during welding by checking the material at a point at least four times the plate thickness, but not less than 3 in. (76 mm), on either side of the seam.

### 3.7.4 Tack Welding

Small erection tack welds used in the assembly of joints need not to be removed provided (1) they are sound and their size does not exceed the subsequently applied root pass; (2) they do not interfere with welding procedures required for closure joints to control thermal stresses; (3) they do not prevent the proper distribution of the annular space to control the distance between faying surfaces in lap joints; and (4) the electrodes used in making the tack welds shall be the same as used in the final welds. Tack welds that are not within the final welds are to be removed.

### 3.7.5 Application and weld contour

The welds shall be applied by means of continuous stringer beads, or a weave pattern as qualified by AWS D1.1 (Figure 5.4 of ANSI/AWS D1.1 shows acceptable and unacceptable weld profiles). Each bead shall be cleaned and descaled before the succeeding bead is applied. Welded joints shall not be covered or coated until after welding is completed and the weld accepted.

a. Surface pass: The surface pass on groove welds shall be central to the seam, and all surface passes shall be smooth and free from depression. The final weld surface shall be free from weld slag and pinholes.

b. Undercutting, overlapping, and finished fillet weld: Undercutting of the base metal in pipe and adjoining the weld is a defect and shall be repaired. Overlapping or burning back the inside or outside corner during application of a fillet weld shall not be permitted. The finished fillet weld shall be free of grooves, deep valleys, or ridges and shall contain no abrupt changes in section at the toe.

c. Lap - or fillet - weld legs and faces: Lap or fillet welds shall have legs of equal size, except when specified otherwise. The faces of fillet welds may be flat to slightly convex. A detail of the typical

Bell and Spigot Lap - joint weld is shown on Drawing No. M1.

d. Cracks in weld and base metal, incomplete fusion, and weld overlap: Cracks in weld and base metal, incomplete fusion, lack of complete joint penetration (including fillet welds that do not penetrate past the point of intersection of the members being joined), and weld overlap are unacceptable. Pinholes are unacceptable and shall be repaired according to Sec. 4.7 of the AWWA C206.

### 3.8 TESTING OF FIELD WELDS

Field welds shall be tested by dye penetrant test or magnetic particle procedure and shall include the following references as applicable American Society of Mechanical Engineers (ASME) 1989, Edition Section V, Non-Destructive examination including current addenda and American Society for Testing and Materials ASTM E709 standard methods for magnetic particle examination.

### 3.9 INSPECTION OF PIPE COATING AND INSPECTION OF FIELD JOINTS

#### 3.9.1 Coating Inspector

The Contractor shall retain an individual certified as a coating inspector by the National Association of Corrosion Engineers (NACE) with a working knowledge of pipeline coatings and cathodic protection. The coating inspector shall ensure the coatings are properly applied, inspected, and repaired if necessary, and free from defects prior to backfilling the pipe. The coating inspector is to ensure the proper equipment and procedures are being followed. The pipe is to be visually inspected and all apparent defects shall be holiday tested and repaired prior to backfill. The coating inspector shall approve the holiday test equipment and instruct the pipe Contractor on its use. The pipe Contractor is to holiday test and repair all field applied coatings on the field joints. The coating inspector must be on the site and witness the holiday testing as each pipe joint is laid. The coating inspector is to keep accurate records of the inspection process and shall work under the supervision of the corrosion engineer specified in Section 26 42 17.00 10 - CATHODIC PROTECTION SYSTEM.

#### 3.9.2 Exterior Pipe Coating

The exterior pipe coating shall be visually inspected for defects sustained during shipping and handling. Any defects shall be repaired in accordance with 2.2.7.2 or 2.2.8.2, depending on coating applied. The Contractor shall dig "bell holes" at every joint large enough to work under the pipe to install the coating.

#### 3.9.3 Exterior Field Joints

After the pipe joints have been welded "in place" and the welds inspected, the joints shall be cleaned with a wire brush and coated in accordance with the requirements of 2.2.7.3 or 2.2.8.3, depending on coating applied.

#### 3.9.4 Interior Coating of Pipe and Joints

The interior of the pipe shall be visually inspected for defects. Any defects in the pipe shall be repaired per manufacturer's recommendation. Joints shall be coated in the same manner.

### 3.9.5 Interior Field Joints

Field joints shall be abrasively blasted to SSPC-SP10 blast Near White and each side of the factory applied coating ruffed-up to accept the field applied coating. Joint shall be coated in the same manner and to the same thickness as the pipe. All blast residue shall be removed from the pipe.

-- End of Section --

SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

SD-04 Shop Drawings

Miscellaneous Metal Items; G

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for all miscellaneous steel items.

1.2 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123, ASTM A 653, or ASTM A 924, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.3 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

#### 1.4 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

#### 1.5 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

#### 1.6 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

### PART 2 PRODUCTS

#### 2.1 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

### PART 3 EXECUTION

#### 3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations.

-- End of Section --

SECTION 23 03 00.00 20

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2012; Errata 2012; INT 1 2012; INT 2 2012) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 11 (1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2011; Errata 2 2012) National Electrical Code

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

SD-03 Product Data

Certification

1.3 RELATED REQUIREMENTS

This section applies to all sections of Division 23: "Mechanical" of this project specification, unless specified otherwise in the individual section.

1.4 QUALITY ASSURANCE

1.4.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

#### 1.4.2 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

#### 1.4.3 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

#### 1.4.4 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

##### 1.4.4.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

##### 1.4.4.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

#### 1.6 ELECTRICAL REQUIREMENTS

Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 33 71 02. 00 20 UNDERGROUND ELECTRICAL DISTRIBUTION.

## 1.7 ELECTRICAL INSTALLATION REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

### 1.7.1 New Work

Provide electrical components of mechanical equipment, such as motors, motor starters, control or push-button stations, float or pressure switches, solenoid valves, integral disconnects, and other devices functioning to control mechanical equipment, as well as control wiring and conduit for circuits rated 100 volts or less, to conform with the requirements of the section covering the mechanical equipment. Extended voltage range motors shall not be permitted. The interconnecting power wiring and conduit, control wiring rated 120 volts (nominal) and conduit, and the electrical power circuits shall be provided under Division 33, except internal wiring for components of package equipment shall be provided as an integral part of the equipment.

### 1.7.2 High Efficiency Motors

#### 1.7.2.1 High Efficiency Single-Phase Motors

Unless otherwise specified, single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11.

## 1.8 ACCESSIBILITY

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

### 3.1 PAINTING OF NEW EQUIPMENT

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

#### 3.1.1 Factory Painting Systems

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

-- End of Section --

SECTION 26 42 17.00 10

CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT)

PART 1 GENERAL

1.1 SCOPE

This specification pertains to the implementation of a corrosion mitigation and monitoring system for the proposed parallel ten (10) foot diameter steel water lines. The proposed system shall include, but not be limited to, coating evaluations, test stations, rectifiers, impressed current anodes, testing and all associated cable hardware required to complete the installation, as well as site clean up and surface restoration. These measures are to be implemented to enhance the coatings and wraps addressed elsewhere in the specifications. This specification shall include all construction labor, equipment, supervision and engineering to ensure the cathodic protection components are installed and tested properly in accordance with these specifications and associated layout drawings. The Contractor shall be completely responsible for workmanship and the satisfactory performance of the components furnished. Power for the cathodic protection system will come from an existing rectifier installed under another contract that is outside the pipeline limits of construction.

The Contractor may propose modifications upon review of the project specifications and site verifications. These changes will only be considered if documented and if they will result in benefits to the system. Any proposed modifications must be fully described and submitted by the Contractor and approved by the Contracting Officer. Any modifications shall incorporate all requirements of this specification.

a) Verification of Site Conditions: The Contractor shall coordinate and properly relate this work to the site and to the work of all trades. The general location of the pipeline is shown on the drawings. However, the Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, verify existing conditions in the field, determine the exact locations of existing lines and structures, and advise the Contracting Officer of any discrepancy that may prevent or hinder the specified work from being completed. The Contractor shall be solely responsible for locating and marking underground structures so as to avoid their damage during construction.

b) System Arrangement: The drawings and specification indicate the locations of the cathodic protection system and components to be installed.

c) Material Storage: The Contractor shall be solely responsible for securing stored on-site materials.

1.2 QUALITY ASSURANCE

a) Corrosion Engineer: The Contractor shall retain an individual certified as a cathodic protection specialist by the National Association of Corrosion Engineers (NACE). Field engineering personnel shall be under the direct supervision of the specialist and shall be certified by NACE.

Corrosion Technicians must be NACE certified, qualified to provide supervision for the engineer and shall have a minimum of 5 years experience. The engineer shall provide a list of at least five (5) similar projects, which involve the evaluation of coatings and cathodic protection on large diameter water lines. The supervising specialist shall receive and review all submittals and certify their compliance with the plans and specifications to the Contracting Officer. The specialist shall also ensure the cathodic protection system is installed and placed into service in accordance with these specifications. As a minimum, the specialist shall make three (3) visits to the project site; once at the start of construction, midway through the project, and for final testing.

### 1.3 SUBMITTALS

Government approval is required for all submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 - "SUBMITTAL PROCEDURE" (BASE BID):

a) Bill of Materials: Prepare a bill of materials indicating quantities, detailed descriptions and manufacturers.

b) Catalog Cuts:

1. Anode Lead Wire
2. Test Leads
3. Anodes
4. Coke Breeze
5. Test Stations
6. Exothermic Welds
7. Backfill Shields
8. Rectifiers
9. Epoxy Splice Kit
10. Test Station Tags
11. Crimp Connectors
12. Test Station Labels and Signage
13. Positive Cable
14. Negative Cable
15. Warning Tape
16. Marker Sign
17. Reference Cells
18. Corrosion Probe

c) Certificates:

1. Submit evidence of the corrosion specialist's qualifications.

d) Shop Drawings: G

- 1.) Rectifier Unit (2.3)
- 2.) Anode Installation Procedure (3.1, 3.2)

### 1.4 DELIVERY, STORAGE, AND HANDLING

Storage for magnesium anodes will be designated by the Contracting Officer. If anodes are not stored in a building, protect them from inclement weather. Packaged anodes damaged as result of improper handling or weather exposure shall be resacked and the required backfill added.

## 1.5 EXTRA MATERIALS

Submit spare parts data for each different item of material and equipment specified, after approval of detail drawings and not later than 3 months prior to the date of beneficial occupancy. Include in the data a complete list of parts, special tools, and supplies, with current unit prices and source of supply. Furnish one spare anode of each type.

## PART 2 PRODUCTS

### 2.1 ANODES

#### 2.1.1 Trenched Type

a) Anodes shall be polymeric material intended for continuous runs buried underground.

Current Rating: 16 milliamperes per linear foot

Type: 1500-01

#### 2.1.2 Lead Wires

a) Anode Bed: Positive cable shall be HMWPE insulated stranded copper not smaller in diameter than #6 AWG, continuous. Splicing of the cable except to the anode will not be permitted.

#### 2.1.3 Backfill

a) Anode Bed: Lubricated calcined petroleum coke having the following analysis:

Chemical	Moisture	0.00%
Volatiles	0.00%	
Ash	0.10%	
Fixed Carbon	99.77%	

#### 2.1.4 Junction Box

a) Galvanized steel with phenolic  $\frac{1}{4}$  inch thick panel.

b) Cabinet shall be 14" wide by 16" high by 6" deep with screened vents.

c) Lugs shall be designed to accommodate #2 AWG cable.

d) Provision for four (4) slide resistor mountings shall be made on the panel with one (1) end terminated on a  $\frac{1}{8}$ " thick by  $\frac{3}{4}$ " wide solid copper buss. Resistors shall be selected based on commissioning survey.

e) Junction box shall have negative terminal bus bar with two (2) terminal lugs for negative cable.

f) Panel shall be labeled to identify anode circuits.

#### 2.1.5 Cable Splices

Anode cable splices are not allowed. Header cables are to be spliced

using copper crimp and cast 3M 90B-1 epoxy or approved equal.

## 2.2 RECTIFIER UNITS

- a) Cabinets are to be NEMA 3R, galvanized with a white powder topcoat. Cabinets shall be small arms proof and capable of being locked to prevent vandalism. Contractor shall provide locks & keys to Contracting Officer.
- b) AC input is to be 230/115 volt, single phase.
- c) Transformers are to be center tap bridge with 5 fine and 5 course settings.
- d) Bridge is to be silicon.
- e) Efficiency filters are to be provided for the output.
- f) Surge arrestors are to be provided for the input and output circuits.
- g) Units are to have a solid state current monitor with a red globe mounted inside of the cabinet that goes off when outside target levels.
- h) Units are to have a built in solid state current interrupters.
- i) Units must have continuous dual meters.
- j) Negative circuit shall have two (2) #2 AWG lugs and positive has one (1) #2 AWG lug.
- k) Wiring diagram is to be laminated on inside door of each unit.
- l) A single 5/8" x 8' solid copper ground rod with solid bare #6 AWG copper ground wire is to be provided for each unit.

## 2.3 NEGATIVE CABLE

- a) #4 AWG stranded copper with HMWPE insulation

## 2.4 MARKER TAPE

- a) Carsonite - Flex-O-Sign or approved equal.

## 2.5 TEST STATION

- a) Head is to be of lexan material with seven (7) terminals.
- b) Mounting pipe is to be 3" galvanized rigid conduit with threaded plastic bushing on bottom.
- c) 24" square x 6" thick concrete footing is to be provided for each test station.
- d) A 1" wide by 2" long stainless tag is to be provided for each station stamped with the test point number (numbers to be assigned by the Contracting Officer).

- e) All cables are to be tagged with plastic labels.
- f) All cables are to be landed with crimp type ring tongue connectors.

## 2.6 WARNING TAPE

- a) 3" wide yellow non-detectable to read "Cathodic Protection Cable Buried Below"

## 2.7 REFERENCE CELLS

- a) Reference cells shall be designed for direct burial in soil.
- b) Cu/CuSO<sub>4</sub> reference cells shall be Permacell Plus or approved equal.
- c) Zinc reference cells shall be 1.4" x 9" with a bare weight of 5 lbs. and a packaged weight of 24 lbs. Zinc shall be 99.99% pure conforming to ASTM B-418 Type II Alloy standard.
- d) Cable shall be #14 AWG stranded copper with HMWPE cable in continuous runs. No splicing of reference cell cables is allowed.
- e) Cable is to be color-coded blue for copper/sulfate and yellow for zinc.
- f) Reference cells shall be provided paired as copper/sulfate and zinc.
- g) A corrosion probe capable of monitoring long-term corrosion rates shall be provided at each reference cell site. The probe is to be of RCS manufacture or approved equal.

## PART 3 EXECUTION

### 3.1 ANODES

Anodes: Trenched Horizontal Anodes

- a) Cut trenches 36 inches deep and 8 inches wide.
- b) Lay 6 inches of coke breeze in trench.
- c) Lay polymer anode on top of coke centered.
- d) Lay 6 inches of coke breeze in trench on top of anode.
- e) Backfill trench with 6 inches of compacted native soil.
- f) Lay positive feeder cables in trench where applicable.
- g) Backfill trench with 6 inches of compacted native soil.
- h) Lay warning tape centered in trench.
- i) Back fill remaining 12 inches of trench with compacted native soil.

### 3.2 NEGATIVE AND POSITIVE CABLES

- a) The positive and negative cables shall be routed as shown.
- b) Below Grade Cables: Cut a 6-inch wide by 18-inch deep trench. Trenches should be kept as straight as possible.

Lay 1 inch PVC rigid conduit in the bottom of the trench. Use sweeps on all corners. Pour 4 inch thick red concrete over conduit in trench.

Pull the cable through the conduit ensuring that the insulation is not damaged.

Backfill the trenches to a depth of twelve inches and install a warning tape. This tape should read "Warning Cathodic Protection Cable Below". When the tape is laid, complete the backfilling.

- c) Above Grade Cables: Run all above grade cables in rigid PVC coated galvanized steel conduits.
- d) All splices shall be made using copper crimps and cast epoxy.

### 3.3 STRUCTURE CONNECTION

- a) The location of the structure (negative) connection associated with the cathodic protection system is to be as shown. These connections shall be made using the exothermic weld method.
- b) Clean each of the structure connection areas to bright metal. Then attach cable using an exothermic weld charge.
- c) Clean the weld off and ensure a good connection has been obtained, then coat the weld with bitumastic.

### 3.4 RECTIFIER UNITS

The rectifier unit and slide switch housing were installed under a previous contract. The Contractor will need to install the proper size slide resistors based on testing of the cathodic protection system.

### 3.5 TEST STATIONS

- a) Install test stations adjacent to the pipe and provide a concrete footing. Terminate test leads and calibrated shunts as indicated. Install test station labels. Test stations will be located according to the layout and details shown on the plans.
- b) Extreme care must be taken to avoid damaging lead wires.

### 3.6 TESTS

All field tests shall be witnessed by the Contracting Officer or his representative. Advise the Contracting Officer at least 5 days prior to conducting final test.

#### 3.6.1 Coating Inspection

- a) (Refer to requirements specified in Section 05 50 04.00 10)

### 3.6.2 Cathodic Protection System

- a) A corrosion engineer will perform all testing and energizing. "Corrosion Engineer" shall be defined as...
1. A person with experience in the field of cathodic protection.
  2. N.A.C.E. certification of "Corrosion Specialist or Cathodic Protection Specialist".
- b) Testing shall consist of acquiring native pipe-to-soil potentials at all test stations. Comparing the permanent zinc reference cell to the permanent copper/copper sulfate reference cell to a portable copper/copper sulfate reference cell contacting the soil over each pipe.
- c) Pipe-to-soil potentials shall be taken with a high impedance digital Voltmeter with greater than ten meg ohm input impedance. The pipe shall be connected to the positive meter terminal and the reference cell shall be connected to the negative meter terminal. The meter shall be set to a 2 volt D.C. scale. Values recorded shall clearly show positive or negative sign.
- d) Zinc reference cell values shall be converted to copper/copper sulfate reference cell by subtracting 1.100 volts from the value recorded for the zinc reference cell. This data column will be marked "zinc converted to copper/copper sulfate".
- e) The system shall be energized by adjusting the rectifier in the smallest increments (fine tap steps) until the furthest set of permanent copper/copper sulfate reference cells reads between negative .900 and .950 volts.
- Sets of permanent reference cells, closer to the rectifier, shall be set to read between negative .900 and .950 volts by adjusting the slide-wire resistor feeding current to the anode segment adjacent to the reference cells under test.
- f) When both rectifiers have been adjusted satisfactorily, a portable copper/copper sulfate reference cell placed directly over the pipe shall be read for a negative value between .950 and 1.050 volts.
- g) After allowing three to four weeks polarization time, rectifiers shall be interrupted synchronously nine seconds "on" and three seconds "off". All "instant off" potentials shall be between -.850 and -1.050 volts (-.800 to -1.000 volts for PCCP) for both permanent reference cells (zinc converted to copper/copper sulfate) and a portable copper/copper sulfate reference cell placed directly over each pipeline. System shall be readjusted until these results are achieved after repolarization time of two months is allowed. Readjustment shall be done quarterly by others.
- h) After the last quarterly readjustment a baseline close interval survey shall be performed with the rectifiers interrupted. Data logging interval shall be 2.5 feet and the reference cells located between the two pipelines. Instant off potentials shall range between -.850 and -1.050 volts (-.800 to -1.000 volts for PCCP). Permanent reference cells shall also fall in this range.

Note: Permanent copper/copper sulfate reference cells will

deteriorate over time and should not be the sole reason for readjustment but zinc converted to copper/copper sulfate will be used to verify the validity of the permanent copper/copper sulfate reference cell.

i) All of the field data shall be tabulated and presented in a typed report. The report must include an evaluation of the field data, as-built drawings and operation and maintenance instructions.

### 3.7 OPERATION AND MAINTENANCE MANUAL

a) The Contractor shall furnish seven copies of an O &M Manual which shall include literature of the manufacturer's data for all related equipment. The manual shall also include descriptions of the equipment, wiring diagrams where applicable, operating and maintenance instructions; and spare parts data including source of supply. The manual shall include specific instructions for monitoring and performing the required testing of the Cathodic Protection System and the internals recommended for performing required maintenance and testing. It shall include any necessary forms for record keeping.\

b) The Contractor shall provide as-built drawings which shall include the exact stationing of each test station and anode. Each test station shall have an 8 1/2" x 11" drawing created showing the distance to other recognizable features, such as permanent pipeline appurtenances, roadways, fences, etc.

### 3.8 TRAINING

The cathodic protection specialist is to provide 4 hours of training for the owner. Training must cover cathodic protection basics, monitoring, trouble shooting and record keeping.

-- End of Section --

SECTION 27 21 10.00 10

FIBER OPTIC CABLE INSTALLATION-UNDERGROUND

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

CONSUMER ELECTRONICS ASSOCIATION (CEA)

EIA ANSI/EIA 455-81A-91	FOTP-81 Compound Flow (Drip) Test for Filled Fiber Optic Cable
EIA ANSI/EIA/TIA-455-30B	FOTP-30 Frequency Domain Measurement of Multimode Optical Fiber Information Transmission Capacity
EIA ANSI/EIA/TIA-455-53A	FOTP-53 Attenuation by Substitution Measurement for Multimode Graded-Index Optical Fibers or Fiber Assemblies Used in Long Length Communications Systems
EIA ANSI/TIA/EIA-568-A	Commercial Building Telecommunications Cabling Standard

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2007; TIA 2007-1; TIA 2007-2; TIA 2007-3; TIA 2007-4; TIA 2007-5; Errata 2006-1; Errata 2007-2; Errata 2009-3) National Electrical Safety Code
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011) National Electrical Code
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1.2 SYSTEM DESCRIPTION

The work consists of furnishing, installing, testing and making ready for operation a complete fiber optic cable system for continuous use. Pipeline station 22+00 and the pipeline optical cable cabinet located at station 12+00, which is outside the limits of pipeline construction. The contractor shall terminate fiber optic cables at the pipeline optical cable cabinets.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

## SD-02 Shop Drawings

Fiber Optic System; G  
Installation; G

Detail drawings including a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Detail drawings shall contain complete cabling, wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function with its associated subsystems as well as other systems. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operations.

Record Drawings; G

Record drawings for the installed wiring system showing the actual location of all cable terminations, splices, routing, and size and type of all cables. The identifier for each termination and cable shall appear on the drawings. The drawings shall include gauge and pair or fiber count for each cable, or conductor assignment of outside plant cable, and protector and connector block layout at the termination points after installation.

SD-03 Product Data

Installation; G

Printed copies of the manufacturer's recommendations for the material being installed, prior to installation. Installation of the item will not be allowed to proceed where installation procedures, or any part thereof, are required to be in accordance with those recommendations until the recommendations are received and approved.

Acceptance Tests; G

Test plans defining all tests required to ensure that the system meets specified requirements. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

SD-06 Test Reports

Acceptance Tests; G

Test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis.

SD-07 Certificates

Fiber Optical Cable; G

Proof that the items furnished under this section conform to the specified requirements in FCC, ICEA, REA, RUS, ANSI, ASTM, NFPA, EIA, or UL 1660, where materials and equipment are so specified.

Qualifications; G

The qualifications of the manufacturer, splicer, and installation supervisor as specified.

#### 1.4 QUALIFICATIONS

##### 1.4.1 Cable Installers

Installation shall be under the direct supervision of an individual with a minimum of 3 years experience in the installation of the specified fiber optic cable and components.

##### 1.4.2 Cable Splicing and Termination

All cable splicers shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

##### 1.4.3 Manufacturers

The cable, equipment, and hardware provided shall be from manufacturers that have a minimum of 3 years experience in producing the types of cable, equipment, and hardware specified.

#### 1.5 DELIVERY AND STORAGE

##### 1.5.1 Cable Requirements

All cable shall be shipped on reels. The diameter of the drum shall be large enough to prevent damage to the cable during reeling and unreeling. The reels shall be constructed to prevent damage during shipment and handling. The outer end of the cable shall be securely fastened to the reel head to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel, or into a housing on the inner slot of the drum, with sufficient length to make it available for testing. The inner end shall be fastened to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from minus 40 to plus 148 degrees F, with relative humidity from 0 to 100 percent.

##### 1.5.2 Equipment

All equipment shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants, in accordance with the manufacturer's requirements.

## PART 2 PRODUCTS

### 2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening. Each major component of equipment shall have the manufacturer's name and type identified on the equipment.

All products supplied shall be specifically designed and manufactured for use with outside plant communications systems. All items of the same class of equipment shall be the products of a single manufacturer. All materials shall appear in RUS - IP 344-2. List of Materials Acceptable for Use on Telecommunications Systems of RUS Borrowers.

## 2.2 CABLE

### 2.2.1 Fiber Optic Cable

Fiber optic cable shall be specifically designed for outside use with loose buffer construction. The loose buffer optical fiber cable shall have the glass optical fiber within a filled loose tube. All fiber optic cables used shall conform to the requirements of RUS REA BULL 1753F-601 (PE-90) including any special requirements made necessary by a specialized design..

The armored cable assembly shall have a fiber count of forty eight (48) fibers. The fiber shall be single mode (1310/1550 nanometer). Maximum attenuation (db/km) shall be 0.4/0.3 for respective wavelengths. The approximate cable weight shall be 148 pounds per thousand feet. Minimum tensile loading shall be 600 pounds force. Long term installed tensile strength shall be 200 pounds force. The guaranteed gigabit ethernet distance shall be 5000 meters. Nominal outside diameter is 0.62 inches. The cable assembly shall be rodent resistant.

Sequential footage markings on the outer jackets of cables shall be provided to facilitate the inventory of cable units. The Contracting Officer and the contractor shall document the inventory of underground plant cable as it is installed. Construction drawings should be appropriately marked so they can be used as permanent records of all plant items.

#### 2.2.1.1 Cable Cores

A central, nonmetallic core member shall be included to serve as a cable core foundation to reduce strain on the fibers, but not to serve as a pulling strength member.

#### 2.2.1.2 Optical Fiber

Single-mode optical fibers shall be Class IV.

#### 2.2.1.3 Shielding or Other Metallic Covering

A copper, copper alloy, or copper and steel laminate metallic covering or shield shall be provided per RUS REA BULL 1753F-601 (PE-90).

#### 2.2.1.4 Performance Requirements

The fiber optic cable shall comply with the specified mechanical performance requirements while used in buried and underground duct applications where the temperature varies from minus 5 to plus 140 degrees F. Optical performance degradation shall be less than 5 percent of the optical performance requirements in the temperature range of minus 5 to plus 140 degrees F. The fiber optic cable shall not be damaged in storage where the temperature may vary from minus 40 to plus 148 degrees F.

## 2.3 ENCLOSURES

### 2.3.1 Fiber Optic Enclosures

#### 2.3.1.1 Fiber Optic Splice Enclosures

The fiber optic splice closures shall be suitable to house a splice organizer in a protective housing.

The closure shall have five splice trays minimum for a 60 fiber count capacity. Include mounting brackets and all accessories required to complete the installation as indicated on the drawings. No tools shall be required for closure or for re-entry.

### 2.4 CABLE SPLICES AND ORGANIZERS

#### 2.4.1 Fiber Optic Cable Splices

Each fiber optic splice shall be physically protected by a splice kit. The kit shall be specially designed for the splice.

#### 2.4.2 Fiber Optic Splice Organizer

The splice organizer shall be suitable for housing fiber optic splices in a neat and orderly fashion. The splice organizer shall allow for a minimum of 3 feet of fiber for each fiber within the cable to be neatly stored without kinks or twists. The splice organizer shall accommodate individual strain relief for each splice. The splice organizer shall allow for future maintenance or modification, without damage to the cable or splices. All required splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors shall be provided in the organizer kit.

### 2.5 CABLE TERMINALS

### 2.6 FIBER-OPTIC TERMINATIONS

#### 2.6.1 Fiber Optic Connectors

At structures and patch panels, where applicable, all outside plant fiber strands shall be terminated in a ST type fiber optic connector, with ceramic ferrule material and a maximum insertion loss of 0.5 dB. Connectors shall meet performance standards of EIA ANSI/TIA/EIA-568-A. If pre-connectorized cable assemblies or pigtailed are used, the connectors shall be terminated on a 10 foot length of single-fiber cable. The single-fiber cable shall contain a buffered optical fiber of the same type and specification as that used in the multi-fiber cable.

### 2.7 MISCELLANEOUS ITEMS

#### 2.7.1 Shield Connectors

Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire. The connector shall be made of tin-plated tempered brass. Shield bond connectors shall comply with REA BULLETIN 345-65.

#### 2.7.2 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. The braid shall be made from flat tin-plated copper.

## PART 3 EXECUTION

### 3.1 INSTALLATION

All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and as shown. All installation work shall be done in accordance with the safety requirements set forth in the general requirements of IEEE C2 and NFPA 70.

#### 3.1.1 Cable Inspection and Repair

All cable and wire used in the construction of the project shall be handled with care. Each reel shall be inspected for cuts, nicks or other damage. All damage shall be repaired to the satisfaction of the Contracting Officer. The reel wrap shall remain intact on the reel until the cable or wire is ready to be placed.

##### 3.1.1.1 Fiber Optic Cable Bends

Fiber optic cable bends shall have a radius of not less than 20 times the cable diameter.

##### 3.1.1.2 Cable Bends

Cable bends shall have a radius of not less than 20 times the cable diameter. Only large radius sweeps shall be used in conduit runs and shall not exceed a cumulative 90 degrees.

##### 3.1.1.3 Pull Cord

Pull cords of 3/8 inch polypropylene shall be installed in all unused ducts with a minimum of 2 feet spare cord protruding from each end.

### 3.2 SPLICING

#### 3.2.1 Fiber Optic Splices

Fiber optic splicing shall be in accordance with the manufacturer's recommendation; each splice shall have a loss of less than 0.1 dB.

### 3.3 GROUNDING

Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of cable sheaths, cable splices, and terminals shall be grounded. Grounding shall be in accordance with requirements of NFPA 70, Articles 800-93 and 800-100.

#### 3.3.1 Grounding and Bonding Connections

Connections above grade shall be made by the exothermic-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

### 3.4 ACCEPTANCE TESTS

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test; testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. The test plans shall define all the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

#### 3.4.1 Fiber Optic Cable

Two optical tests shall be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly. The tests shall be performed on the reel prior to installation and following installation. Deviations of more than 1% between initial and installed test results per unit length shall be reason to require remedial action by the Contractor.

##### 3.4.1.1 OTDR Test

The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings, improper splices, for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 3280 feet minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. The OTDR test shall be conducted in accordance with EIA ANSI/EIA 455-81A-91 for single-mode fiber. Splice losses shall not exceed 0.1db. Attenuation losses shall not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber.

##### 3.4.1.2 Attenuation Test

End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 1300 and 1500 nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met. The measurement method shall be in accordance with EIA ANSI/EIA/TIA-455-53A.

##### 3.4.1.3 Bandwidth Test

The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with EIA ANSI/EIA/TIA-455-30B.

-- End of Section --

SECTION 31 05 22

GEOTEXTILES USED AS FILTERS

PART 1 GENERAL

1.1 SCOPE

The work provided for herein consists of furnishing all plant, labor, equipment and materials, and performing all operations in connection with the installation of the geotextiles, including surface preparation and placement of geotextile, all in accordance with these specifications and the contract drawings.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 123	(2009e1) Terminology Relating to Textiles
ASTM D 4354	(1999; R 2009) Sampling of Geosynthetics for Testing
ASTM D 4355	(2007) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D 4491	(1999a; R 2009) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(2004; R 2009) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM D 4833	(2007) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4873	(2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D 4884	(2009) Strength of Sewn or Thermally Bonded Seams of Geotextiles

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

#### SD-04 Samples

##### Geotextile

Geotextile samples for testing, if requested, to determine compliance with the requirements in this specification, a minimum of 60 days prior to the beginning of installation of the same textile. Upon delivery of the geotextile, submit duplicate copies of the written certificate of compliance signed by a legally authorized official of the manufacturer. The certificate shall state that the geotextile shipped to the site meets the chemical requirements and exceeds the minimum average roll value listed in TABLE 1. Upon request, supply quality control and quality assurance tests for the geotextile. Provide all samples from the same production lot as will be supplied for the contract, of the full manufactured width of the geotextile by at least 10 feet long, except that samples for seam strength may be a full width sample folded over and the edges stitched for a length of at least 5 feet. Samples submitted for testing shall be identified by manufacturers lot designation. For needle punched geotextile, the manufacturer shall certify that the geotextile has been inspected using permanent on-line metal detectors and does not contain any needles.

#### SD-07 Certificates

##### Geotextile

Manufacturer's certification of the geotextile material. All brands of geotextile and all seams to be used will be accepted on the basis of mill certificates or affidavits. Submit duplicate copies of the mill certificate or affidavit signed by a legally authorized official from the company manufacturing the geotextile. The mill certificate or affidavit shall attest that the geotextile meets the chemical, physical and manufacturing requirements stated in this specification.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver only approved geotextile rolls to the project site. All geotextile shall be labeled, shipped, stored, and handled in accordance with ASTM D 4873. No hooks, tongs, or other sharp instruments shall be used for handling geotextile.

#### PART 2 PRODUCTS

##### 2.1 MATERIALS

###### 2.1.1 Geotextile

###### 2.1.1.1 General

Provide geotextile that is a woven pervious sheet of plastic yarn as

defined by ASTM D 123 matching or exceeding the minimum average roll values listed in TABLE 1. Strength values indicated in the table are for the weaker principal direction.

TABLE 1  
MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAP STRENGTH	lb	240 Min	ASTM D 4632
SEAM STRENGTH	lb	216 Min	ASTM D 4632
PUNCTURE	lb	115 Min	ASTM D 4833
TRAPEZOID TEAR	lb	90 Min	ASTM D 4533
PERMEABILITY	cm/sec	5 Ks	ASTM D 4491
APPARENT OPENING SIZE	U.S. SIEVE	70-100	ASTM D 4751
PERMITTIVITY	sec <sup>-1</sup>	7 Min	ASTM D 4491
ULTRAVIOLET DEGRADATION	Percent	7 AT 500 Hrs	ASTM D 4355

#### 2.1.1.2 Geotextile Fiber

Fibers used in the manufacturing of the geotextile shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of polyolefins, polyesters, or polyamides. Add stabilizers and/or inhibitors to the base polymer, if necessary to make the filaments resistant to deterioration caused by ultraviolet light and heat exposure. Reclaimed or recycled fibers or polymer shall not be added to the formulation.

Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Finish the edges of the geotextile to prevent the outer fiber from pulling away from the geotextile.

#### 2.1.2 Seams

Sew the seams of the geotextile with thread of a material meeting the chemical requirements given above for geotextile yarn or bond the seams by cementing or by heat. Attach the sheets of geotextile at the factory or another approved location, if necessary, to form sections not less than 1.5 feet wide. Test seams in accordance with method ASTM D 4884. The strength of the seam shall be not less than 90 percent of the required grab tensile strength of the unaged geotextile in any principal direction.

#### 2.1.3 Securing Pins

Secure the geotextile to the aggregate surfacing foundation soil by pins to prevent movement prior to placement of aggregate surfacing. Other appropriate means to prevent movement such as staples, sand bags, and stone could also be used. Insert securing pins through both strips of overlapped geotextile along the line passing through midpoints of the overlap. Remove

securing pins as placement of aggregate materials are placed to prevent tearing of geotextile or enlarging holes. Maximum spacing between securing pins depends on the steepness of the embankment slope. The maximum pins spacing shall be equal to or less than the values listed in TABLE 2. When windy conditions prevail at the construction site, increase the number of pins upon the demand of the Contracting Officer.

TABLE 2  
MAXIMUM SPACING FOR SECURING PINS

EMBANKMENT	SPACING, feet
STEEPER THAN 1V ON 3H	2
1V ON 3H TO 1V ON 4H	3
FLATTER THAN 1V ON 4H	5

## 2.2 INSPECTIONS, VERIFICATIONS, AND TESTING

### 2.2.1 Manufacturing and Sampling

Geotextiles and factory seams shall meet the requirements specified in TABLE 1. Perform conformance testing in accordance with the manufacturers approved quality control manual. Randomly sample geotextiles in accordance with ASTM D 4354 (Procedure Method A). Sample factory seams at the frequency specified in ASTM D 4884.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Prepare surface, on which the geotextile will be placed, to a relatively smooth surface condition in accordance with the applicable portion of this specification and shall be free from obstruction, debris, depressions, erosion feature, or vegetation. Remove any irregularities so as to ensure continuous, intimate contact of the geotextile with all the surface. Any loose material, soft or low density pockets of material, shall be removed; erosion features such as rills, gullies etc. shall be graded out of the surface before geotextile placement.

### 3.2 INSTALLATION OF THE GEOTEXTILE

#### 3.2.1 General

Place the geotextile in the manner and at the locations shown. At the time of installation, reject the geotextile if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage.

#### 3.2.2 Placement

Place the geotextile as shown on the drawings. The geotextile shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. Place the strips to provide a minimum width of 18 inches of overlap for each joint. Adjust the actual length of the geotextile used based on

initial installation experience. Temporary pinning of the geotextile to help hold it in place until the aggregate layer is placed will be allowed. Remove the temporary pins as the aggregate gravel is placed to relieve high tensile stress which may occur during placement of material on the geotextile. Perform trimming in such a manner that the geotextile is not damaged in any way.

### 3.3 PROTECTION

Protect the geotextile at all times during construction from contamination by surface runoff; remove any geotextile so contaminated and replaced with uncontaminated geotextile. Replace any geotextile damaged during its installation or during placement of aggregate at no cost to the Government. Schedule the work so that the covering of the geotextile with a layer of the specified material is accomplished within 7 calendar days after placement of the geotextile. Failure to comply shall require replacement of geotextile. Protect the geotextile from damage prior to and during the placement of aggregate or other materials. This may be accomplished by limiting the height of drop to less than 1 foot, by placing a cushioning layer of sand or gravel on top of the geotextile before placing the material, or other methods deemed necessary. Care should be taken to ensure that the utilized cushioning materials will not impede the flow of water. Before placement of aggregate or other materials, demonstrate that the placement technique will not cause damage to the geotextile. In no case shall any type of equipment be allowed on the unprotected geotextile.

### 3.4 OVERLAPPING AND SEAMING

#### 3.4.1 Overlapping

Continuously overlap geotextile panels a minimum of 18 inches at all longitudinal and transverse joints. Where seams must be oriented across the slope, lap upper panel over lower panel. Appropriate measures will be taken to ensure required overlap exists after cushion placement.

-- End of Section --

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

SD-03 Product Data

Nonsaleable Materials; G

Written permission to dispose of such products on private property shall be filed with the Contracting Officer.

SD-04 Samples

Tree wound paint  
Herbicide

Samples in cans with manufacturer's label.

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

2.1 TREE WOUND PAINT

Bituminous based paint of standard manufacture specially formulated for tree wounds.

2.2 HERBICIDE

Comply with Federal Insecticide, Fungicide, and Rodenticide Act (Title 7 U.S.C. Section 136) for requirements on Contractor's licensing, certification and record keeping. Contact the command Pest Control Coordinator prior to starting work.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

### 3.1.2 Trees, Shrubs, and Existing Facilities

Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

### 3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor is responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, notify the Contracting Officer in ample time to minimize interruption of the service.

## 3.2 CLEARING

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint.

## 3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

## 3.4 PRUNING

Prune trees designated to be left standing within the cleared areas of dead branches 1 1/2 inches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1 1/2 inches in diameter with an approved tree wound paint.

## 3.5 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and

areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

#### 3.5.1 Pipe and Drains

The Contractor shall inform the Contracting Officer of all pipes and drains not shown on the drawings which are encountered during grubbing. Such pipe and drains shall not be removed or disturbed until so directed by the Contracting Officer. Material excavated in the process of removing pipes and drains shall be disposed of as specified in SECTION 31 23 00.00 20 - EXCAVATION, FILL, BACKFILL AND EMBANKMENT FOR STRUCTURES, subparagraph "Disposal of Excavated Materials".

#### 3.5.2 Filling of Holes

All holes caused by grubbing operations shall be backfilled with suitable material in 8 inch layers to the elevation of the adjacent ground surface, and each layer compacted to a density at least equal to that of the adjoining undisturbed material.

### 3.6 DISPOSAL OF MATERIALS

#### 3.6.1 General

The methods of disposing of all debris resulting from clearing and grubbing operations shall be: burning as specified in paragraph "Burning" or removal from the site in accordance with paragraph "Removal from Site of Work". The Contractor shall make a reasonable effort to channel merchantable material into the commercial market to make beneficial use of materials resulting from clearing and grubbing operations.

#### 3.6.2 Nonsaleable Materials

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed. Burn refuse to be burned at specified locations and in a manner to prevent damage to existing structures and appurtenances, construction in progress, trees, and other vegetation. Comply with all Federal and State laws and regulations and with reasonable practice relative to the building of fires. Burning or other disposal of refuse and debris and any accidental loss or damage attendant thereto shall be the Contractor's responsibility.

#### 3.6.3 Burning

The Contractor shall comply with the applicable pollution restrictions of the State and Title 40, Code of Federal Regulations, Part 76. Subject to such restrictions and obtaining any permit which may be required by said State or Federal agency, the Contractor may burn material within the contract area at any time within the contract period. Burning operations shall be conducted so as to prevent damage to standing timber or other flammable growth. The Contractor shall be responsible for any damage to life and/or property resulting from fires that are started by his employees or as a result of his operations. The Contractor shall furnish, at the

site of burning operations, adequate fire fighting equipment to properly equip his personnel for fighting fires. Fires shall be guarded at all times and shall be under constant surveillance until they have been extinguished.

#### 3.6.4 Removal from Site of Work

The Contractor may elect to remove all or part of the excess debris from the site of the work. Such disposal shall comply with all applicable Federal, State, and local laws. The Contractor shall, at his option, either retain for his own use or dispose of by sale or otherwise, any such materials of value. The Government is not responsible for the protection and safekeeping of any materials retained by the Contractor. Such materials shall be removed from the site of the work before the date of completion of the work. If debris from clearing operations is placed on adjacent property, the Contractor shall obtain, without cost to the Government, additional right-of-way for such purposes in accordance with Section 00 80 00.00 11 - SPECIAL CONTRACT REQUIREMENTS, paragraph "RIGHTS-OF-WAY." Such material shall be so placed as not to interfere with roads, drainage or other improvements and in such a manner as to eliminate the possibility of its entering into channels, ditches, or streams. The Contracting Officer reserves the right to approve or disapprove the use of Contractor-furnished disposal areas based on the location of the areas and a determination of the overall impact the proposed disposal will have on the environment. Contractor-furnished disposal areas shall not be located in woodlands or wetlands.

-- End of Section --

SECTION 31 23 00.00 20

EXCAVATION, FILL, BACKFILL AND EMBANKMENT FOR STRUCTURES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Reference to the standards of any technical society, organization, or association, or to codes of local or state authorities, shall mean the latest standard, code, specification, or tentative standard adopted and published as of the date of receipt of bids, unless specifically stated otherwise.

ASTM INTERNATIONAL (ASTM)

ASTM D 1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2216	(2005) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2487	(2006e1) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 6938	(2005) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 698	(2007e1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

1.2 DEFINITIONS

1.2.1 Degree of Compaction

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 698, for general soil types, abbreviated as percent laboratory maximum density.

1.3 SAMPLING AND TESTING

1.3.1 Soil Testing and Inspection Service

The Contractor shall provide a certified soil testing service approved by the Contracting Officer as specified in Section 01 45 04.00 11, (Contractor Quality Control). Testing shall include field-testing facilities for quality control during the construction period.

1.3.2 Quality Control Testing During Construction

Soil materials shall be tested during construction as follows:

MATERIAL TESTED	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Soil material-in-place after compaction	Density of soil-in-place	ASTM D 1556 Sand Cone Method or ASTM D 6938 Nuclear Method	At least three daily for each subgrade soil material, and for each layer of soil material; additional test whenever there is any change in moisture or as specified in paragraph 3.7 of this section.

Note: A minimum one sand cone density tests (ASTM D 1556) shall be taken with ASTM D 6938, nuclear method for comparison for each type backfill material used. One sand cone test (D 1556) shall be taken ever 25 Nuclear Method (ASTM D6938) initially until good calibration is confirmed, then one test every 200 nuclear readings.

### 1.3.3 Evaluation of Test Results

Soil materials of any classification shall not have a moisture content at the time of compaction that would be classified as unsatisfactory soil materials in the subparagraph 3.3.1 entitled, "Backfill and Embankment".

### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

#### SD-06 Test Reports

##### Laboratory Density Test (ASTM D698)

Submit copies of all laboratory test reports 15 days prior to starting work.

##### Field Density tests

##### Moisture Content Tests

Submit copies of all field test reports within 24 hours of the completion of the test.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

### 1.6 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned

utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 SOIL MATERIALS

#### 2.1.1 Satisfactory Materials

Any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, CL, ML, CL-ML, CH free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and frozen, deleterious, or objectionable materials.

#### 2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials. Unsatisfactory material also includes material classified as satisfactory which contains roots, and other organic matter, frozen material, and stones larger than 3 inches, branches, sticks, and other debris as determined by the Contracting Officer. The Contracting Officer shall be notified of any contaminated materials.

#### 2.1.3 Pipe Bedding

The pipe bedding material shall consist of a clean granular material meeting the Unified Soil Classification System (ASTM D 2487) requirement for either SW or SP. No more than 5 percent of the material will be allowed to pass the Number 200 sieve. Compaction of material below the pipe invert will not be required, except for pipe bedding details for bedding and pipe backfill as shown on drawing C-202, but each layer shall be finished to present a reasonably even surface. The allowable deviation from the prescribed thickness shall be plus 2 inches.

#### 2.1.4 Embankment Backfill

Except as specified below, embankment backfill material shall consist of any or all types of materials (except organic or unsatisfactory materials) from required excavations.

#### 2.1.5 Frozen Materials

Under no circumstances shall frozen earth, snow, or ice be placed in fill or backfill. The Contracting Officer may require the wasting of frozen material in order that construction may proceed and such material wasted by written order of the Contracting Officer will be paid for in accordance with the Contract Clause "Changes". The Contractor may waste frozen material, at his own expense, in order to proceed with the work even when the Contracting Officer has not issued a written order.

### 2.2 EQUIPMENT

The following are compaction equipment requirements for embankment construction.

## 2.2.1 Tamping Rollers

### 2.2.1.1 Tractor-Drawn

Tractor-drawn tamping rollers shall consist of one or more units. Each unit shall consist of a cylindrical drum not less than 60 inches in length and not less than 60 inches in diameter. Each drum shall have staggered feet uniformly spaced over the cylindrical surfaces so as to provide approximately 3 tamping feet for each 2 square feet of drum surface. The tamping feet shall be 7 to 11 inches in clear projection from the cylindrical surface of the roller, and shall have a face area of not less than 1 nor more than 5 square inches. The drums shall be water or sand and water ballasted. The weight of the roller when fully loaded shall not be less than 3,500 pounds per foot of drum length. The Contractor shall vary the amount of ballast in the drums to obtain optimum compaction effort for the material being compacted. The roller shall be equipped with cleaning devices, so designed and attached as to prevent the accumulation of material between the tamping feet. These cleaning devices shall be maintained at their full length and correct alignment throughout the periods of use of the roller. The rolling units of multiple-type tamping rollers shall be pivoted on the main frame in a manner which will permit the units to adapt themselves to uneven ground surfaces and to rotate independently. The roller shall be pulled by a tractor at a speed not to exceed 3.5 miles per hour.

### 2.2.1.2 Self-Propelled

At the option of the Contractor, self-propelled tamping rollers may be used in lieu of tractor-drawn tamping rollers provided these rollers conform to the towed roller requirements for the length and spacing of tamping feet, the empty weight per foot of drum, and cleaning devices. However, self-propelled rollers exceeding the empty weight requirement may be used, provided that by substitution of tamping feet having a face area not exceeding 14 square inches, the nominal foot pressure on the tamping feet of the self-propelled roller can be adjusted to approximate the foot pressure of the towed roller for the particular working conditions. Self-propelled rollers conforming to the above requirements but with tamping feet exceeding the 14 square inch maximum face area may be approved for use provided the Contractor demonstrates to the satisfaction of the Contracting Officer by field tests performed in accordance with the provisions of subparagraph "Alternative Compaction Equipment" that the roller can properly compact the fill without creating planes of weakness or laminations. For the self-propelled rollers in which steering is accomplished through the use of rubber-tired wheels, the tire pressure shall not exceed 40 psi. The roller shall be operated at a speed of not more than 3.5 miles per hour.

## 2.2.2 Rubber-Tired Rollers

Rubber tired rollers shall have a minimum of four wheels per axle equipped with pneumatic tires. The tires shall be of such size and ply as to be capable of being operated at tire pressures between 80 and 100 psi at 25,000 pound wheel load. The roller wheels shall be such that the distance between the nearest edges of adjacent tires is not greater than 50 percent of the rated tire width of a single tire. The roller shall have a rigid

steel frame provided with body suitable for ballast loading so that the load per wheel may be varied, as directed by the Contracting Officer, from 18,000 to 25,000 pounds. The roller shall be towed at speeds not to exceed 5 miles per hour.

#### 2.2.3 Crawler-Type Tractors

Crawler-type tractors used for spreading or compaction shall weigh not less than 20,000 pounds, shall exert a unit tread pressure of not less than 6 psi, and shall be operated at speeds not to exceed 3.5 miles per hour when being used for compaction. The tractor will not be considered to be compacting while spreading material.

#### 2.2.4 Self-Propelled Tamping Rollers

At the option of the Contractor, self-propelled tamping rollers may be used in lieu of tractor-drawn tamping rollers provided these rollers conform to the towed roller requirements for the length and spacing of tamping feet, the empty weight per foot of drum, and cleaning devices. However, self-propelled rollers exceeding the empty weight requirement may be used, provided that by substitution of tamping feet having a face area not exceeding 14 square inches, the nominal foot pressure on the tamping feet of the self-propelled roller can be adjusted to approximate the foot pressure of the towed roller for the particular working conditions. Self-propelled rollers conforming to the above requirements but with tamping feet exceeding the 14 square inch maximum face area may be approved for use provided the Contractor demonstrates to the satisfaction of the Contracting Officer by field tests performed in accordance with the provisions of subparagraph "Alternative Compaction Equipment" that the roller can properly compact the fill without creating planes of weakness or laminations. For the self-propelled rollers in which steering is accomplished through the use of rubber-tired wheels, the tire pressure shall not exceed 40 psi. The roller shall be operated at a speed of not more than 3.5 miles per hour.

#### 2.2.5 Alternative Compaction Equipment

The Contractor may propose use of alternative types of compaction equipment not included in these specifications. The suitability of the alternative equipment must be demonstrated to the Contracting Officer by a field test conducted by and at the expense of the Contractor. The alternative compaction equipment must be capable of properly compacting the soil so that no planes of weakness or laminations are formed in the fill. The field test shall consist of compacting a minimum of three layers of an area of embankment with the alternative type equipment. Testing and inspection of the area shall then be performed by the Contractor at no additional cost to the Government. Procedures for constructing and testing the area will be provided by the Contracting Officer. Each proposed alternative type of equipment must be capable of compacting a layer of soil not less than 12 inches thick. A minimum of four complete passes over each layer of the test fill will be required for each type of alternative equipment that is allowed for use, unless in the course of constructing the test fill the Contractor is able to demonstrate that proper compaction can be obtained with fewer passes. Alternative type equipment shall be operated at speeds not to exceed 3.5 miles per hour. If sufficient previous testing has been performed on the alternative compaction equipment proposed by the Contractor to verify the suitability of the equipment to the Contracting Officer's satisfaction, the Contracting Officer may determine that the above-specified field test is not required.

#### 2.2.6 Miscellaneous Equipment

Scarifiers, disks, spring-tooth or spike-tooth harrows, spreaders, power tampers, and other equipment shall be types suitable for construction of embankments, compacted fills and berms.

#### 2.2.7 Sprinkling Equipment

Sprinkling equipment shall be designed to apply water uniformly and in controlled quantities to variable widths of surface.

### PART 3 EXECUTION

#### 3.1 EXCAVATION

##### 3.1.1 General

Excavation shall consist of removal and disposal of all surplus materials of whatever nature encountered that may be necessary to excavate for structural foundations, pipes, trenches and ditches. Excavation may be performed by any reasonable methods which will produce the desired results. Excavation shall be performed to the lines, grades and sections indicated on the drawings or as otherwise required.

##### 3.1.2 Underground Utilities

The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction.

#### 3.2 EXCAVATION FOR STRUCTURE

The foundations for the structures shall be excavated to the lines and grades necessary for placement of pipe and/or formwork and concrete. The Contractor shall insure stable slope conditions throughout the construction process. The pipe trench shall be excavated to the lines, grades and sections indicated on the drawings, within allowable tolerance of plus 1-inch or minus 2-inches, as long as neither exist for more than 10 percent of the area. All foundations shall be on solid, undisturbed or properly compacted material. Where disturbed by the Contractor's operations and elsewhere as required, the excavated surfaces shall be moistened with water or dried as necessary and tamped or rolled with suitable tools or equipment for the purpose of thoroughly compacting them and forming firm foundations upon or which to place the pipe bedding, geotextiles, compacted aggregate surfacing, filter stone, fill or any other materials. Except for the permissible tolerance, over excavation will not be permitted except to remove unsuitable material as directed by the Contracting Officer, Contractor will not be paid for over excavating unless prior authorization is gained from Contracting Officer. Unauthorized over excavation shall be backfilled with approved materials, placed in layers not more than 4 inches in thickness, and thoroughly compacted by tamping or rolling to a density at least equal to that of the adjacent similar undisturbed material. This corrective work shall be at no additional cost to the Government.

##### 3.2.1 Removal of Unsuitable Materials

If, at any point in the excavation for the structure, the foundation material below the lines indicated on the drawings is found to be

unsuitable, it shall be removed to the depth directed by the Contracting Officer and replaced with approved material placed and compacted as specified above for backfill of over excavation. Payment for authorized over excavation and backfill of authorized over excavation will be made in accordance with the Contract Clause "Changes".

### 3.2.2 Disposal of Excavated and Excess Materials

Suitable materials removed from required excavations may be disposed of by placing directly into embankment fill, backfill, by stockpiling for later use in backfill, or by stockpiling the excess material at on-site locations designated by the Contracting Officer. Materials which are not suitable for use as embankment fill or backfill, will be ordered wasted and shall be disposed of in on-site areas denoted by the Contracting Officer as disposal areas.

Stockpiles of materials temporarily stored for later use shall be located in areas approved by the Contracting Officer. Excess material shall be disposed of in the disposal areas. Stockpiles and excess material shall be built up in layers not more than 2 feet in thickness, shall have a maximum height not to exceed 15 feet, shall have end and/or side slopes not steeper than 1V on 3H, and the surfaces of all stockpiles shall be sloped to drain readily and sealed by compacting. The temporary stockpiled material shall be placed no closer than 25 feet to top bank of excavation trench as shown on Drawing C303. Any and all excess material shall be placed and compacted within the Right-of-Way limits conforming to the plans and specifications.

### 3.2.3 Disposal of Discarded Materials

Discarded material other than those that can be included in the solid waste category shall be disposed of as specified in paragraph "EXCAVATION", subparagraph "Disposal of Excavated and Excess Materials".

## 3.3 PLACEMENT

### 3.3.1 Backfill and Embankment

#### 3.3.1.1 General

All fills and backfills associated with the pipes and access road embankment and subgrade shall be placed as shown on the drawings. No backfill or fill shall be placed on any part of the foundation until such areas have been inspected and approved. No backfill or fill shall be placed on frozen surfaces and no frozen materials shall be placed in the backfill or fill. The foundation surface and any concrete surfaces shall be suitably moistened prior to placement of backfill against them. Unless otherwise directed, the backfill or fill shall be brought up and maintained at approximately the same level on each side of the pipes and no more than a 3-inch differential from one side of the pipe to the other side regardless of the number of types of material being placed. Materials shall be so placed that there is no mixing of the different types of materials in the backfill or fill.

#### 3.3.1.2 Spreading

After dumping, the materials shall be spread by bulldozer or other approved means in approximately horizontal layers over the entire area under construction. During the dumping and spreading process, the Contractor shall remove all roots, trash and debris from the backfill materials.

Compacted materials shall be placed in layers, the first layer not more than 6 inches in thickness and the succeeding layers not more than 9 inches in thickness prior to compaction with tamping rollers. Thickness of layers of structure backfill shall be placed in layers not more than 8 inches in thickness prior to compaction. Thickness of layers of bedding material shall not be greater than 8 inches. As soon as practicable after commencement of construction of any section of the backfill or fill, the surface shall be sloped to drain freely and shall be so maintained throughout construction. If the compacted surface of any layer of random material is determined to be too smooth to bond properly with the succeeding layers, it shall be loosened by harrowing or by other approved means before the succeeding layer is placed thereon. Ruts in the surface of any layer shall be filled before compacting additional materials. The contractor shall bring the backfill evenly to grade on all sides of the pipes with no more differential than 8 inches between the backfill elevation on each side of the pipes.

### 3.4 COMPACTION

#### 3.4.1 Compacted Embankment Backfill

##### 3.4.1.1 Embankment Backfill

A field density test (ASTM D698) will be conducted for each type of embankment backfill material utilized on the project. After a layer of backfill has been placed and spread, it shall be harrowed or disked, if required, to break up and blend the backfill materials, unless harrowing or disk is performed to obtain uniform moisture distribution. Harrowing or disk is performed with a spring-tooth harrow or other approved harrow or disk to the depth of the uncompacted layer. If one pass of the harrow or disk does not accomplish the breaking up and blending of the materials, additional passes of the harrow or disk may be required, but in no case will more than three passes of the harrow or disk on any one layer be required for this purpose. When the moisture content and the condition of the layer is satisfactory, the lift shall be compacted to the following density as determined by ASTM D 698:

95% (Backfill for steel pipe)

95% All other fills

Portions of the backfill or fill which are not accessible to the roller and portions within 2 feet of all pipes, structures, concrete or any non earthen areas shall be placed in 4 inch layers and compacted with small hand held compactors or manually directed and controlled power tampers (small compactors to run parallel along both sides of the pipes) as approved by the Contracting Officer to a degree as specified above. Dumping, spreading, sprinkling, and compacting may be performed at the same time at different points along a section when there is sufficient area to permit these operations to proceed simultaneously. No heavy compaction equipment shall be placed between the pipes unless smaller than 3 feet in width and only operated outside two feet from the pipes.

##### 3.4.1.2 Compaction Test Section

The Contractor will be required to set up a test compaction section in the first 200 feet of twin pipes to monitor any pipe movement during compaction. A survey to determine the elevation of the top of the pipes on both sides of each joint for both pipelines shall be recorded along with the horizontal distance between the pipes at the spring line (middle of the

pipe) at each joint after the pipes have been placed to grade. Surveys shall be made at each one foot increment of compacted embankment backfill materials around the pipes. The top of the pipes shall be surveyed and the horizontal distance between the twin pipes measured for movement both in the vertical and horizontal directions. These measurements shall be recorded in an excel spreadsheet as approved by the Contracting Officer and submitted to the Government. If the compaction requirements are met and no greater than ¼- inch upward or horizontal movement occurs in the pipes, the Contractor will be allowed to continue backfilling along the twin pipe lines with approval from the Contracting Officer. If movement outside ¼-inch occurs during the test compaction reach, a meeting will be held to discuss the compaction effort and tolerances.

### 3.5 MOISTURE CONTROL

#### 3.5.1 General

The materials in each layer of the backfill or fill shall contain the quantity of moisture within the limits specified below or as directed by the Contracting Officer which is necessary to obtain the desired compaction as determined by the Contracting Officer.

#### 3.5.2 Backfill and Embankment

The moisture content shall be as uniform as practicable throughout any one layer of backfill and embankment. The upper and lower limits of moisture content shall not be more than 3 nor less than 2 percentage points, respectively, from the optimum moisture content as determined by the Contracting Officer in accordance with ASTM D 698. The method of determining the moisture content shall be according to ASTM D 2216. Material that is too wet shall be spread on the backfill and permitted to dry, assisted by disking or harrowing, if necessary, until the moisture content is reduced to a value within the specified limits. When the material is too dry, the Contractor shall sprinkle each layer on the backfill. Harrowing or other approved methods will be required to work the moisture into the material until a uniform distribution of moisture is obtained. Water applied on a layer of backfill shall be accurately controlled in quantity so that free water will not appear on the surface during or subsequent to rolling. Should too much water be added to any part of the backfill so that the material is too wet to obtain the desired compaction, the rolling and all work on that section of the backfill shall be delayed until the moisture content of the material is reduced to a value within the specified limits and such delay shall not be the basis for a claim. If it is impracticable to obtain the specified moisture content by wetting or drying the material on the backfill, the Contractor may be required to prewet or dry back the material at the source. If, in the opinion of the Contracting Officer, the top or contact surfaces of a partial backfill section becomes too dry or too wet to permit suitable bond between these surfaces and the additional backfill to be placed thereon, the Contractor shall loosen the dried or wet materials by scarifying or disking to such depths as may be directed by the Contracting Officer, shall dampen or dry the loosened material to an acceptable moisture content and shall compact this layer as provided in paragraph "COMPACTION", to densities comparable to the underlying backfill or fill, at no additional cost to the Government.

### 3.6 DISPOSITION OF SURPLUS MATERIAL

#### 3.6.1 Embankment Slides

In the event of the sliding of any part of the embankment during construction or after completion, but prior to acceptance, the Contractor shall, upon written order of the Contracting Officer, cut out and remove the slide and then rebuild that portion of the embankment or as an alternative shall construct a stability berm of such dimensions and placed in such a manner as the Contracting Officer shall prescribe. In case the slide is caused through fault or negligence of the Contractor, the foregoing operations shall be performed without cost to the Government. In case the slide in the embankment is not caused through fault or negligence of the Contractor, the volume ordered removed from the embankment and volume replaced in the embankment will be paid for in accordance with the Contract Clause "Changes", in addition to any payment due the Contractor for materials previously placed. In either case, the method of slide correction will be determined by the Contracting Officer.

### 3.7 FIELD QUALITY CONTROL

Testing shall be the responsibility of the Contractor and shall be performed by an approved commercial testing laboratory. Field density and moisture content tests shall be performed on every 200 cubic yards of material placed. Field in-place density shall be determined in accordance with ASTM D 698, ASTM D 1556, ASTM D 2167, or ASTM D 6938. The calibration checks of both the density and moisture gages shall be made at the beginning of a job on each different type of material encountered and at intervals as directed. The Contractor shall submit three copies daily of control tests and reports as well as records of corrective action taken.

### 3.8 CONSTRUCTION CRITERIA, ACCESS ROAD AND BALANCING OF EARTHEN MATERIALS

The contractor will be required to balance the earthened materials for the contract from pipeline stations 22+00 to 13+50 from within the Right-of-Way limits as shown on the drawings. In general terms, the contractor can reshape the ground surface within the Right-of-Way limits for needed earthen materials for constructing the pipeline, providing minimum cover of four feet above the top of the discharge pipes and constructing the access road. At any given pipeline station, the elevation of the access road centerline shall be a minimum of 6 inches higher than the elevation of the backfilled ground surface at that pipeline station. Therefore the access road crown slope will follow the slope of the pipe with centerline elevations  $4 \frac{1}{2}$  feet minimum above the top of the pipe. Surface water from within the Right-of-Way limits shall not cross over the top of the access road. The centerline crown of the access road will be the dividing drainage ridge within the right-of-way. Therefore surface water drainage will be directed away from the road, drain across the Right-of-Way area and drain through the natural contours of the adjacent areas along the Right-of-Way limits. The contractor shall not concentrate surface water from the Right-of-Way and shall grade the Right-of-Way area to limit concentrated flows outside the Right-of-Way limits. The finished ground surface elevations for the access road, pipe cover, required drainage slopes and minimum slopes for placing fill are shown in detail by cross sections shown on drawings C301 and C302.

The Contractor will be required to control surface runoff within the right-of-way limits during construction. The contractor shall shape the ground near the top bank of the excavation trench to prevent surface water from entering into the excavated trench. The Contractor will not be allowed to leave surface water standing in the trench excavation where softening of the foundation material would occur. The Contractor shall

utilize pumps, ditching, collection sumps and any other apparatus or grading as necessary to remove accumulated surface water within the pipe trench excavation throughout the life of the project so that the trench remains dry at all times. The Contractor will be responsible for any and all damages from surface water entering the excavation trench, including floating of the pipes and/or removal of earthen materials washing in the trench.

All areas within the Right-of-Way shall be graded to maintain positive drainage with no areas permanently holding water upon completion of this project. The contractor will be allowed to obtain borrow from within the Right-of-Way limits with the following restrictions: (1) Slopes shall be mild and not steeper than 1V:6H. (2) Slopes shall be graded with minimum swell widths of 10 feet. (3) These swells and borrow areas shall transition smoothly into the existing contours at the Right-of-Way limits.

The contractor will have to stockpile materials adjacent to the pipe trench after excavation as shown on drawing C303. This will require drifting materials either upstream or downstream of the pipe alignment in areas where the Right-of-Way limits are constricted. Excavation of the trench in areas where the natural ground is relatively flat will result in approximately 4 to 5 cubic yards of earthen material per linear feet of pipe to be utilized by the contractor to compact the access road and pipe cover embankments to the required grades and to reshape the area within the Right-of-Way limits to drain in each direction from the centerline of the road across. A minimum pipe cover line of four feet is shown on Drawings C101. The access road will be dividing ridge for drainage between ROW limits and a minimum of 6-inch above the earthen material over the pipelines. The Contractor can use the access road grade as the control and minimize required earthen placement. If additional borrow is need, the contractor will obtain the materials within the Right-of-Way limits as specified above and with approval from the Contracting Officer. If excess material is available for specific reaches of the discharge pipes, the contractor will shape and compact those material within the Right-of-Way so that drainage occurs as directed by the Contracting Officer.

-- End of Section --

SECTION 31 62 16.16

STEEL H-PILES

PART 1 GENERAL

1.1 QUALITY CONTROL

1.1.1 General

The Contractor shall establish and maintain quality control for all operations to assure compliance with contract requirements and maintain records of quality control for all construction operations including but not limited to the following:

- (1) Materials
- (2) Storage and handling
- (3) Placing (location, alignment, etc.)
- (4) Driving records
- (5) Cutting
- (6) Record keeping.

1.1.2 Reporting

A copy of these records and tests, and records of corrective action taken shall be furnished to the Government daily. The Contractor shall furnish all original data, as specified on the Government-provided Pile Driving Record form, to the Contracting Officer on a daily basis. Data shall include, but not be limited to, the information specified in paragraph 3.1.2.5. Information under the "Remarks" category must include any unusual driving conditions encountered, interruptions or delays during the driving sequence and any other information bearing upon the pile driving operation.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

SD-02 Shop Drawings

H Pile Handling and Storage Plan; FIO

The Contractor shall submit a detailed plan for the handling and storage of the H piles. This plan shall be received by the Contracting Officer prior to delivery of the H piles to the job site.

Control of Placement Plan; FIO

The Contractor shall submit a detailed plan for controlling the location and alignment of the H piles prior to delivery of the H piles to the job site.

## SD-03 Product Data

### Pile Driving Hammer and Driving System Components; G

The Contractor shall submit the complete pile driving system. This system shall include all pertinent information on the proposed hammer, leads, and all support equipment. Information to be submitted for the hammer shall include the following:

- (1) Make and Model
- (2) Ram weights: pounds (lb)
- (3) Anvil weight: pounds (lb)
- (4) Stroke rated: inches (in)
- (5) Energy rated: foot-pound (lbf)
- (6) Speed rated (blows per minute)
- (7) Steam or air pressure, hammer and boiler: (psi)
- (8) Rated bounce chamber pressure curves or charts including pressure correction chart for type and length of hose used with pressure gage (bar)
- (9) Pile driving cap, make and weight (lb)
- (10) Cushion block, dimensions and material type

### SD-11 Closeout Submittals: Driving Records; FIO

A record of pile driving operations shall be submitted after pile driving is completed.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 STEEL FOR H-PILES

Steel for H-piles shall conform to the requirements of ASTM A 36. Piles shall have standard square ends, unless otherwise specified or directed. Individual piles shall be furnished full length.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Pile Driving Equipment

The proposed pile driving hammer, and driving system components shall be chosen by the Contractor in accordance with specified guidelines and shall be submitted for approval. The pile driving hammer shall be steam, air or diesel impact, single-acting, double-acting, or differential-acting. The size or capacity of hammers shall be as recommended by the manufacturer for the pile weights and soil formation to be penetrated. Hammers shall be supported and guided with fixed or swinging leads.

#### 3.1.2 General

The hammer shall be capable of driving the specified piling to design elevation without damage to the top of the pile. The hammer shall be operated at all times at the speed and under the conditions recommended by the manufacturer subject to the approval of the Contracting Officer. Boiler, compressor, or engine capacity shall be sufficient to operate the hammer continuously at full rated speed. A pressure gage to monitor pile

driving hammer bounce chamber pressure shall be mounted in an accessible location for monitoring by the Contractor and Government personnel. The bounce chamber pressure gage shall be operational at all times while driving the piles. The Contractor shall provide to the Contracting Officer bounce chamber pressure gage correction tables and charts for types and lengths of pressure gage hose used. Once the actual driving has begun, all conditions (such as alignment, cushions, etc.) shall be kept constant. Two intermediate supports for the pile in the leads shall be provided to reduce the unbraced length of the pile during driving. Equipment to remove damaged piles (impact or vibratory) shall be furnished and on site.

#### 3.1.2.1 Lengths

The Contractor shall order and furnish piling to attain the lengths as shown on approved drawings. Any excess length shall be cut and removed.

#### 3.1.2.2 Storing

Steel H piles shall be stored in such a manner that each pile will be supported in order to prevent exceeding the maximum permissible camber or sweep.

#### 3.1.2.3 Handling

All lifting, except for lifting the pile into the driving leads, shall be accomplished in a manner to ensure that the maximum permissible camber and sweep will not be exceeded as a result of insufficient support during handling. A one point pick up may be used for lifting the pile into the driving leads. Burning holes in flanges or webs for lifting piling into the leads shall be permitted in piling above cutoff length. During on site transporting of pile, the pile shall be maintained in a straight position. Dragging of piles across the ground shall not be permitted. Before the piles are placed in the driving leads, the web and flanges of the pile shall be visually inspected for damage by the Contractor in addition to sweep and camber. Camber and sweep shall be checked by rotating the pile with the pile resting on a firm level surface or by alternate methods approved by the Contracting Officer. The maximum permissible camber and/or sweep shall be 2 inches over the length of the pile. Damaged piles or piles with camber or sweep exceeding 2 inches shall be rejected for use. Any pile found damaged shall be rejected and replaced at no additional cost to the Government.

#### 3.1.2.4 Placement

Piles shall be accurately placed in the correct location and alignment, both laterally and longitudinally, and to the vertical lines as shown on the Contractor's approved drawings. Prior to driving and with the pile head seated in the hammer, the Contractor shall ensure that each pile has been correctly aligned and that orientation of the web about the centerline of the pile is as shown on the Contractor's approved drawings. A final lateral deviation from the correct location at the cut-off elevation of not more than 3 inches will be permitted. A final variation in rotation of the pile about the centerline of the web of not more than 7.5 degrees will be permitted. A final variation in alignment of not more than ¼ inch per foot of longitudinal axis will be permitted. The correct relative position of piles shall be maintained by the use of templates or by other approved means. Piles which are misplaced or exceed the maximum limits for rotation, for lateral deviation, and for alignment, shall be pulled and redriven at the correct location, at no additional cost to the Government.

### 3.1.2.5 Driving

Submit records of the completed sheet piling driving operations, including a system of identification which shows the disposition of approved piling in the work, driving equipment performance data, piling penetration rate data, piling dimensions and top and bottom elevations of installed piling. The format for driving records shall be as directed. Drive pilings with the proper size hammer and by approved methods so as not to subject the pilings to damage and to ensure proper interlocking throughout their lengths.

- a. Maintain driving hammers in proper alignment during driving operations by use of leads or guides attached to the hammer. Caution shall be taken in the sustained use of vibratory hammers when a hard driving condition is encountered to avoid interlock-melt or damages. Discontinue the use of vibratory hammers and impact hammers employed when the penetration rate due to vibratory loading is one foot or less per minute.
- b. Employ a protecting cap in driving when using impact hammers to prevent damage to the tops of pilings. Use cast steel shoe to prevent damage to the tip of the sheet piling. Remove and replace pilings damaged during driving or driven out of interlock at the Contractor's expense.
- c. Drive pilings without the aid of a water jet.
- d. If obstructions restrict driving a piling to the specified penetration, the obstructions shall be removed or penetrated with a chisel beam. If the Contractor demonstrates that removal or penetration is impractical, make changes in the design alignment of the piling structure as directed to ensure the adequacy and stability of the structure. Pilings shall be driven to depths shown and shall extend up to the elevation indicated for the top of pilings. A tolerance of 2 inches above the indicated top elevation will be permitted.

-- End of Section --

SECTION 32 11 23

AGGREGATE COURSE

PART 1 GENERAL

ASTM INTERNATIONAL (ASTM)

ASTM C 117	(2004) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D 2487	(2006e1) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D 4318	(2005) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(2009) Wire Cloth and Sieves for Testing Purposes

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data; G

Plant, Equipment, and Tools

List of proposed equipment to be used in performance of construction work, including descriptive data.

Waybills and Delivery Tickets

Copies of waybills and delivery tickets during the progress of the work.

SD-06 Test Reports

Sampling and Testing; G  
Field Density Tests; G

Certified copies of test results for approval not less than 30 days before material is required for the work.

Calibration curves and related test results prior to using the device or equipment being calibrated.

Copies of field test results within 24 hours after the tests are performed.

## 1.2 WEATHER LIMITATIONS

Compacted aggregate surface courses shall not be constructed when the ambient temperature is below 35 degrees F and on subgrades that are frozen or contain frost. It shall be the Contractor's responsibility to protect, by approved method or methods, areas of surfacing that have not been accepted by the Contracting Officer. Surfaces damaged by freeze, rainfall, or other weather conditions shall be brought to a satisfactory condition by the Contractor.

## 1.3 STOCKPILING MATERIALS

Prior to stockpiling material, the storage sites shall be cleared and leveled by the Contractor. Aggregates shall be so stockpiled as to prevent segregation. Aggregates and binders obtained from different sources shall be stockpiled separately.

## 1.4 SCOPE

The work covered by this section consists of furnishing all plant, labor, materials, and equipment, and performing all operations necessary for grading, excavating and compacting earthen materials, placement of filter fabric for access roads (See Section 31 05 22), access road at manways, and constructing a compacted limestone/granite aggregate surface upon the crown of the access roads within the limits specified herein and as indicated on the drawings.

## 1.5 QUALITY CONTROL

The Contractor shall establish and maintain quality control for the work specified in this section to assure compliance with contract requirements and maintain records of his quality control for all construction operations including but not limited to the following:

### 1.5.1 Subgrade

Location, preparation.

### 1.5.2 Material

Material delivered to the site shall conform to the specifications.

### 1.5.3 Placement

Width, thickness, distribution, compaction, final grading and maintenance.

A copy of these Records and Tests, as well as the records of corrective action taken, shall be furnished to the Government.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT

Plant, equipment, and tools used in the performance of the work covered by this section will be subject to approval by the Contracting Officer before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, and meeting the grade and thickness controls, and smoothness requirements set forth herein.

## 2.2 MATERIALS.

Aggregate shall be selected from one of the stone sources posted at <http://155.76.117.11/conops/MVDStoneLST.htm>.

### 2.2.1 Aggregates

Aggregates shall consist of clean, sound, durable particles of crushed limestone/granite. Aggregates shall be free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign materials. The Contractor shall be responsible for obtaining materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein after compaction operations have been completed.

#### 2.2.1.1 Coarse Aggregates

Coarse aggregate is defined as retained on the No. 10 (2.00 mm) sieve. Coarse aggregates shall be reasonable uniform in density and quality. Coarse aggregate shall consist of hard, durable particles or fragments of stone. Materials that are soft, pliable, or subject to rapid deterioration when exposed to weathering shall not be used.

#### 2.2.1.2 Fine Aggregates

Fine aggregate is defined as aggregate passing the No. 10 (2.00 mm) sieve. Fine aggregate shall consist of crushed limestone, granite and/or crushed sand, and also shall include fine particles passing the No. 200 (0.425 mm) sieve. The fraction of the material passing the No. 200 (0.075 mm) sieve shall be no more than two-thirds that of the fraction passing the No. 40 (0.425 mm) sieve. The portion of the aggregate passing the No. 40 (0.425 mm) sieve for Crushed Limestone/granite shall have a liquid limit of not more than 35 and a plasticity index between 0 and 9, as determined by ASTM D 4318.

### 2.2.2 Gradation Requirements

Aggregate gradation shall be made in conformance with ASTM C 117, ASTM C 136, and ASTM D 422. Gradation requirements specified in TABLE I shall apply to the complete aggregate surface of Crushed Limestone/Granite. It shall be the responsibility of the Contractor to obtain materials that will meet the gradation requirements after mixing, placing, compacting, and other operations. TABLE I shows permissible gradations for granular material used in the compacted aggregate roads. Sieves shall conform to ASTM E 11.

TABLE I. GRADATION FOR CRUSHED LIMESTONE/GRANITE

U.S. Standard Sieve Sieve Designation	Permissible Limits Percent By Weight, Passing
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1-1/2 in.	100
1 in.	90 - 100
3/4 in.	70 - 100
1/2 in.	58 - 90
No. 4	35 - 71
No. 10	25 - 52
No. 40	12 - 32
No. 200	6 - 16

Aggregates shall be well graded between the limits shown in TABLE I. All points on the individual grading curves obtained from representative samples of material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated gradation limits plotted on ENG For 2087 or similar form. The individual gradation curves within these limits shall not exhibit abrupt changes in slope denoting either skip grading or scalping of certain sizes or other irregularities which would be detrimental to the proper functioning of the material.

### 2.2.3 Contractor Testing

Prior to delivery of any material to the job site, the material shall be tested for compliance with the specifications by an approved independent testing laboratory. Such tests shall be performed before each 300 tons of limestone/granite gravel delivered to the job site under this contract, and in the event a noticeable change in the materials is observed during placement, such testing shall be performed at the direction of the Contracting Officer regardless of the quantity of material delivered. Certified Results of the tests shall be submitted to the Contracting Officer for review before the next 300 tons of material is delivered to the job site. When a noticeable change is observed during placement of the material, samples shall be obtained from the delivery truck and a gradation test shall be performed by an approved testing laboratory. If this test fails to meet the requirements, then the questionable material shall be removed from the job site. Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a testing laboratory validated by the Material Testing Center (MTC) of the Corps of Engineers. If the Contractor elects to establish testing facilities, approval of the facilities and work requiring testing will not be permitted until the Contractor's facilities have been validated by MTC.

### Field Density Tests

Measure field density in accordance with ASTM D1556, ASTM D2167 or ASTM D6938. For the method presented in ASTM D6938 check the calibration curves and adjust them, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D6938 result in a wet unit weight of soil, and ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D6938. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals as directed.

- a. Submit certified copies of test results for approval not less than 30 days before material is required for the work.

- b. Submit calibration curves and related test results prior to using the device or equipment being calibrated.
- c. Submit copies of field test results within 24 hours after the tests are performed.

#### Initial Tests

Perform one of each of the following tests, on the proposed material prior to commencing construction, to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis.
- c. Moisture-density relationship.

#### In Place Tests

Perform each of the following tests on samples taken from the placed and compacted aggregate. Samples shall be taken and tested at the rates indicated.

- a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 200 square yards, or portion thereof, of completed area.
- b. Perform sieve analysis on every lift of material placed and at a frequency of one sieve analysis every 300 tons of material delivered to the site.
- c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.
- d. Measure the total thickness of the base course at intervals, in such a manner as to ensure one measurement for each 500 square yards of base course. Measurements shall be made in 3 inch diameter test holes penetrating the base course.

#### 2.2.4 Sampling

Sampling for material gradation, liquid limit, and plastic limit tests shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

#### 2.2.5 Approval of Materials

Apply the specified gradation requirements to the completed aggregate course. The aggregates shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E 11.

### PART 3 EXECUTION

#### 3.1 GENERAL REQUIREMENTS

When the aggregate is constructed in more than one layer, clean the previously constructed layer of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area. Provide line and grade stakes as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

### 3.2 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

### 3.3 PREPARATION OF UNDERLYING COURSE

Prior to constructing the aggregate course(s), the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the aggregate course(s), the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to Section 31 23 00.00 EXCAVATION AND FILL. Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the aggregate course(s). Stabilization shall be accomplished by mixing aggregate into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until the aggregate course is placed.

### 3.4 INSTALLATION

#### 3.4.1 Mixing the Materials

Mix the coarse and fine aggregates in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. Make adjustments in mixing procedures or in equipment, as directed, to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory aggregate course meeting all requirements of this specification.

#### 3.4.2 Placing

Place the mixed material on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 6 inches or less in thickness is required, place the material in a single layer. When a compacted layer in excess of 6 inches is required, place the

material in layers of equal thickness. No layer shall be thicker than 6 inches or thinner than 3 inches when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the aggregate course is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable aggregate course.

#### 3.4.3 Grade Control

The finished and completed aggregate course shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required aggregate course thickness so that the finished course will meet the designated grades.

#### 3.4.4 Edges of Aggregate Course

The aggregate course(s) shall be placed so that the completed section will be a minimum of 1 foot wider, on all sides, than the next layer that will be placed above it. Additionally, place approved fill material along the outer edges of the aggregate course in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 2 foot width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of aggregate course. If this course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along this edge at the same time.

#### 3.4.5 Compaction

Compact each layer of the aggregate course, as specified, with approved compaction equipment. Maintain water content during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified in paragraph SAMPLING AND TESTING. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Continue compaction until each layer has a degree of compaction that is at least 95 percent of maximum laboratory dry density (Modified Proctor-ASTM D 1557) through the full depth of the layer. Make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory aggregate course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

#### 3.4.6 Thickness

Construct the compacted thickness of the aggregate course as indicated. No individual layer shall be thicker than 6 inches nor be thinner than 3 inches

in compacted thickness. The total compacted thickness of the course(s) shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated. The total thickness of the aggregate course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square yards of aggregate course. Measurements shall be made in 3 inch diameter test holes penetrating the aggregate course.

#### 3.4.7 Finishing

The surface of the top layer of aggregate course shall be finished after final compaction and proof rolling by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of aggregate course to meet grade. If the elevation of the top layer of aggregate course is 1/2 inch or more below grade, then the top layer should be scarified to a depth of at least 3 inches and new material shall be blended in and compacted to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable aggregate course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompacted or it shall be replaced as directed.

#### 3.4.8 Smoothness

The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 12 foot straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 50 foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

#### 3.5 TRAFFIC

Completed portions of the aggregate course may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

#### 3.6 MAINTENANCE

Maintain the aggregate course in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any course that is not paved over prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of aggregate course that is damaged shall be reworked or replaced as necessary to comply with this specification.

3.7 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of outside the limits of Government-controlled land. No additional payments will be made for materials that must be replaced.

-- End of Section --

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A116	(2011) Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A702	(1989; R 2006) Standard Specification for Steel Fence Posts and Assemblies, Hot Wrought
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A90/A90M	(2011) Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
ASTM C94/C94M	(2012) Standard Specification for Ready-Mixed Concrete
ASTM F1043	(2011a) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
ASTM F1083	(2010) Standard Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, for Fence Structures
ASTM F567	(2011a) Standard Practice for Installation of Chain Link Fence
ASTM F626	(2008) Standard Specification for Fence Fittings
ASTM F883	(2009) Padlocks

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-F-191/3	(Rev E; Am 1) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails)
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and Braces)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

### SD-02 Shop Drawings

Fence Assembly; FIO

Location of Gate, Corner, End, and Pull Posts; FIO

Gate Assembly; FIO

### SD-07 Certificates

Certificates of Compliance; FIO

## 1.3 ASSEMBLY AND INSTALLATION INSTRUCTIONS

Submit manufacturer's erection/installation drawings and instructions that detail proper assembly and materials in the design for fence, gate, hardware and accessories.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

## 1.5 QUALITY ASSURANCE

### 1.5.1 Required Report Data

Submit reports of listing of chain-link fencing and accessories regarding weight in ounces for zinc coating.

### 1.5.2 Certificates of Compliance

Submit certificates of compliance in accordance with the applicable reference standards and descriptions of this section for the following:

- a. Zinc coating
- b. Fabric
- c. Stretcher bars
- d. Gate hardware and accessories
- e. Concrete

## PART 2 PRODUCTS

## 2.1 GENERAL

Provide fencing materials conforming to the requirements of ASTM A116, ASTM A702, ASTM F626, and as specified.

## 2.2 ZINC COATING

Provide hot-dip galvanized (after fabrication) ferrous-metal components and accessories, except as otherwise specified.

Provide zinc coating of weight not less than 1.94 ounces per square foot, as determined from the average result of two specimens, when tested in accordance with ASTM A90/A90M.

Provide zinc coating conforming to the requirements of the following:

- a. Pipe: FS RR-F-191/3 Class 1 Grade A in accordance with ASTM F1083.
- b. Hardware and accessories: ASTM A153/A153M, Table 1
- c. Surface: ASTM F1043
- d. External: Type B-B surface zinc with organic coating, 0.97 ounce per square foot minimum thickness of acrylated polymer.
- e. Internal: Surface zinc coating of 0.97 ounce per square foot minimum.

Provide galvanizing repair material that is cold-applied zinc-rich coating conforming to ASTM A780/A780M.

## 2.3 FABRIC

Provide fabric consisting of No. 9-gage wires woven into a 2-inch diamond mesh, with dimensions of fabric and wire conforming to ASTM A116, ASTM A702 and ASTM F626, with 1.20 ounces per square foot zinc galvanizing.

Provide one-piece fabric widths for fence heights up to 12 feet.

## 2.4 TOP AND BOTTOM SELVAGES

Provide knuckled selvages at top and bottom for fabric with 2 inch mesh and up to 60 inches high, and if over 60 inches high, provide twisted and barbed top selvage and knuckled bottom selvage.

## 2.5 LINE POSTS

Minimum acceptable line posts are as follows:

Up to 6-feet high:

Grade A: 1.900 inch O.D. pipe weighing 2.72 pounds per linear foot.

Grade B: 2.375 inch O.D. pipe weighing 3.12 pounds per linear foot.

Over 6-feet high:

2.0 inch O.D. pipe weighing 3.65 pounds per linear foot.

## 2.6 END, CORNER, AND PULL POSTS

Provide minimally acceptable end, corner, and pull posts as follows:

Up to 6 feet high:

Grade A: 2.375 inch O.D. pipe weighing 3.65 pounds per linear foot.

Grade B: 2.375 inch O.D. pipe weighing 3.12 pounds per linear foot.

Over 6 feet high:

Grade A: 2.875 inch O.D. pipe weighing 5.79 pounds per linear foot.

Grade B: 2.875 inch O.D. pipe weighing 4.64 pounds per linear foot.

#### 2.7 TOP RAIL

Provide a minimum of 1.660 inches O.D. pipe rails. Provide expansion couplings 6-inches long at each joint in top rails.

#### 2.8 CENTER RAILS BETWEEN LINE POSTS

For fencing over 6-feet high, provide 1.660 inches O.D. pipe center rails.

#### 2.9 POST-BRACE ASSEMBLY

Provide bracing consisting of 1.660 inches O.D. pipe and 3/8 inch adjustable truss rods and turnbuckles.

#### 2.10 TENSION WIRE

Provide galvanized wire, No. 7-gage, coiled spring wire, provided at the bottom of the fabric only. Provide zinc coating that weighs not less than 1.2 ounces per square foot.

#### 2.11 STRETCHER BARS

Provide bars that have one-piece lengths equal to the full height of the fabric with a minimum cross section of 3/16 by 3/4 inch, in accordance with ASTM A116, ASTM A702 and ASTM F626.

#### 2.12 POST TOPS

Provide tops that are steel, wrought iron, or malleable iron designed as a weathertight closure cap. Provide one cap for each post, unless equal protection is provided by a combination post-cap and barbed-wire supporting arm. Provide caps with an opening to permit through passage of the top rail.

#### 2.13 STRETCHER BAR BANDS

Provide bar bands for securing stretcher bars to posts that are steel, wrought iron, or malleable iron spaced not over 15 inches on center. Bands may also be used in conjunction with special fittings for securing rails to posts. Provide bands with projecting edges chamfered or eased.

#### 2.14 GATE POSTS

Provide a gate post for supporting each gate leaf as follows:

Up to 6-feet wide:

2.875 inch O.D. pipe Grade A weighing 5.79 pounds per linear foot.

Over 6 feet wide and up to 13 feet wide:

2.875 inch O.D. pipe Grade A weighing 5.79 pounds per linear foot.

#### 2.15 GATES

For gate leaves up to 6-feet high or 6-feet wide, provide perimeter gate frames of 1.66 inch O.D. pipe Grade A weighing 2.27 pounds per linear foot.

For gate leaves over 6 feet high or 6 feet wide, provide perimeter gate frames of 1.90 inch O.D. pipe Grade A weighing 2.72 pounds per linear foot.

Provide gate frame assembly that is welded or assembled with special malleable or pressed-steel fittings and rivets to provide rigid connections. Install fabric with stretcher bars at vertical edges; stretcher bars may also be used at top and bottom edges. Attach stretcher bars and fabric to gate frames on all sides at intervals not exceeding 15 inches. Attach hardware with rivets or by other means which provides equal security against breakage or removal.

Provide diagonal cross-bracing, consisting of 3/8-inch diameter adjustable-length truss rods on welded gate frames, where necessary to obtain frame rigidity without sag or twist. Provide nonwelded gate frames with diagonal bracing.

#### 2.16 GATE HARDWARE AND ACCESSORIES

Provide gate hardware and accessories that conforms to ASTM A116, ASTM A702, ASTM F626, and be as specified:

Provide hinges to suit gate size, non-lift-off type, offset to permit 180-degree opening.

Provide latch that permits operation from either side of the gate, with a padlock eye provided as an integral part of the latch.

Provide stops and holders of malleable iron for vehicular gates. Provide stops that automatically engage the gate and hold it in the open position until manually released.

#### 2.17 MISCELLANEOUS HARDWARE

Provide miscellaneous hot-dip galvanized hardware as required.

#### 2.18 WIRE TIES

Provide 16-gage galvanized steel wire for tying fabric to line posts, spaced 12 inches on center. For tying fabric to rails and braces, space wire ties 24 inches on center. For tying fabric to tension wire, space 0.105-inch hog rings 24 inches on center.

Manufacturer's standard procedure will be accepted if of equal strength and durability.

Provide wire ties constructed of the same material as the fencing fabric.

#### 2.19 CONCRETE

Provide concrete conforming to ASTM C94/C94M, and obtaining a minimum 28-day compressive strength of 3,000 psi.

#### 2.20 GROUT

Provide grout of proportions one part portland cement to three parts clean, well-graded sand and a minimum amount of water to produce a workable mix.

#### 2.21 PADLOCKS

Provide padlocks conforming to ASTM F883, with chain.

### PART 3 EXECUTION

Provide complete installation conforming to ASTM F567.

#### 3.1 GENERAL

Ensure final grading and established elevations are complete prior to commencing fence installation.

#### 3.2 EXCAVATION

Provide excavations for post footings which are drilled holes in virgin or compacted soil, of minimum sizes as indicated.

Space footings for line posts 10 feet on center maximum and at closer intervals when indicated, with bottoms of the holes approximately 3-inches below the bottoms of the posts. Set bottom of each post not less than 36-inches below finished grade when in firm, undisturbed soil. Set posts deeper, as required, in soft and problem soils and for heavy, lateral loads.

Uniformly spread soil from excavations adjacent to the fence line or on areas of Government property, as directed. Remove excavated soil from Government property.

When solid rock is encountered near the surface, drill into the rock at least 12 inches for line posts and at least 18 inches for end, pull, corner, and gate posts. Drill holes at least 1 inch greater in diameter than the largest dimension of the placed post.

If solid rock is below the soil overburden, drill to the full depth required except that penetration into rock need not exceed the minimum depths specified above.

#### 3.3 SETTING POSTS

Remove loose and foreign materials from holes and the soil moistened prior to placing concrete.

Provide tops of footings that are trowel finished and sloped or domed to shed water away from posts. Set hold-open devices, sleeves, and other accessories in concrete.

Keep exposed concrete moist for at least 7 calendar days after placement or

cured with a membrane curing material, as approved.

Grout all posts set into sleeved holes in concrete with an approved grouting material.

Maintain vertical alignment of posts set in concrete construction until concrete has set.

### 3.3.1 Earth and Bedrock

Provide concrete bases of dimensions indicated [except in bedrock]. Compact concrete to eliminate voids, and finish to a dome shape. [In bedrock, set posts with a minimum of 1 inch of grout around each post. Work grout into hole to eliminate voids, and finish to a dome shape.]

### 3.3.2 Concrete Slabs and Walls

Set posts into zinc-coated sleeves, set in concrete slab or wall, to a minimum depth of 12 inches. Fill sleeve joint with lead, nonshrink grout, or other approved material. Set posts for support of removable fence sections into sleeves that provide a tight sliding joint and hold posts aligned and plumb without use of lead or setting material.

### 3.3.3 Bracing

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 12 inches below top of fence, and two diagonal tension rods.

## 3.4 CONCRETE STRENGTH

Provide concrete that has attained at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than 7 calendar days after placement, before rails, tension wire, or fabric are installed. Do not stretch fabric and wires or hang gates until the concrete has attained its full design strength.

Take samples and test concrete to determine strength as specified.

## 3.5 TOP RAILS

Provide top rails that run continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by the fencing manufacturer.

## 3.6 CENTER RAILS

Provide single piece center rails between posts set flush with posts on the fabric side, using special offset fittings where necessary.

## 3.7 BRACE ASSEMBLY

Provide bracing assemblies at end and gate posts and at both sides of corner and pull posts, with the horizontal brace located at midheight of the fabric.

Install brace assemblies so posts are plumb when the diagonal rod is under proper tension.

Provide two complete brace assemblies at corner and pull posts where required for stiffness and as indicated.

### 3.8 TENSION WIRE INSTALLATION

Install tension wire by weaving them through the fabric and tying them to each post with not less than 7-gage galvanized wire or by securing the wire to the fabric with 10-gage ties or clips spaced 24 inches on center.

### 3.9 FABRIC INSTALLATION

Provide fabric in single lengths between stretch bars with bottom barbs placed approximately 1-1/2-inches above the ground line. Pull fabric taut and tied to posts, rails, and tension wire with wire ties and bands.

Install fabric on the security side of fence, unless otherwise directed.

Ensure fabric remains under tension after the pulling force is released.

### 3.10 STRETCHER BAR INSTALLATION

Thread stretcher bars through or clamped to fabric 4 inches on center and secured to posts with metal bands spaced 15 inches on center.

### 3.11 BARB WIRE SUPPORTING ARMS AND BARBED WIRE

#### 3.11.1 General Requirements

Barbed wire supporting arms and barbed wire shall be installed as indicated and as recommended by the manufacturer. Supporting arms shall be anchored to the posts in a manner to prevent easy removal with the tools. Barbed wire shall be pulled taut and anchored to the arms with clips or other means that will prevent easy removal.

### 3.12 GATE INSTALLATION

Install gates plumb, level, and secure, with full opening without interference. Install ground set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricated where necessary.

### 3.13 TIE WIRES

Provide tie wires that are U-shaped to the pipe diameters to which attached. Twist ends of tie wires not less than two full turns and bent so as not to present a hazard.

### 3.14 FASTENERS

Install nuts for tension bands and hardware on the side of the fence opposite the fabric side. Peen ends of bolts to prevent removal of nuts.

### 3.15 ZINC-COATING REPAIR

Clean and repair galvanized surfaces damaged by welding or abrasion, and cut ends of fabric, or other cut sections with specified galvanizing repair material applied in strict conformance with the manufacturer's printed instructions.

### 3.16 TOLERANCES

Provide posts that are straight and plumb within a vertical tolerance of 1/4 inch after the fabric has been stretched. Provide fencing and gates that are true to line with no more than 1/2 inch deviation from the established centerline between line posts. Repair defects as directed.

### 3.17 SITE PREPARATION

#### 3.17.1 Clearing and Grading

Clear fence line of trees, brush, and other obstacles to install fencing. Establish a graded, compacted fence line prior to fencing installation.

### 3.18 FENCE INSTALLATION

Install fence on prepared surfaces to line and grade indicated. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

#### 3.18.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 10 feet on center. Provide gate posts spaced as necessary for size of gate openings. Do not exceed 500 feet on straight runs between braced posts. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degrees or more, or for abrupt changes in grade. Provide drawings showing location of gate, corner, end, and pull posts.

#### 3.18.2 Top and Bottom Tension Wire

Install tension wires before installing chain-link fabric, and pull wires taut. Place top and bottom tension wires within 8 inches of respective fabric line.

### 3.19 ACCESSORIES INSTALLATION

#### 3.19.1 Post Caps

Install post caps as recommended by the manufacturer.

#### 3.19.2 Padlocks

Provide padlocks for gate openings and provide chains that are securely attached to gate or gate posts. Provide padlocks keyed alike, and provide two keys for each padlock.

### 3.20 CLEANUP

Remove waste fencing materials and other debris from the work site.

-- End of Section --

SECTION 32 92 19

SEEDING AND FERTILIZING

PART 1 GENERAL

1.1 SCOPE OF WORK

The work covered by this Section includes the labor, equipment, and materials necessary to prepare the seedbed, plant seed, fertilize, and water as required to establish a uniform turfgrass.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 SEED

The seed mixture selected shall be State-certified seed of the latest season's crop and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination, weed seed content, and inert material. Weed seed shall not exceed 1 percent by weight of the total mixture. Seed shall be labeled in conformance with applicable State seed laws. Seed that has become wet, moldy, or otherwise damaged will not be acceptable.

2.1.2 Fertilizer

The fertilizer used shall be commercial grade, free flowing, and uniform in composition. Fertilizer shall be 13-13-13 Grade.

2.1.3 Topsoil

Topsoil shall be free from large clumps, roots, rocks, and other debris. Topsoil may be obtained from off-site or on-site source(s) and shall be acceptable to the Contracting Officer.

2.1.4 Mulch

Mulch shall be free from weeds, mold, and other deleterious materials.

2.1.5 Water

Water shall be free from oil, acid, alkali, salt, and other substances harmful to the growth of grass. The water source shall be subject to approval prior to use.

PART 3 EXECUTION

3.1 GENERAL

Seeding and fertilizing operations shall be performed only during periods when beneficial results can be obtained. The work shall be stopped when drought, excessive moisture, or other unsatisfactory conditions prevail, or when directed. When special conditions warrant a variance to the turfing operations, proposed times shall be submitted and approved prior to

proceeding. Turfgrass establishment shall be accomplished on embankments, berms, unpaved, graded and all disturbed areas.

### 3.2 SITE PREPARATION

#### 3.2.1 Seedbed Preparation

Areas to be seeded shall be cultivated to a depth of at least 4 inches. The seedbeds shall be cultivated sufficiently to reduce the soil to a state of good tilth where the existing soil can bond with the hydromulching application. Large roots, rocks, and other debris shall be removed.

#### 3.2.2 Topsoil Application

Topsoil shall be applied to new embankment areas and disturbed areas. After the subgrade soil has been prepared, topsoil shall be spread evenly to a depth of 4 inches by an approved method. The finish surface of the topsoil shall be evenly graded, conform to the finished grade, and shall be free from hollows or other inequalities, stones, sticks, and other extraneous matter. The Contractor shall be prepared to immediately install grass seeding and fertilizing upon completed and accepted finish grade.

### 3.3 SEEDING

Prior to seeding, previously prepared seedbed areas that are compacted or damaged by interim rain, traffic, or other cause, shall be reworked to restore the ground condition previously specified. Seeding operations shall not take place when weather conditions prevent uniform seed distribution.

Beginning at Sta. 17+00 and extending to Sta. 22+00, project site shall be planted in a perennial mix consisting of Ladino Clover, *Trifolium repens*, at a rate of 10 lb/ac and Common Lespedeza, *Lespedeza striata* (synonym *Kummerowia striata*), also at a rate of 10 lb/ac.

All of project site on slope and all of project site adjacent to pumping station site (Sta. 13+50 to Sta. 17+00) will be planted as follows:

From October 1 to March 31:           KY-31 Tall Fescue  
  Hulled Common Bermudagrass  
  Unhulled Common Bermudagrass

From April 1 to September 30:       Foxtail Millet  
  Hulled Common Bermudagrass  
  Lespedeza

#### 3.3.1 Applying Seed

Seeding method shall be either hydroseeding or broadcast and drop seeding.

##### 3.3.1.1 Hydroseeding

Seed and fertilizer shall be added to water and thoroughly mixed. Wood cellulose fiber or shredded paper fiber mulch shall be added at the rates recommended by the manufacturer after the seed, fertilizer, and water have been thoroughly mixed to produce a homogeneous slurry. Slurry shall be uniformly applied under pressure over the entire area. The hydroseeded area shall not be rolled.

### 3.3.1.2 Broadcast and Drop Seeding

Seed shall be uniformly broadcast at the rate of 10 pounds per acre for each variety. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly by means of spike-tooth harrow, cultipacker, raking or other approved device.

### 3.3.1.3 Protection of Seeded Areas

Immediately after seeding, the area shall be protected against equipment traffic or other use as directed. Sloped areas shall be protected from erosion by the application of an asphalt-tacked mulch or other approved methods.

## 3.4 TURF ESTABLISHMENT

### 3.4.1 Turf Establishment

A satisfactory stand of turfgrass from the seeding and fertilizing operation is defined as a minimum of twenty (20) warm-season perennial grass plants per square foot and the area having less than the minimum plants be not more than 5 percent of total area being turfed. Areas 50 square feet or larger, that are not covered by a satisfactory stand of grass shall be re-planted. A satisfactory stand of turfgrass will not be accepted until a uniform density coverage of warm-season perennial grass has been established that satisfies the "final stabilization" requirement of the National Pollutant Discharge Elimination System (NPDES). The Environmental Protection Agency NPDES regulations describe "final stabilization" as a uniform warm-season perennial vegetative cover with a density of 80 percent.

### 3.4.2 Final Inspection

A final inspection shall be held by the Contracting Officer to make note of deficiencies in seeding coverage. Areas not properly germinated shall be repaired by the Contractor.

### 3.4.3 Warranty

The Contractor will have up (1) year to establish acceptable turfing, after which the Government shall/will establish turfing and take a deductive credit from the Contractor.

-- End of Section --

SECTION 33 71 02.00 20

UNDERGROUND ELECTRICAL DISTRIBUTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Reference to the standards of any technical society, organization, or association, or to codes of local or state authorities, shall mean the latest standard, code, specification, or tentative standard adopted and published as of the date of receipt of bids, unless specifically stated otherwise.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative  
Dictionary of IEEE Standards Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.1 Rigid Steel Conduit - Zinc Coated

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2011; Errata 2 2012) National Electrical  
Code

UNDERWRITERS LABORATORIES (UL)

UL 651 (2011; Reprint Mar 2012) Standard for  
Schedule 40 and 80 Rigid PVC Conduit and  
Fittings

1.2 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.
- b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.
- c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.
- d. Underground structures subject to aircraft loading are indicated on the drawings.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The

following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

SD-01 Data

Manufacturer's Catalog Data; G

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents. Equipment data submitted shall include precast handholes and manholes.

SD-04 Drawings

As-Built Drawings; G

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Upon completion of the work, the Contractor shall provide three full sized sets of the marked prints.

Field Constructed Manholes: G

Drawings shall show all details of construction.

SD-09 Reports

Cable Installation Reports; G

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of 3 rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

- a. Site layout drawing with all cable pulls numerically identified.
- b. A list of equipment used, with calibration certifications. The manufacturer of and quantity of lubricant used on pull.
- c. The cable manufacturer and type of cable.
- d. The dates of cable pulls, time of day, and ambient temperature.
- e. The length of cable pull and calculated cable pulling tensions.
- f. The actual cable pulling tensions encountered during pull.

SD-13 Certificates

Materials and Equipment; G

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both,

in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

#### Cable Installer Qualifications; G

The Contractor shall provide at least one on-site person in a supervisory position with a documentable level of competency and experience to supervise cable pulling operations.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the environment in accordance with the manufacturer's published instructions.

### PART 2 PRODUCTS

#### 2.1 STANDARD PRODUCTS

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

#### 2.2 CORROSION PROTECTION

##### 2.2.1 Aluminum Materials

Aluminum shall not be used.

##### 2.2.2 Ferrous Metal Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153 and ASTM A 123.

##### 2.2.3 Finishing

Painting required for surfaces not otherwise specified shall be coated with manufacturer's standards painting system.

#### 2.3 CABLES

Cables shall be single conductor type unless otherwise indicated.

#### 2.3.1 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70. Cables shall utilize ethylene-propylene-rubber (EPR) insulation and shall conform to the requirements of NEMA WC 8.

##### 2.3.1.1 In Duct

Cables shall be single-conductor cable, Type RHW, THW, THWN, USE, or XHHW in accordance with NFPA 70.

#### 2.4 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

##### 2.4.1 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B. Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

##### 2.4.2 Fire and Electrical Arc Proofing Tape

Fire and electrical arc proofing tape shall be flexible conformable unsupported intumescent elastomer. Tape shall be not less than .03 inches thick. Tape shall expand in a fire to act as a heat shield and flame barrier to protect cable. The tape shall be non-corrosive to metallic cable sheaths and compatible with synthetic cable jackets. The tape shall be self-extinguishing and not support combustion. The tape shall not deteriorate when subjected to water, salt water, gases, and sewage. Fire and electrical arc proofing tape shall be equal to 3M Scotch 77. Tape used to secure fire and electrical arc proofing tape shall be high temperature glass cloth electrical tape equal to 3M Scotch 69.

#### 2.5 CONDUIT AND DUCTS

Ducts shall be single, round-bore type, with wall thickness and fittings suitable for the application. Duct lines shall be concrete encased PVC conduit with PVC coated rigid steel elbows and stub-ups.

##### 2.5.1 Metallic Conduit

Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

##### 2.5.2 Concrete Encased Ducts

UL 651 Schedule 40 or NEMA TC 6 Type EB.

### 2.5.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

### 2.6 MANHOLES, HANDHOLES, AND PULLBOXES

Manholes, handholes, and pullboxes shall be as indicated. Strength of manholes, handholes, and pullboxes and their frames and covers shall conform to the requirements of IEEE C2. Precast-concrete manholes shall have the required strength established by ASTM C 478, ASTM C 478M. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48, Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be fabricated from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 10,000 psi and a flexural strength of at least 5,000 psi. Pullbox and handhole covers in sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

### 2.7 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions.

#### 3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable.

#### 3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work. The Contractor is specifically advised to coordinate the size of the connection boxes on the pump motors to assure adequate space to permit stress cone terminations.

### 3.2 CABLE INSTALLATION

The manufacturer's installation manual shall govern cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture.

### 3.2.1 Cable Installation Plan and Procedure

Cable shall be installed in accordance with the cable manufacturer's recommendations. Each conductor shall be identified by means of a colored tape band at each termination point.

#### 3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

#### 3.2.1.2 Conduit/Duct Cleaning

Conduit/duct shall be cleaned with an assembly consisting of 2 wire brushes, a rag and a flexible mandrel which is 1/4 inch less than inside diameter of duct and is furnished in lengths recommended by the manufacturer for the specific size and type of duct. The cleaning assembly shall be pulled through conduit a minimum of two times or until less than a volume of 8 cubic inch of debris is expelled from the duct.

#### 3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

#### 3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manila rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation in cold weather, cables shall be kept at 50 degrees F temperature for at least 24 hours before installation.

#### 3.2.1.5 Cable Installation Plan

The Contractor shall submit a cable installation plan for all cable pulls for power feeders size 4/0 AWG and larger in accordance with the detail drawings portion of paragraph SUBMITTALS. Cable installation plan shall include:

- a. Cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.
- b. List of cable installation equipment.

- c. Lubricant manufacturer's application instructions.
- d. Procedure for resealing cable ends to prevent moisture from entering cable.
- e. Cable pulling tension calculations of all cable pulls.
- f. Cable percentage conduit fill.
- g. Cable sidewall thrust pressure.
- h. Cable minimum bend radius and minimum diameter of pulling wheels used.
- i. Cable jam ratio.
- j. Maximum allowable pulling tension on each different type and size of conductor.
- k. Maximum allowable pulling tension on pulling device.

### 3.2.2 Duct Line

Cables shall be installed in duct lines where indicated. Cable splices in medium voltage and low-voltage cables shall not be permitted. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

#### 3.2.2.1 Trenching

Trenches for duct lines shall be excavated to depths required to provide the minimum necessary cable cover. Bottoms of trenches shall be smooth and free of stones and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil.

### 3.2.3 Electric Manholes

Cables shall be routed around the interior walls and securely supported from walls on cables racks. Cable routing shall minimize cable crossover, provide access space for maintenance and installation of additional cables, and maintain cable separation in accordance with IEEE C2.

#### 3.2.3.1 Fire and Electrical Arc Proofing Tape

All 480V cables in manholes shall be wrapped with fire and electrical arc proofing tape. Tape shall be wrapped in half-lapped layers. Tape may be stretched to obtain a snug, wrinkle-free wrap which conforms to the cable. Overlap the last 6 inches of protection cable when starting a new roll of tape. Tape shall be secured according to manufacturer's instructions with glass cloth electrical tape.

## 3.3 DUCT LINES

### 3.3.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and

36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used.

### 3.3.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be thoroughly cleaned before being laid.

### 3.3.3 Concrete Encasement

Ducts requiring concrete encasement shall comply with NFPA 70. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction.

Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Ducts shall be anchored to prevent movement during the placement of concrete, and joints shall be staggered at least 6 inches vertically.

### 3.3.4 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

#### 3.3.4.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

### 3.3.5 Duct Line Markers

A 5 mil brightly colored plastic tape, not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches below finished grade levels of such lines.

## 3.4 MANHOLES, HANDHOLES, AND PULLBOXES

### 3.4.1 General

Manholes shall be constructed approximately where shown. The exact location of each manhole shall be determined after careful consideration

has been given to the location of other utilities, grading, and paving. The location of each manhole shall be approved by the Contracting Officer before construction of the manhole is started. Manholes shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. The Contractor may at his option utilize monolithically constructed precast-concrete manholes having the required strength and inside dimensions as required by the drawings or specifications. In paved areas, frames and covers for manhole and handhole entrances in vehicular traffic areas shall be flush with the finished surface of the paving. In unpaved areas, the top of manhole covers shall be approximately 1/2 inch above the finished grade. Where existing grades that are higher than finished grades are encountered, concrete assemblies designed for the purpose shall be installed to elevate temporarily the manhole cover to existing grade level. All duct lines entering manholes must be installed on compact soil or otherwise supported when entering a manhole to prevent shear stress on the duct at the point of entrance to the manhole. Duct lines entering cast-in-place concrete manholes shall be cast in-place with the manhole. Duct lines entering precast concrete manholes through a precast knockout penetration shall be grouted tight with a portland cement mortar. PVC duct lines entering precast manholes through a PVC endbell shall be solvent welded to the endbell. A cast metal grille-type sump frame and cover shall be installed over the manhole sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance.

#### 3.4.2 Electric Manholes

Cables shall be securely supported from walls by hot-dip galvanized cable racks with a plastic coating over the galvanizing and equipped with adjustable hooks and insulators. The number of cable racks indicated shall be installed in each manhole and not less than 2 spare hooks shall be installed on each cable rack. Insulators shall be made of high-glazed porcelain. Insulators will not be required on spare hooks.

#### 3.4.3 Communications Manholes

The number of hot-dip galvanized cable racks with a plastic coating over the galvanizing indicated shall be installed in each telephone manhole. Each cable rack shall be provided with 2 cable hooks. Cables for the telephone and communication systems will be installed by others.

#### 3.4.4 Handholes

Handholes shall be located approximately as shown. Handholes shall be of the type noted on the drawings and shall be constructed in accordance with the details shown.

#### 3.4.5 Pullboxes

Pullbox tops shall be flush with sidewalks or curbs or placed 1/2 inch above surrounding grades when remote from curbed roadways or sidewalks. Covers shall be marked "Low-Voltage" and provided with 2 lifting eyes and 2 hold-down bolts. Each box shall have a suitable opening for a ground rod. Conduit, cable, ground rod entrances, and unused openings shall be sealed with mortar.

#### 3.4.6 Ground Rods

A ground rod shall be installed at the manholes, handholes and pullboxes. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 4 inches of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.

### 3.5 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment, shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose.

#### 3.5.1 Concrete Pads

##### 3.5.1.1 Construction

Concrete pads for pad-mounted electrical equipment may be either pre-fabricated or poured-in-place. Pads shall be constructed as indicated, except that exact pad dimensions and mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project 4 inches above finished paving or grade and sloped to drain. Edges of concrete pads shall have 3/4 inch chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

##### 3.5.1.2 Concrete and Reinforcement

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE. Concrete pad reinforcement shall be in accordance with Section 03200 CONCRETE REINFORCEMENT.

##### 3.5.1.3 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

### 3.6 CONNECTIONS TO BUILDINGS

Underground electrical systems shall enter buildings as shown on the drawings. Where conduit enters the building below grade, the conduit shall be routed through a sump or pit. Install a tee fitting with a drain in the sump or pit at the point where the conduit enters the wall of the building

and seal the conduit at the tee fitting on the side toward the building. Seal around all sleeves used to penetrate concrete walls.

### 3.7 FIELD TESTING

#### 3.7.1 General

The Contractor shall perform tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results

#### 3.7.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

#### 3.7.3 Low-Voltage Cable Test

Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combination conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

$$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 / (\text{length of cable in feet})$$

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

### 3.8 GROUNDING

#### 3.8.1 Ground-Resistance Tests

The resistance of the grounding grid shall be measured using the fall-of-potential method defined in IEEE Std 81. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.
- b. Grid electrode - 1 ohm.

#### 3.8.2 Ground-Grid Connection Inspection

All below-grade ground-grid connections will be visually inspected by the Contracting Officer before backfilling. The Contractor shall notify the Contracting Officer 8 hours before the site is ready for inspection.

### 3.9 INSTALLATION ENGINEER

After delivery of the equipment, the Contractor shall furnish one electrical field engineer, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests, initial operation, and instruct personnel as to the operational and maintenance features of the equipment.

### 3.10 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed tests and after defects in installation, material or operation have been corrected.

-- End of Section --

SECTION 35 31 19.00 11

STONE PROTECTION

PART 1 GENERAL

1.1 SCOPE

The work provided for herein consists of furnishing all plant, labor, equipment and materials, and performing all operations in connection with the construction of the stone protection, including foundation preparation, placement of filter material, and placement of riprap in check dams, all in accordance with these specifications and the contract drawings.

1.2 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM C 127 (2001) Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate

ASTM C 29/C 29M (1997; R 2003) Bulk Density ("Unit Weight") and Voids in Aggregate

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES (BASE BID):

SD-04 Samples

Representative Sample

SD-05 Design Data

Gradation Data

SD-06 Test Reports

Records and Tests

Test & Service Records

Plots on the Gradation Graph; G Const

Certified Test Report

1.4 QUALITY CONTROL

The Contractor shall establish and maintain quality control for the work specified in this section to assure compliance with contract requirements and maintain records of his quality control for all construction operations including but not limited to the following:

- (1) Foundation  
Preparation (line and grade).
- (2) Inspection  
At the worksite to ensure use of specified materials.
- (3) Filter  
Quality, gradation, and placement.
- (4) Riprap  
Quality, gradation, and placement.
- (5) Surveys  
The contractor shall conduct a survey of the stone placement before, during, and after construction to help maintain placement control of the stone and to verify that the required grades, thickness, and cross sections are obtained. Unless otherwise required by the Contracting Officer, sections shall be taken at intervals not exceeding 50-feet. The contractor shall plot cross sections from the survey data to visually depict the grade, thickness and sections obtained. The contractor shall use the survey data to develop the required as-built drawings.

A copy of these Records and Tests, as well as the records of corrective action taken, shall be furnished to the Government.

## PART 2 PRODUCTS

### 2.1 STONE

#### 2.1.1 General

All stone shall be durable material as approved by the Contracting Officer. The sources from which the Contractor proposes to obtain the material shall be selected well in advance of the time when the material will be required. In case an undeveloped source is to be used, the Contractor will be required to show that an ample quantity of material is available before quality tests will be made. Stone for riprap shall be of a suitable quality to ensure permanence in the structure and in the climate in which it is to be used. It shall be free from cracks, seams and other defects that would tend unduly to increase its deterioration from natural causes. The inclusion of objectionable quantities of dirt, sand, clay and rock fines will not be permitted.

#### 2.1.2 Sources and Evaluation Testing

Riprap shall be obtained in accordance with the paragraph entitled STONE SOURCES in SECTION 00 80 00.00 11 SPECIAL CONTRACT REQUIREMENTS. Test data submitted from an approved source should include at a minimum the results from the quarry investigation, petrographic analysis, specific gravity, abraision, absorption, wetting and drying, and freezing and thawing. Other test information and service records may be requested as needed by the Contracting Officer to evaluate the acceptability of the riprap. The

Contractor shall submit suitable Test & Service Records to show the acceptability of the riprap. If the Contractor proposes to furnish riprap from a source not currently listed, the Contractor will make such investigations as necessary to determine whether acceptable riprap can be produced from the proposed source. Satisfactory service records on work outside the Corps of Engineers will be acceptable. In order for riprap to be acceptable on the basis of service records, riprap of a similar size must have been placed in a similar thickness and exposed to weathering under similar conditions as is anticipated for this contract, and have satisfactorily withstood such weathering for a minimum of twenty years. If no such records are available, the Contractor will make tests to assure the acceptability of the riprap. The tests to which the riprap may be subjected will include petrographic analysis, specific gravity, abrasion, absorption, wetting and drying, freezing and thawing and such other tests as may be considered necessary by the Contracting Officer. The following guidance is provided for use by the Contractor in analyzing a new source of riprap. Riprap that weighs less than 155 lbs/c.f., has more than 2% absorption, or has other impurities or qualities deemed inadequate by the Contracting Officer will not be accepted unless other tests and service records show that the riprap is satisfactory. The method of testing for unit weight will be ASTM C 29/C 29M. The method of testing for absorption will be ASTM C 127. Samples shall be taken by the Contractor under the supervision of the Contracting Officer at least 60 days in advance of the time the placing of the riprap is expected to begin. The Contractor has the responsibility to assure the tests are performed in accordance with applicable Corps of Engineers' methods of testing and will be performed at an independent, approved testing laboratory. The cost of testing will be borne by the Contractor.

### 2.1.3 Gradation

Gradation shall conform to the tables below. Neither the width nor the thickness of any piece shall be less than one-third of its length. An allowance of 5 percent by weight for inclusion of quarry spalls will be permitted. Stone shall be reasonably well graded between the largest and smallest pieces. The tables below describe the upper and lower limit curves for the riprap gradation. The graph of the riprap submitted, when plotted on ENG Form 4055, shall fall within the limit curves plotted thereon. The Contractor shall submit to the Contracting Officer a copy of the plots on the gradation graph for each size of riprap furnished.

TABLE 1 - RIPRAP "R90"

Percent Lighter by Weight	Limits of Stone Weight, lb.
100	90-40
50	40-20
15	20-5

TABLE 2 - RIPRAP "200"

Percent Lighter by Weight	Limits of Stone Weight, lb.
100	200-80
50	80-40
15	40-10

TABLE 3 - RIPRAP "R400"

Percent Lighter by Weight	Limits of Stone Weight, lb.
100	400-160
50	160-80
15	80-30

TABLE 4 - RIPRAP "R650"

Percent Lighter by Weight	Limits of Stone Weight, lb.
100	650-260
50	260-130
15	130-40

2.1.4 Test Method

The gradation test method shall conform to the requirements found at <http://www.mvm.usace.army.mil/contracting/forms/forms.htm>. For an example, see "LMVD Standard Test Method and Example Gradation R-650" at the aforementioned website.

2.1.5 Gradation Test

The Contractor shall perform a gradation test or tests on the riprap at the quarry; at least one gradation test shall be performed. The sample shall be taken by the Contractor under the supervision of the Contracting Officer, shall consist of not less than 15 tons of riprap and shall be collected in a random manner which will provide a sample which accurately reflects the actual gradation arriving at the jobsite. If collected by the truckload, each truckload shall be representative of the gradation requirements. The Contractor shall provide all necessary screens, scales and other equipment, and the operating personnel therefore, and shall grade the samples, all at no additional cost to the Government. For each sample, the Contractor shall record, plot, and submit the Gradation Data, using the forms found at <http://www.mvm.usace.army.mil/contracting/forms/forms.htm>, to the Contracting Officer. The Contractor shall submit to the Contracting Officer a copy of the Plots on the Gradation Graph for each size of riprap furnished. Refer to the GRADATION paragraph above. The Contractor shall notify the Contracting Officer Representative not less than 14 days in advance of each test.

2.2 FILTER MATERIALS

2.2.1 General

Filter material shall consist of crushed stone. The material shall be composed of tough, durable particles, shall be reasonably free from thin, flat and elongated pieces, and shall contain no organic matter nor soft, friable particles in quantities considered objectionable by the Contracting Officer.

### 2.2.2 Gradation

<u>U.S. Standard Sieve No.</u>	<u>Permissible Limits Percent by Weight, Passing</u>
3-inch	100
1 1/2-inch	85-100
3/4-inch	35-70
3/8-inch	5-40
No. 4	0-10

The material shall be well-graded between the limits shown. The Contractor shall furnish a Certified Test Report which certifies that the supplied filter material meets the above gradation and also furnish a Representative Sample of this same material to the Government.

## PART 3 EXECUTION

### 3.1 BASE PREPARATION

Areas on which the filter material and riprap are to be placed shall be dressed to conform to cross sections shown on the contract drawings. Humps and depressions within the slope lines shall be dressed to provide relatively smooth and uniform surfaces. Immediately prior to placing the filter material, the prepared base will be inspected by the Contracting Officer and no material shall be placed thereon until that area has been approved.

### 3.2 PLACEMENT OF FILTER MATERIAL

Filter Material shall be placed as directed by the Contracting Officer. Filter material for riprap bedding shall be spread uniformly on the prepared base to the lines and grades as indicated on the contract drawings and in such manner as to avoid damage to the prepared base. Any damage to the surface of the prepared base during placing of the material shall be repaired before proceeding with the work. Compaction of material placed on the prepared base will not be required, but each layer shall be finished to present a reasonably even surface, free from mounds or windrows. The allowable deviation from the prescribed thickness shall be plus 2 inches.

### 3.3 RIPRAP

#### 3.3.1 General

Riprap shall be placed on the prepared base and/or filter material within the limits shown on the contract drawings. Riprap shall be as specified in the paragraph entitled STONE above.

#### 3.3.2 Placement

Riprap shall be placed as directed by the Contracting Officer. Riprap shall be placed in the channel and overbank from the downstream riprap limit to the upstream riprap limit. The riprap shall also be placed across the channel bottom first and then from the bottom of the channel slopes to the top of the channel side slopes to the overbank. Riprap shall be placed in a manner which will produce a reasonably well-graded mass of rock with the minimum practicable percentage of voids, and shall be constructed, within the specified tolerance, to the lines and grades indicated on the contract drawings. A tolerance of plus 6 inches and minus 3 inches from the required finished surface of the riprap will be allowed provided these extremes do not occur adjacent to each other, and that neither extreme exists over more than 10 percent of the total area. Riprap shall be placed to its full course thickness in one operation and in such manner as to avoid displacing the filter material. The larger stones shall be well distributed and the entire mass of stones in their final position shall be graded to conform to the gradation specified in the paragraph entitled RIPRAP above. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Placing riprap in layers will not be permitted. Placing riprap by dumping it at the top of the slope and pushing it down the slope will not be permitted. The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source; by controlled dumping of successive loads during final placing; or by other methods of placement which will produce the specified results. Rearranging of individual stones by mechanical equipment or by hand will be required to the extent necessary to obtain a reasonably well-graded distribution of stone sizes as specified above. The Contractor shall maintain the riprap until accepted and any material displaced prior to acceptance and due to the Contractor's negligence shall be replaced at his expense and to the lines and grades indicated on the contract drawings.

### 3.4 GROUTING

#### 3.4.1 Grout

Grout shall be concrete consisting of one (1) part Portland cement, two (2) parts clean sand, three (3) parts of ¾-inch (3/4") maximum size coarse aggregate, a suitable air-entraining admixture and sufficient potable water to facilitate working grout into riprap voids.

#### 3.4.2 Placement

Portions of completed riprap paving as indicated on the drawings furnished with each task order shall be grouted. No grout shall be placed under water. The grout shall be mixed in a manner so as to produce a mixture having a consistency which will permit gravity flow into the interstices of the riprap with the help of limited spading and brooming. The grout shall be used in the work within 90 minutes after mixing. Retempering of grout will not be permitted. Riprap shall not be grouted when the ambient temperature is below 40 degrees F or above 85 degrees F unless approved by the Contracting Officer in writing, nor when the grout, without special protection, is likely to be subjected to freezing temperatures before final set has occurred. Prior to grouting, all surfaces of riprap shall be wetted. The riprap shall be grouted in successive strips, approximately ten feet (10') in width, commencing at the lowest strip and working up the slope. Each batch of grout shall be dumped on the upper portion of the ungrouted part of the strip and worked into the voids between the stones and down the slopes. Grout shall be brought to the place for final deposit by approved means, and in no case shall grout be permitted to flow on the

riprapped surface a distance in excess of ten feet (10'). Immediately after dumping a batch of grout, it shall be distributed over the surface of the strip by the use of brooms and the grout worked into place between stones with suitable spades and trowels. Adequate precautions shall be taken to prevent grout from penetrating the prepared base. As a final operation, the excess grout shall be removed from the top surfaces of the upper stones and from pockets and depressions in the surface of the stone protection by use of a stiff broom having bristles resistant to water and capable of withstanding hard sweeping; and scrubbing. After completion of any strip as specified, no workman, nor any load, shall be permitted on the grouted surface for a period of at least 24 hours. The surface of all grouted riprap shall be protected from rain, flowing water and mechanical injury for a period of at least 24 hours. The surface of all grouted riprap shall be cured by keeping the surface continuously wet for a period of not less than 72 hours or by application of an approved curing compound.

#### 3.4.3 Maintenance

The Contractor shall maintain the grouted riprap until accepted, and any material displaced prior to acceptance and due to the Contractor's negligence shall be replaced at his expense and to the lines and grades shown on the contract drawings.

-- End of Section --