

US Department of Agriculture (USDA)



Grindstone Recreation Area Wastewater Treatment Plant Replacement  
Statement of Work

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## Project Name

Grindstone Recreation Area Wastewater Treatment Plant Replacement

## General Information

### 1.0 Scope of Work

The project will rehabilitate the existing Grindstone Campground sanitary sewer system as well as decommission the existing lagoon system. Scope of work will include construction of the replacement of 4,300+ LF of 8" gravity sewer, 20+ manholes, and laterals. A new treatment system with drip field and associated site improvements will be constructed to replace the existing lagoon system. The existing lagoon system will be removed and decommissioned. The awarded contractor shall furnish all materials, personnel, and equipment necessary to meet the requirements outlined in the construction documents (plans and specifications).

### 2.0 Background

The Grindstone Campground currently does not have sanitary sewage facilities available as the existing system is inoperable and out of compliance with its state permit. All bathrooms/bathhouses are inoperable. Existing sanitary sewer lines and manholes will be replaced with new pipe and manholes along their existing alignment. The existing sewage treatment system uses two open-air lagoons located on the other side of Laurel Valley Road from the campground. This existing treatment system will be decommissioned, filled in, and the site will be recontoured to drain. A new wastewater treatment system, located within the grounds of the campground, will be installed. The new sewage treatment system will use an Orenco, or equivalent system, that consists of pre-treatment tanks which distribute the wastewater effluent into a grassy drip field, roughly 0.5 acres in size.

### 3.0 Project Location

Grindstone Campground  
1946 Laurel Valley Rd  
Troutdale, VA 24378  
Lat/Long: N 36.688363, W 81.539310

See maps on plan sheet G100 of the construction plans for additional location information.

### 4.0 Pre-Bid Site Visit

A non-mandatory pre-bid site visit will be scheduled for 18 March 2026, 1000ET. Offerors are **highly** encouraged to attend the site visit. Meet at the Mt Rogers Officer 3714 Highway 16 Marion VA 24354. USFS Point of Contact for RSVP is Richard Childs [richard.childs@usda.gov](mailto:richard.childs@usda.gov). This is to facilitate the Offeror's understanding of the work. Forest Service representatives will be present to assist with access and general awareness of the project area. Contact the Contracting Officer (CO) to indicate if you will be attending the site visit at least 24 hours before the scheduled visit. If no offerors intend to attend the site visit, it will be canceled.

## Contractor Requirements

### 5.0 Technical Requirements / Tasks

This project can be divided into three phases (some phases may be conducted simultaneously):

1. Decommissioning
  - a. Remove and dispose of existing sanitary sewer lines and manholes, which equal approximately 4300 LF, and related components.
  - b. Drain existing lagoons according to environmental guidelines and dispose of lagoons' liners.
  - c. Fill lagoons with existing material from lagoon site and regrade according to specifications.
2. Sanitary Sewer Line Replacement
  - a. Perform site clearing and grubbing according to specifications.
  - b. Install new sanitary sewer lines, laterals, manholes and related components according to plans and specifications.
3. Installation of New Wastewater Treatment Disposal System
  - a. Perform site clearing and grubbing according to specifications.
  - b. Install new proprietary wastewater treatment disposal system, which includes a drip field of approximately 0.5 acres.

### 5.1 Operational Hours

The contractor is responsible for performing work between the hours of 6 a.m. to 6 p.m. Eastern Daylight Time, Monday through Friday, except Federal holidays or when the Government facility is closed due to local or national emergencies, administrative closings, or similar Government directed facility closings. Work outside of these hours or circumstances must be approved in writing by the CO in advance. The contractor shall always maintain an adequate work force for the uninterrupted performance of all tasks defined within this Statement of Work when the Government facility is not closed for the above reasons.

- Federal Holidays

1. New Year's Day – January 1st
2. Martin Luther King Junior's Birthday – Third Monday in January
3. President's Day – Third Monday in February
4. Memorial Day – Last Monday in May
5. Juneteenth – June 19th
6. Independence Day – July 4th
7. Labor Day – First Monday in September
8. Columbus Day – Second Monday in October
9. Veteran's Day – November 11th
10. Thanksgiving Day – Fourth Thursday in November
11. Christmas Day – December 25th

### 5.2 Period of Performance

The project period of performance is 365 calendar days from the date of issuance of the Notice to Proceed by the CO. By submitting a response to this Request for Proposals (RFP), the offeror is affirming their capability to accomplish the work stated within this Statement of Work and associated attachments within this stated period. If the Offeror believes the work included in this Statement of Work cannot be accomplished within this period of performance, they should submit a statement explaining to the CO their reasons and justifications for a different period of performance and identify what that performance period would be as it relates to their proposal.

### 5.3 Construction Schedule

As referenced in this Statement of Work - "Section 5.2 Construction Schedule," the contractor shall submit a final construction schedule a minimum of 10 Days after contract award to the CO for approval and before any work can commence. Construction schedule shall be in GANTT chart format and incorporate all major components of the work.

### 5.4 Contractor's Key Personnel

The awarded contractor shall identify their key personnel assigned to the project and provide written delegated authority citing their role(s), responsibilities, and authorities. Roles such as Site Superintendent, Quality Control Manager, Site Safety Manager, and On-Site Sewage System Installer, among others and where appropriate, should be clarified to the CO. All project work shall be directly supervised by the prime contractor at all times and a designated representative shall be present for any and all work operations. When required by the Federal Acquisition Regulations, the contractor shall provide a subcontractor plan that clearly identifies which scope of work will be accomplished by the contractor and which work by their subcontractors.

### 5.5 Permits

The awarded contractor is responsible for acquiring all applicable permits prior to starting work on any construction that is regulated by the applicable permits. The following permits are anticipated to be required but are not necessarily fully inclusive:

1. Wastewater Treatment System Construction Permit –
  - a. Acquired by Forest Service – VDH Construction Permit 23-186-078 (available upon request)
2. Virginia Pollution Discharge Elimination System (VPDES) Permit for Decommissioning of the Existing Lagoon System

- a. This permit (IP VA0022993) was acquired by the Forest Service but has expired and needs to be renewed by the contractor
- b. VDEQ letter documenting acceptance of the Decommissioning plan, dated 03/22/2024, is available upon request
3. Virginia Stormwater Management Permit (VSMP)
  - a. Contractor shall apply for this permit using the VDEQ Registration Statement that shall be provided by the Forest Service
  - b. Contractor shall be the permit holder for this permit and manage compliance with the permit from VDEQ
  - c. VDEQ has reviewed and approved the E&SC and SWM plans (DEQ Plan# 2023-0185)
4. VDOT Land Use Permit (LUP)
  - a. Contractor shall apply for this permit through VDOT prior to performing any work within the VDOT Right-of-Way
  - b. Link to VDOT info: <https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/land-use-and-development/land-use-permits/>

### 5.6 Project Site Closure

The campground will be closed to the public during the contractor's construction operations. The contractor is responsible for maintaining closure of the project site throughout the duration of the construction. Coordinate with the Forest Service to maintain government personnel access to the site in a safe and effective manner and to allow for other activities that the government may incur during the contractor's operations.

### 5.7 Control of Noxious Weeds

To prevent the introduction and control the spread of seeds of noxious weeds onto and around National Forest land, the Contractor shall ensure all equipment moved onto National Forest land is free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds. The contractor shall notify the CO and Contracting Officer's Representative (COR) a minimum of ten (10) business days in advance of equipment arrival. Government inspection is required before any unloading of equipment. The Contractor shall certify their compliance with this requirement in writing. All contractor's vehicles and equipment inspections shall be done prior to entrance onto the National Forest.

### 5.8 Environmental Control Measures

#### 5.8.1 Bat Conservation Measures

There are special restrictions regarding tree cutting timeframes to be in alignment with the USFS bat conservation strategy. Unrestricted tree removal will need to take place in the bat hibernation season of November 16 – March 31 to avoid potential impacts to bat species on the Threatened and Endangered Species list. If trees need to be taken outside of this time frame, the Forest Service biologist will be consulted to mitigate potential impacts. That mitigation can include individual tree or stand level monitoring with audible detection equipment.

#### 5.8.2 Assessment of Asbestos & Lead

Forest Service has had testing performed on the existing chemical storage shed building at the existing lagoon for asbestos and lead presence. No asbestos was detected in 5 samples taken. Lead was identified as present in the green paint on the metal doorframe of this building. No lead was detected in the CMU block (white) paint. The full report can be provided by the FS upon request.

### 5.9 Temporary Facilities

Staging Area: The Contractor shall arrange the location for exterior stockpiling of materials as approved by the CO. The CO will approve an adequate staging area at the project site. This shall be approved by the CO in advance and in writing before contractor's staging. The Contractor shall be responsible for protecting their own materials stockpiled against adverse weather, damage, theft, and other risks of loss. The Government assumes no responsibility for material or equipment left in the storage area and/or project site.

Temporary utilities available on site are listed below. The contractor will not be responsible for charges or fees associated with use of these utilities during construction as long as use is solely for purposes of the construction project.

- A. Sanitary Facilities: Not available
- B. Water: Available – non-potable water may be made available at certain water hydrants in the campground, with certain restrictions:
  - Due to a known leak in the system, only certain hydrants may be used (to be identified by the FS)
  - Water cannot be flushed through the existing sanitary sewer conveyance system due to permit restrictions from the DEQ (no water can be sent to the existing lagoon system)
- C. Electricity: Available at some campsites (30 Amp service)
- D. Telephone: Hard line phone service exists at the campground entrance station, and is only available to the contractor for emergency communications

### 5.10 Wastewater Treatment Plant Operations

The current wastewater treatment plant operator for the existing sewage lagoon system is Blue Ridge Analytical. Primary Point of Contact for the operator is:

- Mychel Johnson  
Laboratory Director  
Blue Ridge Analytical  
2280 West Ridge Road  
Wytheville, VA 24382  
(276) 228-6464  
[www.blueridgeanalytical.com](http://www.blueridgeanalytical.com)

Several other wastewater treatment plants located within the vicinity can be found in Washington County and the Town of Abingdon, VA (Wolf Creek Water Reclamation Facility).

### 6.0 Required Personnel Qualifications

On-Site Sewage System Installer (OSSI) –

A) Credentials: Be currently licensed (in Virginia) as an On-site Sewage System Installer (OSSI) with a rank of “Master Alternative”. Provide the license number as it exists in the Virginia Department of Professional Occupation and Regulation (VDPOR) database. Existing license shall be current for at least 3 months beyond the date of this solicitation. Personnel must be capable of maintaining this license for the duration of the construction.

B) Project Experience: At least 2 years as an OSSI Master Alternative rank on at least two (2) projects valued at least \$2,000,000 of construction of wastewater treatment and conveyance systems. Note: Appropriate experience on wastewater projects where the individual did not hold such license may be substituted for this requirement.

C) Training: Shall be in accordance with the VDPOR’s licensing requirements. VDPOR maintains a database of licensed individuals at: <https://www.dpor.virginia.gov/LicenseLookup> (using search term “Onsite Sewage System Installer License”) Additional information about licensing requirements are identified in the Virginia Administrative Code 18VAC160-40-110 through 160 ([https://www.dpor.virginia.gov/sites/default/files/boards/WWWOOSP/REG\\_OSSP.pdf](https://www.dpor.virginia.gov/sites/default/files/boards/WWWOOSP/REG_OSSP.pdf)).

5. Virginia Dept of Environmental Quality – Responsible Land Disturber (RLD)

A) Credentials: A responsible land disturber (RLD) is an individual holding a certificate issued by Virginia DEQ who is responsible for carrying out a land-disturbing activity in accordance with an approved erosion and sediment control (ESC) plan. The RLD must be designated on the ESC plan or permit as a prerequisite for engaging in land disturbance. Offeror shall be responsible for identifying and validating the credentials of their

RLD to the government. More information about this role can be found here: <https://www.deq.virginia.gov/our-programs/training-certification/responsible-land-disturber>

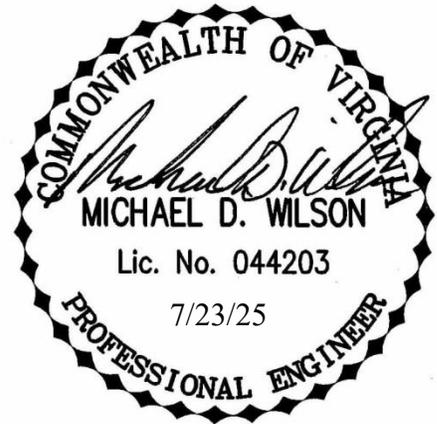
Sub-contracting out required personnel is accepted.

TECHNICAL SPECIFICATIONS

**USDA-FS GRINDSTONE RECREATION AREA  
WASTEWATER SYSTEM REPLACEMENT  
CONTRACT 12445122C0026**



July 23, 2025  
BID SET



Prepared by:

Prepared for:



2524 Langhorne Road, Lynchburg VA, 24501

**USDA Forest Service**  
5162 Valleypointe Parkway  
Roanoke, VA 24019  
(540) 266-5128

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## SECTION 010000 - GENERAL REQUIREMENT

### PART 1 – GENERAL

#### 1.1 SUMMARY OF WORK

- A. Work covered by the Contract Documents consists of providing all work and materials indicated on the Drawings or required by the Contract Documents and Specifications, including, but not necessarily limited to, the following:
  - 1. The project will provide rehabilitation of the campground sanitary sewer system as well as the decommissioning of the existing lagoon system. Scope of work will include replacement of 4,300+ LF of 8” gravity sewer, 20+ manholes, and laterals as detailed on the design plans. A new treatment system with drip field and associated site improvements will replace the existing lagoon system. The lagoon system will be decommissioned as specified in the project documents.
- B. Contractor use of premises:
  - 1. Contractor shall not remove material from the site without written consent from the Contracting Officer (CO).
- C. Government furnished items:
  - 1. There are no Government furnished items in this project.

#### 1.02 SITE INFORMATION AND LIMITATIONS.

- A. The following site conditions are considered incidental to the contract and contractor will not be paid directly for any of the following items:
  - 1. Construction sites will be closed to the public during construction. The Forest Service will issue a closure order to the public. The Contractor will be responsible for signing and limiting public access.
  - 2. Contractor will provide all materials and labor necessary to protect streams, wet or dry, during construction activities. The Contractor will be required to submit an erosion and sediment control plan and received approval from the CO, in writing, prior to the beginning of construction.
  - 3. All construction equipment shall be pressure washed before entering Nation Forest System lands. The removal of mud and debris from treads, tracks and undercarriage, with emphasis on axles, frame, cross-members, motor mounts, and underneath steps, running boards, and front bumper/brush guard assemblies will be required. The purpose is to reduce or eliminate the transportation of noxious weeds, which is required by Federal and State regulations.
  - 4. The Contractor shall located all existing utilities at the site prior to any ground disturbing activities.

5. No work that endangers, interferes, or conflicts with traffic or access to work sites shall be performed until a plan for satisfactory warning and handling of traffic has been submitted by the contractor and approved by the COR. Construction signed for traffic control shall conform to the Manual of Uniform Traffic Control Devices (MUTCD). All traffic control signs will be placed in areas adequate for a truck pulling a fifth wheel trailer to be turned around. Contractor shall not be paid directly for this item, rather it will be considered incidental to other items of work listed in the Schedule of Items.
6. Areas for staging operations and storage of materials shall be approved by the CO. The Contractor must request in writing for approval from the CO to stage trailers (work or housing) on site.
7. The Contractor acknowledges they have taken the necessary steps to ascertain the nature and location of work and have investigated and satisfied themselves as to the general and local conditions that can affect the work or its cost. Any failure of the contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from the responsibility of estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expenses to the Government.

#### 1.03 MEASUREMENT AND PAYMENT

##### A. Applications for Payment:

1. The form of each application for payment shall be the "Application for Payment" form included in the contract documents. The AIA standard form is not acceptable for this project. Payment for stored material delivered, but not incorporated in the work, will be the invoiced amount only. Submit applicable invoices with the application for payment.
2. Application for progress payments shall be as discussed in Section 012900 Price and Payment Procedure. A schedule of values shall be submitted by the Contractor with the project schedule.

#### 1.04 COORDINATION

- ##### A. Phases of construction which involve the temporary interruption of essential services shall be scheduled in consultation with the Contracting Office and shall not be of longer duration than essential to accomplish the purpose for such interruptions. Liaison with the Government in these matters shall be a salient feature of this Contract.

#### 1.05 CONSTRUCTION STAKING

- ##### A. The Government will not provide construction staking.
- ##### B. The Contractor shall be responsible for the preservation of all stakes and marks established by Hurt & Proffitt, Inc., and if any of the stakes and marks is carelessly or willfully disturbed, the cost of replacing them shall be charged back to the Contractor.

1.06 PROJECT MEETINGS

- A. A preconstruction conference with the Contractor will be held within ten days after the effective date of the Agreement or later at the request of the Contractor.
- B. Progress meetings shall be held on a monthly basis during the execution of the work. The Contractor's superintendent is expected to attend these meetings and provide status of the project and projected schedules and conflicts. The meetings will be held on site. Frequency of meetings may be changed at mutual consent of Contracting Officer and Contractor.

1.07 SUBMITTALS

- A. All submittals shall be made in accordance with Section 013300 – Submittal Procedures.
- B. Submittal Schedule” Submit to COR for review a schedule for submittals:
  - 1. Submit at the same time as the preliminary schedule.
  - 2. Coordinate with Contractor's construction schedule an Schedule of Values.
  - 3. Format schedule to allow tracking of status of submittals throughout duration of construction.
  - 4. Arrange information to include scheduled date of initial submittal, specification number and title, submittal category,(for review or for information), description of item of work covered, and role and nae of subcontractor.
  - 5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    - a. Or assemblies, equipment, systems comprise of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revision to initial submittals, and time for their review.

1.08 QUALITY CONTROL

- A. Refer to Section 014000 – Quality Requirements.
- B. Contractor will employ and pay for the services of a testing laboratory to perform testing specified to be done.
- C. Contractor shall cooperate with the laboratory to facilitate execution of its required services.
- D. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the work of the Contract.
- E. Related requirements in other parts of the project manual:

Inspections and testing required by laws; ordinances, rules, regulations, orders, or approvals of public authorities.
- F. Related requirements specified in other sections:
  - 1. Certification of products: the respective sections of the specifications.
  - 2. Laboratory tests required and standards for testing.

G. Limitations of authority of testing laboratory: Laboratory is not authorized to:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the work.
3. Perform any duties of the Contractor or direct the Contractor on the methods used by the Contractor to meet the requirements of the Contract Documents.

H. Contractor's responsibilities:

1. Cooperate with laboratory personnel. Provide access to work and to manufacturer's operations.
2. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
3. Furnish copies of products test reports as required.
4. Furnish incidental labor and facilities.
5. Obtain and handle samples at the project site or source of the product to be tested.
6. Facilitate inspections and tests.

I. Make arrangements with laboratory and pay for additional samples and tests required for Contractor's convenience.

J. Employ and pay for the services of a separate, qualified independent testing laboratory to perform additional inspections, sampling, and testing required when initial tests indicate work does not comply with contract documents.

1.09 CONSTRUCTION FACILITIES

A. Refer to Section 015000 – Temporary Facilities and Controls.

B. Project identification: Contractor may erect one business sign on the site for the duration of the project. Design and size of the proposed sign shall be submitted to the Owner for approval. Signs shall meet requirements of all local codes and ordinances. This sign would be in addition to any signs required by other sections of the Contract Documents.

1.10 MATERIALS AND EQUIPMENT

A. Quality: Material and equipment incorporated in the Work shall:

1. Conform to applicable specifications and standards.
2. Comply with size, make, type, and quality specified, or as specifically approved in writing by Engineer.
3. Manufactured and fabricated products:
  - a. Design, fabricate, and assemble in accordance with the best engineering and shop practices.
  - b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
  - c. Two or more items of the same kind shall be identical, by the same manufacturer.
  - d. Products shall be suitable for service conditions.
  - e. Equipment capacities, sizes, and dimensions shown or specified shall be adhered to, unless variations are specifically approved in writing.

- f. Unless otherwise specifically provided in the Contract Documents, all equipment, material, and accessories incorporated into the Work shall be new and in first class condition.
- 4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.
  - 5. Manufacturer's instructions:
    - a. When the Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Hurt & Proffitt, Inc. Maintain one set of complete instructions at the job site during installation and until completion.
    - b. Handle, install, connect, clean, condition, and adjust products in accordance with such instructions and in conformity with specified requirements.
      - (1) Conflict between manufacturer's instructions and Contract Documents shall be submitted in writing to Hurt & Proffitt, Inc. for clarification.
      - (2) Do not proceed with work without clear instructions and until all discrepancies have been resolved.
    - c. Perform work in accordance with the manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by the Contract Documents.
- B. Transportation and handling:
- 1. Arrange deliveries of products in accordance with construction schedules. Coordinate to avoid conflict with work and conditions at the site.
    - a. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
    - b. Immediately on delivery, inspect shipments to assure compliance with requirements of the Contract Documents and approved submittals, and that products are properly protected and undamaged.
  - 2. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.
- C. Storage and protection:
- 1. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
    - a. Store products subject to damage by the elements in weather tight enclosures.
    - b. Maintain temperature and humidity within the ranges required by manufacturer's instructions.
  - 2. Exterior storage:
    - a. Store fabricated products above the ground, on blocking or skids; prevent soiling or staining; cover products, which are subject to deterioration with impervious sheet coverings; and provide adequate ventilation to avoid condensation.

- b. Store loose granular materials in a well-drained area on solid surfaces to prevent missing with foreign matter.
3. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.
4. Protection after installation: Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

#### 1.11 PROJECT CONDITIONS

- B. Use of explosives is not permitted
- C. Grade site to drain. Maintain excavation free of water. Provide, operate, and maintain pumping equipment.
- D. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- E. Perform dewatering activities, as required, for the duration of the project.
- F. Dust Control” Execute work by methods to minimize raining dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- G. Erosion and Sediment Control” Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
  1. Minimize amount of bare soil exposed at one time.
  2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
  3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
  4. Periodically inspect earwork to detect evidence of erosion and sedimentation, promptly apply corrective measures.

#### 1.12 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
  1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
  2. Comply with limitations on the time of year restrictions regarding tree cutting and bat species of concern. Time of year restrictions shall include:
    - a. No tree cutting will be allowed by Contractor without written approval from the US Forest Service (Contracting Officer)
    - b. Approval to cut trees must be coordinated and negotiated with local US Forest Service personnel having jurisdiction and authority.
- B. On-Site Work Hours: Limit work to normal business working hours of 7 a.m. to 7 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: Unless approved in writing by the Contracting Officer, work not to occur on weekend.
  2. Early Morning Hours: Any work outside of normal business working hours is to be approved by the CO.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by the Forest Service (FS) or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
1. Notify CO not less than two (2) days in advance of proposed interruptions.
  2. Obtain CO's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to the Forest Service with CO.
1. Notify CO not less than three (3) days in advance of proposed disruptive operations.
  2. Obtain CO's written permission before proceeding with disruptive operations.
- E. Controlled Substances: Use of tobacco products and other controlled substances on the Project site is not permitted.

#### 1.13 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Forest Service (FS) is required to operate all pump stations. Turning the pump stations off to make piping and equipment connections shall be coordinated with the CO three (3) days in advance of activities that affect the operations of the pump stations. Bypass pumping of some of the pump stations will be required if the pump stations are off-line greater than the storage capacity of the wetwell during outage for piping and equipment installation. Cooperate with FS during construction operations to minimize conflicts and facilitate FS usage. Perform the Work so as not to interfere with FS's day-to-day operations. Maintain existing exits unless otherwise indicated.
1. Maintain access to existing walkways and other adjacent occupied or used facilities. Do not close or obstruct walkways, access corridors, or other occupied or used facilities without written permission from CO and approval of authorities having jurisdiction.
  2. Notify CO not less than 72 hours in advance of activities that will affect Owner's operations.

#### 1.14 ACCESS TO SITE

- A. General: Contractor shall have limited use of project site for construction operations as indicated on Drawings by the Contract Limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to areas within the Contract limits as indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
- C. Limits: Confine construction operations to the areas as shown on the Drawings as permanent and temporary construction easements. Areas shown as public (VDOT) right-of-ways may also be used as construction areas with prior authorization from VDOT.
- D. Roads, Driveways, Walkways, & Entrances: Keep roads, driveways, and entrances serving all properties clear and available to FS, their employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

- E. Condition of Existing Building: Maintain portions of existing building(s) affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction activities.

1.15 CONTRACT CLOSEOUT

A. Refer to Section 017700 – Contract Closeout.

B. PUNCH LIST: Correct all punch list items to the satisfaction of the Owner.

C. PROJECT RECORD DOCUMENTS:

1. Provide one complete set of drawings and project manual recording all changes to the work to indicate actual installation. Changes shall be noted in legible red letters at least 1/8 inch high. These changes shall include, but are not limited to, the following:
  - a. Exact location and elevation of underground utilities
  - b. Changes in general construction work above or below ground.
2. The records are a specific contract requirement, and final payment will not be made until these drawings and project manual have been submitted in an acceptable form.

1.16 GUARANTEE

The Contractor shall provide a twelve month guarantee that all materials and workmanship performed under this Contract shall be free of defects.

END OF SECTION 010000

## **SECTION 012900 – PRICE AND PAYMENT PROCEDURE**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Applications for Payment.
- B. Payment for Tests and Inspections.
- C. Typical Measurement and Payment Descriptions.
- D. Payment for Items Stored on Site.
- E. Change Order Procedures.

#### **1.02 APPLICATIONS FOR PAYMENT**

- A. Payment Period: Submit at intervals stipulated in the Contract.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to COR for approval.
- C. Submit an advance copy of each Application for Progress Payment to the CO and COR for review prior to uploading to IPP ([www.ipp.gov](http://www.ipp.gov)). Forms filled out by hand will not be accepted.
- D. For each item, provide a column for listing each of the following:
  - 1. Item Number.
  - 2. Description of work.
  - 3. Scheduled Values.
  - 4. Previous Applications.
  - 5. Work in Place and Stored Materials under this Application.
  - 6. Authorized Change Orders.
  - 7. Total Completed and Stored to Date of Application.
  - 8. Percentage of Completion.
  - 9. Balance to Finish.
  - 10. Retainage.
- E. Execute certification by signature of authorized officer.
- F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- H. Include the following with the application:
  - 1. Transmittal letter as specified for submittals in Section 013000.
  - 2. Construction progress schedule revised and current as specified in Section 013000.

3. Partial release of liens from major subcontractors and vendors.

I. When the Contracting Officer requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

#### 1.03 PAYMENT FOR TESTS AND INSPECTIONS

A. Include the costs of shop tests and shop inspections in the price of the manufactured Products, and no separate or extra payment will be made for such tests and inspections.

B. Contractor shall employ and pay for the services of an independent firm(s) to perform laboratory and field testing and inspections for the following items as necessary for approval:

1. Testing of collection lines and manhole testing.
2. Compaction testing of sewer line backfill and foundation subgrades.
3. Concrete testing for all footer pours.
4. Concrete testing for cast-in-place concrete.
5. X-ray testing for welding, if applicable.
6. Vibration & blast monitoring, if applicable.
7. Structural steel inspection.
8. Reinforcing steel inspection.

C. Contractor shall be responsible for the cost of all other field tests and inspections as required by the Specifications.

#### 1.04 TYPICAL MEASUREMENT AND PAYMENT DESCRIPTIONS

A. Standard payment items shown on Bid Form:

##### WWTP DECOMMISSIONING

1. Construction Stakeout includes costs associated with survey stakeout and re-staking to facilitate construction activities. Item includes all labor, materials, and equipment necessary to complete the work.
2. Clearing and Grubbing includes all costs to remove trees and other vegetation from the construction area. Item includes all labor, materials, tools, equipment, and incidentals necessary to properly remove and dispose of woody vegetation.
3. Fence Removal includes all costs to remove fence, posts, gates, and associated materials from the construction area. Item includes all labor, materials, tools, equipment, and incidentals necessary to properly remove fence materials and dispose of legally off-site.
4. Remove WWTP Components includes all costs to abandon or removal all WWTP materials(structures, piping, liners, etc.)from the construction area as noted on plans. Item includes all labor, materials, tools, equipment, and incidentals necessary to properly remove materials and dispose of legally off-site.
5. Remove Existing Sanitary Sewer Components includes all costs to abandon or removal all sanitary sewer materials (sewer line, manholes, laterals, etc.) from the construction area as noted on plans. Item includes all labor, materials (including flowable fill), tools, equipment, and incidentals necessary to properly remove materials and dispose of legally off-site.

6. Remove Water System Components Removal includes all costs to abandon or removal all water line materials (pipe, valves, etc.) from the construction area as noted on plans. Item includes all labor, materials (including flowable fill), cut and cap, tools, equipment, and incidentals necessary to properly remove materials and dispose of legally off-site.
7. Remove Existing Electrical Components Removal includes all costs to abandon or removal all electrical service materials (control panels, wire, conduit, etc.) from the construction area as noted on plans. Item includes all labor, materials, tools, equipment, and incidentals necessary to properly remove materials and dispose of legally off-site.
8. Discharge Lagoon includes all costs to pump liquid from the WWTP as noted on plans. Item includes all labor, materials, tools, equipment, and incidentals necessary to properly remove and dispose of legally off-site.
9. Lime Application includes all costs to apply lime for stabilization of sludge materials. Item includes all labor, materials, tools, equipment, and incidentals necessary to properly apply lime stabilization materials.
10. Sludge Stabilization includes all costs to dispose of sludge material on-site as noted on plans. Item includes all labor, materials, tools, equipment, and incidentals necessary to properly dispose of sludge materials.
11. Excavation & Fill includes all costs fill in the WWTP area with on-site materials. Item includes all labor, materials, tools, equipment, and incidentals necessary to provide bulk grading of the site.
12. Regrade Site includes all costs to finish grade the area as shown on construction plans. Item includes all labor, materials, tools, equipment, and incidentals necessary to provide finish grading of the site.
13. Contractor Sampling & Testing includes all cost by the contactor for sampling and testing of disposed materials. Item includes all labor, materials, tools, equipment, and incidentals necessary to provide required testing. All results shall be provided to USFS prior to payment.
14. Seeding & Restoration includes restoration of all property disturbed as part of construction activity including seeding and mulching, moving of incidentals, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
15. E&S Control includes all costs to properly install, maintain, and remove E&S control measures as needed for construction of the project. Item includes all labor, materials, tools, equipment, and incidentals necessary to complete the work.
16. Red-Line Drawings / O&M Manuals will be paid for as a lump sum item. Price shall be full compensation for providing contractor red-line drawings and O&M manuals suitable to the Contracting Officer. Red-line drawings shall include all applicable documentation associated with construction. Information includes, but is not limited to general contractor contact information, subcontractors, RFIs, Field Orders, installed components (pipe lengths, structure invert/top elevations, location of lateral/main-line connection, etc.), drawing changes, structure relocations, locations of water line cut and cap connections, etc. It shall include all labor, tools, and materials necessary to complete the work
17. Mobilization shall include all activities necessary to mobilize in order to carry out construction activities. No more than 50 percent of the mobilization cost will be paid in the first pay request by the Contractor under this item. Any additional monies will be paid as part of the second and/or subsequent pay requests as determined by the USFS. Total cost of Mobilization shall be limited to 5% of the total project cost.

SANITARY SEWER REPLACEMENT

1. Construction Stakeout includes costs associated with survey stakeout and re-staking to facilitate construction activities. Item includes all labor, materials, and equipment necessary to complete the work.
2. Clearing and Grubbing includes all costs to remove trees and other vegetation from the construction area. Item includes all labor, materials, tools, equipment, and incidentals necessary to properly remove and dispose of woody vegetation
3. Remove Existing Sewer Manhole includes all costs to remove existing manhole structures. Payment will be per structure as noted on the plans. This price shall be full compensation for removal of manhole including any by-bass pumping, unclassified excavation, trench dewatering, backfill with suitable material, compaction, disposal of excess and unsuitable material, fittings, cleanouts, sheeting and/or shoring, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
4. Remove Existing Sewer Pipe includes all costs associated with mainline and lateral pipe removal. Payment will be in lineal feet measured horizontally from interior manhole wall to interior manhole wall, through all fittings, casings, and will be paid for at the contract unit price per linear foot to the points noted on the plans. This price shall be full compensation for removal of pipe including any by-bass pumping, unclassified excavation, trench dewatering, backfill with suitable material, compaction, disposal of excess and unsuitable material, fittings, cleanouts, sheeting and/or shoring, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
5. Material Disposal Off-Site includes all costs associated with disposal of materials (pipe, manhole, unsuitable soil, pavement, etc.) off-site. Item includes all labor, materials, tools, equipment, and incidentals necessary to properly dispose of materials off site.
6. Electric Line Relocation will be measured as a lump sum. It shall include all costs associated with moving, relocating, and or stabilizing electric lines in close proximity (crossing or paralleling) to the sanitary sewer components. Item shall include furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work
7. 8" DI Cement Lined pipe will be measured in linear feet. Measurement will be horizontally from interior manhole wall to interior manhole wall, through all fittings, casings, and will be paid for at the contract unit price per linear foot to the points noted on the plans. This price shall be full compensation for any by-bass pumping, test pits, unclassified excavation, trench dewatering, backfill with suitable material, compaction, disposal of excess and unsuitable material, necessary bedding material, fittings, cleanouts, sheeting and/or shoring, abandoning or removing existing line, acceptance testing, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
8. 8" PVC SDR 35 Sanitary Sewer Pipe will be measured in linear feet. Measurement will be horizontally from interior manhole wall to interior manhole wall, through all fittings, casings, and will be paid for at the contract unit price per linear foot to the points noted on the plans. This price shall be full compensation for any by-bass pumping, test pits, unclassified excavation, trench dewatering, backfill with suitable material, compaction, disposal of excess and unsuitable material, necessary bedding material, fittings, cleanouts, sheeting and/or shoring, abandoning or removing existing line, acceptance testing, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
9. 6" PVC SDR 35 Sanitary Sewer Lateral connection shall be measured in linear feet from the sanitary sewer main to the cleanout connection as shown on Standard

- Details, complete in place. The price shall include all labor and materials, connection to the main, service pipe, locator tracer wire, fittings, and testing.
10. Rock Excavation will be paid on a cubic yard basis as defined in the specifications. Price shall include all materials, equipment, and labor to excavate and dispose of rock material. Quantity of rock excavation will be measured by the USFS, or representative, in its original position then excavated to required depth then measured by the cubic yard. No payment shall be made for rock removed by ripping.
  11. Sanitary Sewer Cleanout includes all costs for installation of cleanout structures. Payment will be per structure as noted on the plans and detail. The price shall include all labor and materials, the connection to the lateral, pipe, locator tracer wire, fittings, and testing.
  12. Sanitary Sewer Double Cleanout includes all costs for installation of cleanout structures. Payment will be per structure as noted on the plans and detail. The price shall include all labor and materials, the connection to the lateral, pipe, locator tracer wire, fittings, and testing.
  13. Sewer Manhole includes all costs to install new manhole structures. Payment will be per structure as noted on the plans. This price shall be full compensation for installation of manhole including any by-bass pumping, unclassified excavation, trench dewatering, backfill with suitable material, compaction, disposal of excess and unsuitable material, fittings, sheeting, testing and/or shoring, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
  14. Manhole Frame & Cover (waterproof) includes all costs to install new manhole manhole castings. Payment will be per structure as noted on the plans. This price shall be full compensation including adjustment rings and casting, backfill with suitable material, compaction, disposal of excess and unsuitable material, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
  15. Water Line Removal includes all costs to abandon or removal all water line materials (pipe, valves, etc.) from the construction area as noted on plans. Item includes all labor, materials (including flowable fill), cut & cap, tools, equipment, and incidentals necessary to properly remove materials and dispose of legally off-site .
  16. RV Dump Station includes all costs to install dump station. This price shall be full compensation for any by-bass pumping, unclassified excavation, trench dewatering, backfill with suitable material, compaction, disposal of excess and unsuitable material, necessary bedding material, fittings, cleanouts, sheeting and/or shoring, concrete, water tower, water service, signage, acceptance testing, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
  17. Contractor Sampling & Testing includes all cost by the contractor for sampling and testing. Item includes all labor, materials, tools, equipment, and incidentals necessary to have an installed and approved sewer system. All results shall be provided to USFS prior to payment.
  18. Pavement Restoration shall be measured in square yards of pavement installed. This will include all materials, subbase, grading, stone, pavement, and compaction as specified on plans and in specifications. This shall be full compensation for all materials, tools, equipment, labor, and incidentals necessary to complete the work.
  19. E&S Control includes all costs to properly install, maintain, and remove E&S control measures as needed for construction of the project. Item includes all labor, materials, tools, equipment, and incidentals necessary to complete the work.
  20. Seeding & Restoration includes restoration of all property disturbed as part of construction activity including seeding and mulching, moving of incidentals, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.

21. Manhole Marker includes all costs for installation of manhole markers. Payment will be per structure as noted on the plans and detail. The price shall include all labor and materials to complete the work.
22. Red-Line Drawings / O&M Manuals will be paid for as a lump sum item. Price shall be full compensation for providing contractor red-line drawings and O&M manuals suitable to the Contracting Officer. Red-line drawings shall include all applicable documentation associated with construction. Information includes, but is not limited to general contractor contact information, subcontractors, RFIs, Field Orders, installed components (pipe lengths, structure invert/top elevations, location of lateral/main-line connection, etc.), drawing changes, structure relocations, locations of water line cut and cap connections, etc. It shall include all labor, tools, and materials necessary to complete the work
23. Mobilization shall include all activities necessary to mobilize in order to carry out construction activities. No more than 50 percent of the mobilization cost will be paid in the first pay request by the Contractor under this item. Any additional monies will be paid as part of the second and/or subsequent pay requests as determined by the USFS. Total cost of Mobilization shall be limited to 5% of the total project cost.

#### NEW WWTP & DISPOSAL SYSTEM

1. Construction Stakeout includes costs associated with survey stakeout and re-staking to facilitate construction activities. Item includes all labor, materials, and equipment necessary to complete the work.
2. Clearing and Grubbing includes all costs to remove trees and other vegetation from the construction area. Item includes all labor, materials, tools, equipment, and incidentals necessary to properly remove and dispose of woody vegetation.
3. PVC SDR 35 Sanitary Sewer Pipe will be measured in linear feet. Measurement will be horizontally from interior manhole wall to interior manhole wall, through all fittings, casings, and will be paid for at the contract unit price per linear foot to the points noted on the plans. This price shall be full compensation for any by-bass pumping, test pits, unclassified excavation, trench dewatering, backfill with suitable material, compaction, disposal of excess and unsuitable material, necessary bedding material, fittings, cleanouts, sheeting and/or shoring, abandoning or removing existing line, acceptance testing, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
4. 5,000 GPD Advantex Treatment System will be measured as lump sum for installation of the Advantex System (AX100 & AX20 Pods, risers, tank adaptors, lids, splice boxes, filters, pumps controls, drainfield tubing & valves, control panel structure, electrical panel boxes, conduit, wire, etc.) This price shall be full compensation for site grading, excavation, pipe installation, backfill with suitable material, compaction, disposal of excess and unsuitable material, necessary bedding material, fittings, cleanouts, acceptance testing, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
5. **Items 5-11**, \_\_\_\_\_ Gal Tank will be measured as lump sum. This price shall be full compensation for any by-bass pumping, test pits, unclassified excavation, trench dewatering, backfill with suitable material, compaction, disposal of excess and unsuitable material, necessary bedding material, fittings, sheeting and/or shoring, acceptance testing, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
12. Yard Hydrant / Service shall installed in accordance with plans and specifications. This item will be paid for as a lump sum item the yard hydrant and service line. This

- price shall be full compensation for unclassified excavation, backfill with suitable material, trench construction, compaction, disposal of excess and unsuitable material, necessary bedding material, fittings, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work
13. Contractor Sampling & Testing includes all cost by the contractor for sampling and testing. Item includes all labor, materials, tools, equipment, and incidentals necessary to have an installed and approved sewer system. All results shall be provided to USFS prior to payment.
  14. Site Removal will be paid on a per site basis. Price shall include removal of all site materials (parking area, pad site, water/sewer/electric termination at the main, fire pit, etc.), equipment, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
  15. Excavation & Fill includes all costs for grading the treatment site with on-site materials. Item includes all labor, materials, tools, equipment, and incidentals necessary to provide bulk grading of the site.
  16. Rock Excavation will be paid on a cubic yard basis as defined in the specifications. Price shall include all materials, equipment, and labor to excavate and dispose of rock material. Quantity of rock excavation will be measured by the USFS, or representative, in its original position then excavated to required depth then measured by the cubic yard. No payment shall be made for rock removed by ripping.
  17. Seeding & Restoration includes restoration of all property disturbed as part of construction activity including seeding and mulching, moving of incidentals, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
  18. Gravel Drive Area shall be measured in square yards square yards of drive area installed. This will include all materials, subbase, grading, stone, and compaction as specified on plans and in specifications. This shall be full compensation for all materials, tools, equipment, labor, and incidentals necessary to complete the work.
  19. Treatment Area Stone Ground Cover shall be measured in square yards square yards of drive area installed. This will include all materials, subbase, grading, stone, and compaction as specified on plans and in specifications. This shall be full compensation for all materials, tools, equipment, labor, and incidentals necessary to complete the work.
  20. Security Fencing shall installed in accordance with plans and specifications. This item will be paid for based on the number of linear feet of fencing installed, which price shall be full compensation for excavation, concrete, fence fabric, posts, barbed wire, fence appurtenances, disposal of excess or unsuitable material, and for all labor, tools, equipment and incidentals necessary to complete the work.
  21. Double Access Gate shall installed in accordance with plans and specifications. This item will be paid as lump sum. Item shall include full compensation for excavation, concrete, fence fabric, gate, posts, barbed wire, fence appurtenances, disposal of excess or unsuitable material, and for all labor, tools, equipment and incidentals necessary to complete the work.
  22. Split Rail Fencing shall installed in accordance with plans and specifications. This item will be paid for based on the number of linear feet of fencing installed, which price shall be full compensation for excavation, concrete, fence rails, posts, fence appurtenances, disposal of excess or unsuitable material, and for all labor, tools, equipment and incidentals necessary to complete the work.
  23. E&S Control includes all costs to properly install, maintain, and remove E&S control measures as needed for construction of the project. Item includes all labor, materials, tools, equipment, and incidentals necessary to complete the work.

24. Drive Culvert shall installed in accordance with plans and specifications. This item will be paid for as a lump sum item. Price shall be full compensation for pipe material, any unclassified excavation, backfill with suitable material, compaction, disposal of excess and unsuitable material, necessary bedding material, fittings, and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.
25. Mowing Marker shall installed in accordance with plans and specifications. This item will be paid for based on the number structures installed, which price shall be full compensation for excavation, posts, appurtenances, disposal of excess or unsuitable material, and for all labor, tools, equipment and incidentals necessary to complete the work.
26. Landscape Screening shall installed in accordance with plans and specifications. This item will be paid for as a lump sum item. Price shall be full compensation for excavation, plants, watering, fertilization, disposal of excess or unsuitable material, and for all labor, tools, equipment and incidentals necessary to complete the work.
27. WWTP Commissioning will be paid for as a lump sum item. Price shall be full compensation for testing, system start-up, training government staff, and placing the WWTP into permanent service. It shall include all labor, tools, and materials necessary to complete the work.
28. Red-Line Drawings / O&M Manuals will be paid for as a lump sum item. Price shall be full compensation for providing contractor red-line drawings and O&M manuals suitable to the Contracting Officer. Red-line drawings shall include all applicable documentation associated with construction. Information includes, but is not limited to general contractor contact information, subcontractors, RFIs, Field Orders, installed components (pipe lengths, structure invert/top elevations, location of lateral/main-line connection, etc.), drawing changes, structure relocations, locations of water line cut and cap connections, etc. It shall include all labor, tools, and materials necessary to complete the work.
29. Mobilization shall include all activities necessary to mobilize in order to carry out construction activities. No more than 50 percent of the mobilization cost will be paid in the first pay request by the Contractor under this item. Any additional monies will be paid as part of the second and/or subsequent pay requests as determined by the USFS. Total cost of Mobilization shall be limited to 5% of the total project cost.

#### 1.05 WORK ITEMS

- A. Bedding Stone is not a pay item. Bedding stone is considered to be an incidental to the cost of the pipe installation when necessary.
- B. Excavation and backfill are not pay items. All excavation and backfill shall be included in the cost of the other bid items.
- C. Fittings, Restraints, and Accessories are not a pay item. Fittings and specialty items are considered incidental to the installation of the pipe and shall be included in the cost of the other bid items.
- D. Fertilizing is considered incidental to seeding and restoration.

#### 1.06 PAYMENT FOR ITEMS STORED ON SITE

- A. Payment for stored material delivered but not incorporated in the work will be the invoiced

amount only. Material must be stored in a bonded or insured location approved by the CO. Submit applicable invoices with Application for Payment.

#### 1.07 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents to the Contracting Officer.
- B. For minor changes not involving an adjustment to the Contract Scope, Contract Price, or Contract Time, the COR will issue Field Order instructions directly to Contractor.
- C. For other required changes, the Contracting Officer will issue a document instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
  1. The document will describe the required changes and will designate method of determining any change in Contract Scope, Contract Price, or Contract Time.
  2. Promptly execute the change.
- D. For changes for which advance pricing is desired, the Contracting Officer will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.
- E. Computation of Change in Contract Price:
  1. For change requested by the Government for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
  2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Contracting Officer.
  3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
- F. Substantiation of Costs: Provide full information required for evaluation.
  1. Provide the following data:
    - Quantities of products, labor, and equipment.
    - Taxes, insurance, and bonds.
    - Overhead and profit.
    - Justification for any change in Contract Time.
    - Credit for deletions from Contract, similarly documented.
  2. Support each claim for additional costs with additional information:

- Origin and date of claim.
  - Dates and times work was performed, and by whom.
  - Time records and wage rates paid.
  - Invoices and receipts for products, equipment, and subcontracts, similarly documented.
- G. Execution of Change Orders: The Contracting Officer will issue Change Orders for signatures of parties.
- H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Price.
- I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- J. Promptly enter changes in Project Record Documents

PART 2 - PRODUCTS  
NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION  
NOT APPLICABLE TO THIS SECTION

END OF SECTION 012900

## **SECTION 013100 - COORDINATION**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Coordination among Contractor's employees and Subcontractors; and any utility company, separate contractor, property owner, the Forest Service, and authority having jurisdiction.

#### **1.02 GENERAL COORDINATION**

- A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements.
- B. Do not unload or store materials or equipment where they will interfere with the progress of the Project or delay the work of other Contractors.
- C. For equipment units, coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building where applicable. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for the Forest Service's partial occupancy.
- F. After final completion, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Forest Service's activities.

#### **1.03 COORDINATING WITH ENGINEER**

- A. Cooperate with Contracting Officer (CO), Contracting Officer's Representative (COR), designated inspectors, and separate contractors to establish on-site lines of authority for communication.
- B. Develop procedures for handling submittals, reports, records, recommendations, coordination drawings, and schedules.
- C. Notify in writing of problems that develop during construction.
- D. Ensure agency responsible for operation and maintenance of the completed facility is advised before a project or parts thereof are open for use.

- E. Maintain and operate the Work until accepted and turned over to the agency responsible for operation and maintenance.

**1.04 COORDINATING WITH PRIVATE AND PUBLIC AGENCIES**

- A. Notify private and public agencies affected by the proposed construction, coordinate required adjustments, and arrange for all necessary adjustments of utilities within or adjacent to the limits of construction.
- B. Obtain utility locations from the one-call center (Miss Utility) or other utility coordination service 2 to 7 working days prior to any excavation. Locations must be updated every 14 days.
- C. All utilities and utility appurtenances within the limits of the Work that are to be relocated or adjusted shall be moved by the affected utility company, unless specified otherwise.
- D. Notify police, fire and transit authority.

**1.05 COORDINATING WITH SEPARATE CONTRACTORS**

- A. Coordinate with separate contractors at no additional cost to the Forest Service to leave Work complete and finished.
- B. Inspect and promptly report any apparent discrepancies or defects in work done by separate contractors that render Work unsuitable for proper execution and results. Failure to inspect and report shall constitute acceptance of separate contractor's work as fit and proper to receive work of this contract, except as to defects that may develop in the other separate contractor's work after the execution of the Contractor's work.

**1.06 COORDINATING WITH ADJACENT PROPERTY OWNERS**

- A. Provide all weather access to property owners at all times, unless property owner or CO approve otherwise.
- B. Where work is on easements on private property, coordinate work with the property owner so that work will minimize inconvenience to property owner.
- C. Notify all affected property owners ahead of time by written notice. Notify them not to put out any refuse at the appropriate time. Tell them another time that will be the time to collect their refuse.
- D. If necessary haul refuse to nearest point of suitable collection as determined by the refuse collection agency.
- E. Cooperate with the U.S. Postal Service in the delivery of mail.

**1.07 INTERRUPTION OF UTILITIES**

- A. Notify fire and police services in local jurisdiction if emergency is safety related or if construction activities interrupt any utility service.
- B. Contact the affected utility company. Find out how soon repairs can be made as well as when the repairs will begin.
- C. Contact the affected local residences or businesses. Inform when repairs will begin and how long it will take to complete them.
- D. Inform Contracting Officer (CO) or Contracting Officer's Representative (COR).

**1.08 INTERRUPTION OF OWNER'S OPERATIONS**

- A. If any aspect of normal Forest Service operations needs to be interrupted for completion of the Work, notify CO in writing.
- B. Submit notice with an alternate plan to cover contingency problems. In the alternate plan allow for maintenance of utilities or other essential services that must be interrupted for any period otherwise deemed necessary by Forest Service to be unacceptable for necessary operations.
- C. Shutdown of utilities must be accomplished during approved-hours at no additional cost to Forest Service. If work requires a longer shutdown, it must then be accomplished during separate periods.
- D. Do not proceed with proposed shutdown without written approval.

**PART 2 - PRODUCTS**

NOT APPLICABLE TO THIS SECTION

**PART 3 - EXECUTION**

NOT APPLICABLE TO THIS SECTION

END OF SECTION 013100

## **SECTION 013110 - PROJECT MEETINGS**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Preconstruction conference.
- B. Construction sequence coordination meetings.
- C. Progress meetings.
- D. Project close-out meeting.
- E. Pre-installation conferences.

#### **1.02 PRECONSTRUCTION CONFERENCE**

- A. Contracting Officer's Representative (COR) will schedule a conference to be held prior to Contractor's commencement of the Work.
- B. Attendance:
  - 1. Contracting Officer (CO)
  - 2. Contracting Officer's Representative (COR) Designated Government Technical Monitors (GTM)
  - 3. Forest Service Local Unit Representative
  - 4. Engineer of Record
  - 5. Contractor and their designated representatives (Project Manager, Superintendent, QC Manager, etc.)
  - 6. Major Subcontractors
  - 7. Governmental agency representatives, utility representatives, and other parties who may have control of, or may be affected by, the Work.
- C. Agenda Items (as applicable to the Project):
  - 1. Designation of Contractors' supervisory personnel and phone numbers to be used in event of an emergency during non-working hours.
  - 2. Distribution of Contract Documents
  - 3. List of major Subcontractors and suppliers
  - 4. List of proposed Products
  - 5. Schedule of Shop Drawing submissions
  - 6. Schedule of Values
  - 7. Construction progress schedule and work sequencing
  - 8. Use of premises
  - 9. Utility relocations
  - 10. Procedures for submittals; Field Orders and Change Orders; substitutions, and Applications for Payment
  - 11. Survey Data and Control points
  - 12. Procedures for maintaining record documents
  - 13. Project coordination

14. Site security
15. Temporary utilities
16. Field offices
17. Housekeeping
18. Safety and first-aid procedures
19. Environmental requirements
20. Work Hours and Restrictions

- D. COR will preside at conference and prepare minutes for distribution to participants unless delegated otherwise.

### **1.03 CONSTRUCTION SEQUENCE COORDINATION MEETINGS**

- A. COR may schedule construction sequence coordination meetings at critical times during the construction period to discuss interfacing of the new work with the existing facilities and connections between divisions of the work. In general, meetings will be scheduled a minimum 7 calendar days prior to major construction milestones.

- B. Attendance:

1. COR.
2. Contractors' project superintendents and other Contractor representatives.
3. Major subcontractors including bypass pumping subcontractor, if applicable.
4. Governmental agency representatives, utility representatives, and other parties who may have control of, or may be affected by, the Work.
5. Others as deemed appropriate by the Forest Service or Contractor.

- C. Agenda:

1. Review of schedule for shutdowns and/or changeovers.
2. Review of shutdown/changeover procedures.
3. Review of plan for maintaining operations during shutdown/changeover.
4. Discussion of any anticipated problems which may impede planned schedule.
5. Review of contingency plans for maintaining/restoring service in the event of problems.
6. Review of operational issues associated with planned shutdown/changeover.
7. Resolution of any outstanding operational concerns about maintenance of service.
8. Coordination of work of all trades.
9. Other business relating to work.

- D. COR will conduct meeting and prepare minutes for distribution to participants, unless delegated otherwise.

### **1.04 PROGRESS MEETINGS**

- A. COR will schedule monthly progress meetings throughout the construction period.

- B. Attendance:

1. CO
2. COR

3. Contractors' Project Superintendents (attendance required) and other Contractor(s) representatives.
4. Major Subcontractors and suppliers.
5. Governmental agency representatives, utility representatives, and other parties who may have control of, or may be affected by, the Work.
6. Others as appropriate for agenda topics for each meeting.

C. Agenda:

1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFI log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Coordination of projected progress.
12. Maintenance of quality and work standards.
13. Effect of proposed changes on progress schedule and coordination.
14. Other business relating to Work.

- D. COR will conduct meeting and prepare minutes for distribution to participants, unless delegated otherwise.

## **1.05 PROJECT CLOSE-OUT MEETING**

- A. CO will schedule a project close-out meeting no later than 90 days prior to the scheduled date of Substantial Completion.

B. Attendance:

1. CO
2. COR
3. Contractors' Project Superintendents (attendance required) and other Contractor(s) representatives.
4. Major Subcontractors and suppliers.
5. Governmental agency representatives, utility representatives, and other parties who may have control of, or may be affected by, the Work.
6. Others as appropriate for agenda topics for each meeting.

C. Agenda:

1. Preparation of record documents.
2. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
3. Submittal of written warranties.
4. Requirements for preparing operations and maintenance data.

5. Requirements for delivery of material samples, attic stock, and spare parts.
  6. Requirements for demonstration and training.
  7. Preparation of Contractor's punch list.
  8. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
  9. Forest Service's partial occupancy requirements.
  10. Responsibility for removal of temporary facilities and controls.
- D. COR will conduct meeting and prepare minutes for distribution to participants, unless delegated otherwise.

**1.06 PRE-INSTALLATION CONFERENCES**

- A. When pre-installation conference is required in individual Specification Section, notify COR at least seven days prior to start of installation.
- B. COR will schedule conference to be held prior to start of installation.
- C. Attendance: Parties directly affecting, or affected by, work of the specific Section.
- D. COR will prepare agenda, preside at conference, record minutes, and distribute copies within two days after conference to participants.
- E. At conference, Contractor shall review conditions of installation, preparation and installation procedures, and coordination with related work.

**PART 2 - PRODUCTS**

NOT APPLICABLE TO THIS SECTION

**PART 3 - EXECUTION**

NOT APPLICABLE TO THIS SECTION

END OF SECTION 013110

## SECTION 013200 – CONSTRUCTION PROGRESS SCHEDULES

### PART 1 - GENERAL

#### 1.01 PROJECT SCHEDULE

- A. General: The Contractor shall provide the Project Schedule after award and before the Preconstruction Meeting. The schedule shall include a summary construction schedule with important milestones.
- B. Development and Updates: Fully develop the construction portion of the schedule and submit before the Preconstruction meeting or any construction begins. The Project Schedule shall be updated on a monthly basis throughout the entire contract period and until project substantial completion. The status date of each schedule update shall be 10 days before the progress payment request date.
- C. Purpose: The purpose of the Project Schedule is to ensure adequate planning, coordination, scheduling, and reporting during construction activities of the Contractor. The Project Schedule will assist the Contractor and the Government in monitoring the progress of the work, evaluating proposed changes, and processing the Contractor's progress payment requests.
- D. Schedule Development: The Project Schedule shall cover the entire contract period. The late finish date of the Project Schedule shall be the same date as the established completion date of the contract.
- E. The Contractor shall use the Critical Path Method (CPM) with limited use of lead or lag durations between schedule activities. The Contractor's Project Schedule shall consist of procurement activities (including mobilization, submittal, and the fabrication and delivery of key and long-lead procurement items) and construction activities.

### PART 2 - PRODUCTS

- A. The Contractor's Project Schedule shall consist of, but not be limited to, the following for each activity:
  - I. Concise description of the work represented by the activity (maximum 48 characters). Avoid the use of non-standard abbreviations.
  - II. Activity duration in whole working days, except for non-construction activities including mobilization, shop drawing and sample submittals, fabrication of materials, delivery of materials and equipment, and concrete curing.
  - III. In developing the Project Schedule, the Contractor shall be responsible for ensuring that subcontractor work at all tiers, as well as its own work, is included in the Project Schedule.
  - IV. The Project Schedule, as developed, shall show the sequence and

interdependence of activities required for complete performance of the work. The Contractor shall be responsible for ensuring all work sequences are logical and the Project Schedule shows a coordinated work plan. Proposed durations assigned to each activity shall be the Contractor's best estimate of time required to complete the activity considering the scope and resources planned for the activity. Resource loading of each activity shall list all personnel by labor category and equipment type and capacity proposed to complete the activity in the duration shown. Include permit requirements and constraints. Seasonal weather conditions shall be considered and included in the planning and scheduling of all work influenced by high or low ambient temperatures, wind and/or precipitation to ensure completion of all work within the contract time.

### PART 3 - EXECUTION

- A. Project Schedule Updates:
- I. Monthly Updates: The monthly updating of the Project Schedule shall be an integral part and basic element of the estimate upon which progress payments shall be made under this contract. If, in the judgment of the CO, the Contractor fails or refuses to provide a Schedule of Values and a complete schedule update or revision as specified hereinafter, the Contractor shall be deemed to have not provided the required information upon which the progress payment may be made and shall be subject to retainage of a portion of the payment.
  - II. Time Impact Analysis for Contract Modifications, Changes, Delays, and Contractor Requests Requirements: When contract modifications or changes are initiated, delays are experienced, or the Contractor desires to revise the Project Schedule, the Contractor shall submit to the CO a written time impact analysis illustrating the influence of each modification, change, delay, or Contractor request on the contract time.
  - III. Time Extensions: Activity delays shall not automatically mean that an extension of the contract time is warranted or due the Contractor. It is possible that a modification, change, or delay will not affect existing critical activities or cause non-critical activities to become critical. A modification, change, or delay may result in only absorbing a part of the available total float that may exist within an activity chain of the Project Schedule, thereby not causing any effect on the contract time. Time extensions will be granted in accordance with the terms of the contract.
  - IV. Float: Float is not for the exclusive use or benefit of either the Government or the Contractor. Extension of the contract time will be granted only to the extent the equitable time adjustments to the activity or activities affected by the modification, change, or delay exceeds the total (positive or zero) float available on a particular activity.

END OF SECTION 013200

## **SECTION 013300 - SUBMITTAL PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.
- B. Related Sections include the following:
  - 1. Section 14000 "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals.

#### **1.3 DEFINITIONS**

- A. Action Submittals: Written and graphic information that requires COR's responsive action.
- B. Informational Submittals: Written information that does not require COR's approval. Submittals may be rejected for not complying with requirements.

#### **1.4 SUBMITTAL PROCEDURES**

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Government for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Contractor to provide COR a submittal log for review and approval.
  - 2. Contractor to maintain submittal log and provide COR with Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. COR reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on COR's receipt of submittal.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. COR will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Concurrent Review: Where concurrent review of submittals by COR's consultants, Owner, or other parties is required, allow 21 days for initial review of each submittal.
  3. If intermediate submittal is necessary, process it in same manner as initial submittal.
  4. Allow 15 days for processing each resubmittal.
  5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- D. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by COR.
  3. Include the following information on label for processing and recording action taken:
    - a. Official Project name and number, and any additional required identifiers established in Contract Documents.
    - b. The Contracting Officer's, COR's, and Contractor's names.
    - c. Discrete and consecutive RFI number, and descriptive subject/title.
    - d. Issue date, and requested reply date.
    - e. Reference top articular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s)
    - f. Annotations: Field dimensions and/or description of conditions which have engendered the request.
    - g. Contractors suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum
- E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- F. Additional Copies: Unless additional copies are required for final submittal, and unless COR observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to COR.
  2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

- G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. COR will return submittals, without review, received from sources other than Contractor.
1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by COR on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
  2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
  3. Transmittal Form: Provide locations on form for the following information:
    - a. Project name.
    - b. Date.
    - c. Destination (To:).
    - d. Source (From:).
    - e. Names of subcontractor, manufacturer, and supplier.
    - f. Category and type of submittal.
    - g. Submittal purpose and description.
    - h. Submittal and transmittal distribution record.
    - i. Remarks.
    - j. Signature of transmitter.
- H. RFI Log: Contractor shall prepare and maintain a tabular log of RFIs (aka Information Submittals), for the duration of the project. Log shall be available for reference by COR at all times, including during progress meetings. This log shall:
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
  2. Note dates of when each request is made, and when a response is received.
  3. Highlight items requiring priority or expedited response.
  4. Highlight items for which a timely response has not been received to date.
  5. Identify and include improper or frivolous RFIs
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Use only final submittals with mark indicating action taken by COR in connection with construction.

## PART 2 - PRODUCTS

### 2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Number of Copies: Submit six copies of each submittal, unless otherwise indicated. COR will return two copies. Mark up and retain one returned copy as a Project Record Document.
  2. Number of Copies: Submit copies of each submittal, as follows, unless otherwise indicated:
    - a. Initial Submittal: Submit a preliminary single copy of each submittal where selection of options, color, pattern, texture, or similar characteristics is required. COR will return submittal with options selected.
    - b. Final Submittal: Submit six copies, unless copies are required for operation and maintenance manuals. Submit eight copies where copies are required for operation and maintenance manuals. COR will retain four copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Document.
  3. Alternate Submittal Method: If agreed to by Contractor and Forest service, electronic document format may be utilized in place of or in addition to the use of paper copies. Agreement to this method shall be documented in writing. Submit one electronic copy in PDF format; an electronically marked-up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Manufacturer's catalog cuts.
    - e. Wiring diagrams showing factory-installed wiring.
    - f. Printed performance curves.
    - g. Operational range diagrams.
    - h. Mill reports.
    - i. Standard product operating and maintenance manuals.
    - j. Compliance with recognized trade association standards.
    - k. Compliance with recognized testing agency standards.
    - l. Application of testing agency labels and seals.
    - m. Notation of coordination requirements.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.

- e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
  - f. Shopwork manufacturing instructions.
  - g. Templates and patterns.
  - h. Schedules.
  - i. Design calculations.
  - j. Compliance with specified standards.
  - k. Notation of coordination requirements.
  - l. Notation of dimensions established by field measurement.
2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
  3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
  4. Number of Copies: Submit six blue- or black-line prints of each submittal, unless prints are required for operation and maintenance manuals. Submit eight prints where prints are required for operation and maintenance manuals. COR will retain four prints; remainder will be returned. Mark up and retain one returned print as a Project Record Drawing.
  5. Number of Copies: Submit copies of each submittal, as follows:
    - a. Initial Submittal: Submit one correctable, translucent, reproducible print and one blue- or black-line print. COR will return the reproducible print.
    - b. Initial Submittal: Submit two blue- or black-line prints. COR will return one print.
    - c. Final Submittal: Submit six blue- or black-line prints, unless prints are required for operation and maintenance manuals. Submit eight prints where prints are required for operation and maintenance manuals. COR will retain four prints; remainder will be returned. Mark up and retain one returned print as a Project Record Drawing.
- D. Delegated-Design Submittal: Comply with requirements in Division 1 Section "Quality Requirements."
- E. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.

## 2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit three copies of each submittal, unless otherwise indicated. COR will not return copies.

2. **Alternate Submittal Method:** If agreed to by Contractor and Forest service, electronic document format may be utilized in place of or in addition to the use of paper copies. Agreement to this method shall be documented in writing. Submit one electronic copy in PDF format; an electronically marked-up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
  3. **Certificates and Certifications:** Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
  4. **Test and Inspection Reports:** Comply with requirements in Division 1 Section "Quality Requirements."
- B. **Qualification Data:** Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of CORs, architects, and owners, and other information specified.
- C. **Product Certificates:** Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
- D. **Welding Certificates:** Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- E. **Installer Certificates:** Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- F. **Manufacturer Certificates:** Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- G. **Material Certificates:** Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- H. **Material Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- I. **Preconstruction Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.
- J. **Compatibility Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- K. **Field Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

- L. **Product Test Reports:** Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- M. **Maintenance Data:** Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment.
- N. **Design Data:** Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- O. **Manufacturer's Instructions:** Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
  - 1. Preparation of substrates.
  - 2. Required substrate tolerances.
  - 3. Sequence of installation or erection.
  - 4. Required installation tolerances.
  - 5. Required adjustments.
  - 6. Recommendations for cleaning and protection.
- P. **Manufacturer's Field Reports:** Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
  - 1. Name, address, and telephone number of factory-authorized service representative making report.
  - 2. Statement on condition of substrates and their acceptability for installation of product.
  - 3. Statement that products at Project site comply with requirements.
  - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  - 6. Statement whether conditions, products, and installation will affect warranty.
  - 7. Other required items indicated in individual Specification Sections.
- Q. **Insurance Certificates and Bonds:** Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- R. **Record Drawings:** After the final punchlist items have been addressed to the satisfaction of the COR, submit one (1) copy of the set of construction drawings and specifications upon which all changes to the Project during performance of the work have been identified. This submittal will be used to generate as-built drawings for the Owner's use. Submittal of record drawings are a prerequisite for release of retainage, project closeout, and initiation of the warranty period.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to COR.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 CONTRACTING OFFICER'S REPRESENTATIVE ACTION

- A. General: COR will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: COR will review each submittal, make marks to indicate corrections or modifications required, and return it. COR will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
  - 1. Authorizing purchasing, fabrication, deliver, and installation:
    - a. Approved: Acceptable with no corrections
    - b. Approved as Noted, Resubmission not required: Minor notes or clarification required. All comments are clear, and no further review is required. Address all review comments when proceeding with the Work. At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
    - c. Approved as Noted Resubmit for Record: Minor notes or clarification required. No further review is needed. Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
  - 2. Not Authorizing purchasing, fabrication, deliver, and installation:
    - a. Revise and Resubmit: Rejected as not in accordance with the Contract or required major correction or clarification. The Government will identify the reasons for not approving. Clearly identify changes when submitting revisions.
    - b. Resubmit revised item, with review notations acknowledged and incorporated.
- C. Informational Submittals: COR will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. COR will forward each submittal to appropriate party. Further responses will include as follows:
  - 1. "Received" – to notify Contractor that the submittal has been received for record only.
  - 2. "Reviewed" – no further action is required from Contractor.
- D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 013300

## **SECTION 014000 - QUALITY REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-control services required by CO, or authorities having jurisdiction are not limited by provisions of this Section.

#### **1.3 REFERENCES AND STANDARDS**

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from COR before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of COR shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.4 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by CO and COR.
- C. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.5 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to COR.

1.6 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.
- C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Description of test and inspection.
  - 3. Identification of applicable standards.
  - 4. Identification of test and inspection methods.
  - 5. Number of tests and inspections required.
  - 6. Time schedule or time span for tests and inspections.
  - 7. Entity responsible for performing tests and inspections.
  - 8. Requirements for obtaining samples.
  - 9. Unique characteristics of each quality-control service.

- D. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
  2. Project title and number.
  3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Ambient conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- E. Permits, Licenses, and Certificates: For the Government's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Government's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- G. Manufacturer's Field Reports: Submit reports for the Government.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressing the Contract Documents.
- H. Construction Quality Control Plan: Prior to the Preconstruction meeting, submit for approval a written Contractor Quality Control Plan.
1. If the plan requires any revisions or corrections, the Contractor shall resubmit the plan within ten (10) days.
  2. The Government reserves the right to require changes in the plan during the contract period as necessary to obtain the quality specified.
  3. No change in the approved plan may be made without written concurrence by the CO.
  4. The plan shall include:
    - a. A list of personnel responsible for quality control and assigned duties. Include each person's qualifications.
    - b. A copy of a letter of direction to the Contractor's Quality Control Supervisor outlining assigned duties.
    - c. Names, qualifications, and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms.
    - d. Methods of performing, documenting, and enforcing quality control of all work.

- e. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.

## 1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.
- G. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.
- H. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.
- I. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.
  - 1. Contractor responsibilities include the following:

- a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.
  - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
  - c. Fabricate and install test assemblies using installers who will perform the same tasks for Project.
  - d. When testing is complete, remove assemblies; do not reuse materials on Project.
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to COR with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Contractor's Quality Control (CQC) Plan: Prior to start of Construction, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
1. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
    - a. Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
  2. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
    - a. Management and control of documents and records relating to quality.
    - b. Communications. Coordination procedures.
    - c. Resource management.
    - d. Process control.
    - e. Inspection and testing procedures and scheduling.
    - f. Control of noncomplying work.
    - g. Tracking deficiencies from identification, through acceptable corrective action, and verification.
    - h. Control of testing and measuring equipment.
    - i. Project materials certification.
    - j. Managerial continuity and flexibility
  3. The Government will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in the Contract Price.
  4. Acceptance of the plan is required prior to start of construction activities not including mobilization work. The Government's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. The Government reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results

1.8 QUALITY CONTROL

- A. Government's Responsibilities: Where quality-control services are indicated as Forest Service's responsibility, FS will engage a qualified testing agency to perform these services.
  - 1. FS will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
  - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
  - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ the same entity engaged by FS, unless agreed to in writing by CO.
  - 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  - 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents, at no additional cost to Forest Service.
- E. Testing Agency Responsibilities: Cooperate with COR and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify COR and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  - 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  - 4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
  - 5. Do not perform any duties of Contractor.

- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  - 4. Facilities for storage and field-curing of test samples.
  - 5. Delivery of samples to testing agencies.
  - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
  
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  - 1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
  
- B. Protect construction exposed by or for quality-control service activities.
  
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

### 3.2 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality
  
- B. Comply with manufacturers' instructions, including each step in sequence.

- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from COR before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement

### 3.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from COR before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

### 3.4 OFF-SITE CONTROL

- A. Items that are fabricated or assembled off-site shall be inspected for quality control at the place of fabrication.
- B. On-Site Notify the Contracting Officer at least 48 hours in advance of the preparatory phase meeting.
- C. Notify the Contracting Officer at least 24 hours in advance of the initial and follow-up phases.
- D. Submit inspection reports prior to shipment.

### 3.5 MANUFACTURER'S FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.6 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of the Contracting Officer, it is not practical to remove and replace the work, the Contracting Officer will direct an appropriate remedy or adjust payment.

END OF SECTION 014000

## **SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities include, but are not limited to, the following:
  - 1. Storm sewers and drainage.
  - 2. Water service and distribution.
  - 3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
  - 4. Heating and cooling facilities.
  - 5. Electric power service.
  - 6. Lighting.
  - 7. Telephone service.
- C. Support facilities include, but are not limited to, the following:
  - 1. Temporary roads and paving.
  - 2. Dewatering facilities and drains.
  - 3. Project identification and temporary signs.
  - 4. Waste disposal facilities.
  - 5. Field offices.
  - 6. Storage and fabrication sheds.
  - 7. Lifts and hoists.
  - 8. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
  - 1. Environmental protection.
  - 2. Stormwater control.
  - 3. Tree and plant protection.
  - 4. Pest control.
  - 5. Site enclosure fence.
  - 6. Security enclosure and lockup.
  - 7. Barricades, warning signs, and lights.
  - 8. Temporary enclosures.
  - 9. Fire protection.

E. Related Sections include the following:

1. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
2. Divisions 2, 31, and 33 for products in those Sections.
3. Division 1 "VSMP Storm Water Permit Requirements" for environmental concerns related to storm water management.

1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to the Government and shall be included in the Contract Sum, unless otherwise directed by the CO. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
1. Government's staff.
  2. Delegated Government representatives.
  3. Testing agencies.
  4. Personnel of authorities having jurisdiction.
- B. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.
- C. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site for project trailer/office. Water for initial fill, flushing, and one test of water lines and/or tank will be provided by Government. If additional water is required due to test results, Contractor responsible for purchase of that water.
- D. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.
- E. Telecommunication Services: Provide, maintain, and pay for telecommunications services to field offices or Contractor facilities for duration of project. Government will pay for its own telecommunications services.

1.4 SUBMITTALS

- A. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- B. Implementation and Termination Schedule: Within 15 days of date established for submittal of Contractor's Construction Schedule, submit a schedule indicating implementation and termination of each temporary utility.

1.5 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
  2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

## 1.6 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to the Government, change over from use of temporary service to use of permanent service.
1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before the Government's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
1. Keep temporary services and facilities clean and neat.
  2. Relocate temporary services and facilities as required by progress of the Work.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Engineer. Provide materials suitable for use intended.
- B. Water: Potable.

### 2.2 EQUIPMENT

- A. General: Provide equipment suitable for use intended.
- B. Field Offices: Prefabricated, mobile units, or job-built construction, with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading. A field office will not be a requirement of this contract. Use of trailer is at discretion of Contractor.
- C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

- D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- E. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
- F. Telephone Communications: Provide reliable telephone service for safety considerations and for communications between the Contractor's representative at the site and the Forest Service. Portable cellular telephone service is acceptable, provided it is dependable and ensures that the site can contact, and be contacted by, outside parties.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
  - 1. Arrange with utility company, Government, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
  - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
  - 3. Obtain easements to bring temporary utilities to Project site where Government's easements cannot be used for that purpose.
- B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
  - 1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
  - 2. Connect temporary sewers to municipal system as directed by sewer department officials.
  - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.

4. Provide devices to purify effluent to levels acceptable to authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
  2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Provide separate facilities for male and female personnel.
  3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
- E. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
1. Install electric power service underground, unless overhead service must be used.
  2. Install power distribution wiring overhead and rise vertically where least exposed to damage.
  3. Connect temporary service to the Government's existing power source, as directed by electric company officials.
  4. Telephone Service: Provide temporary telephone service throughout construction period. Cellular service is acceptable if it effects reliable communication from the site to the Engineer and all necessary emergency services.
- 3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access and in accordance with the Government's approval.
2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Government.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide a reasonably level, graded, well-drained subgrade of satisfactory soil material, compacted to not less than 95 percent of maximum dry density in the top 6 inches.
  2. Provide gravel paving course of subbase material not less than 3 inches thick; roller compacted to a level, smooth, dense surface.
  3. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
  4. Ensure that access to the existing shell building is maintained at all times for the Governmnet's use during construction.
- C. **Traffic Controls:** Provide temporary traffic controls at junction of temporary roads with public roads and other locations where construction personnel or the public might be endangered. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction. All traffic controls must conform to the Manual for Uniform Traffic Control Devices.
- D. **Dewatering Facilities and Drains:** Dewatering of the site for construction purposes is solely the responsibility of the Contractor. Comply with requirements in applicable Division 2 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
  2. Before connection and operation of permanent drainage piping system, provide temporary drainage.
  3. Remove snow and ice as required to minimize accumulations.
- E. **Project Identification and Temporary Signs:** Prepare Project identification and other signs in sizes approved by Government. Install signs at approved locations to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.
1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with detail appended to this section.
  2. Prepare temporary signs to provide directional information to construction personnel and visitors.
  3. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.
  4. Paint sign and graphics with exterior-grade alkyd gloss enamel over exterior primer.
  5. Install sign at a location approved by the Forest Service and in a manner consistent with the appropriate section(s) of the most recent edition of the project locality's zoning and/or subdivision ordinance.
- F. **Waste Disposal Facilities:** Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.
1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

- G. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services.
  - 1. Construct using fire-retardant-treated lumber and plywood.
  - 2. Paint exposed surfaces with exterior-grade acrylic-latex emulsion over exterior primer.
- H. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Common-Use Field Office: Provide an insulated, weathertight, air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of 10 persons at Project site. Keep office clean and orderly.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and VSMP Storm Water Permit Requirements and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking equipment to hours that will minimize complaints from parties near Project site.
- B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
- C. Tree and Plant Protection: Comply with requirements in VSMP permit for the prevention of disturbance of preservation buffers. Avoid areas flagged by the Forest Service to prevent such disturbance.
- D. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- E. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
  - 1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch- thick exterior plywood.
- F. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
  - 1. Store combustible materials in containers in fire-safe locations.

2. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
3. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

### 3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
  1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  1. Materials and facilities that constitute temporary facilities are the property of Contractor. Government reserves right to take possession of Project identification signs.
  2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscaping, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
  3. At Substantial Completion, clean and renovate permanent facilities used during construction period.

END OF SECTION 015000

## **SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Sections:
  - 1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
  - 2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

#### **1.3 DEFINITIONS**

- A. Caliper: Diameter of a trunk measured by the average of the smallest and largest diameters at 6 inches above the ground for trees up to, and including, 4-inch (100-mm) size; and 12 inches above the ground for trees larger than 4-inch size.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of the following:
  - 1. Organic Mulch: 1-quart volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
  - 2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.
  - 3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

- C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
  - 1. Species and size of tree.
  - 2. Location on site plan. Include unique identifier for each.
  - 3. Reason for pruning.
  - 4. Description of pruning to be performed.
  - 5. Description of maintenance following pruning.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified arborist and tree service firm.
- B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
  - 1. Use sufficiently detailed photographs or videotape.
  - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

## 1.6 QUALITY ASSURANCE

- A. Arborist Qualifications: Licensed arborist in jurisdiction where Project is located.
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- C. Preinstallation Conference: Conduct conference as part of pre-construction conference or part of monthly status meetings.
  - 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
    - a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
    - b. Enforcing requirements for protection zones.
    - c. Arborist's responsibilities.
    - d. Field quality control.

## 1.7 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
  - 1. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.
- B. Topsoil: Imported or manufactured topsoil complying with ASTM D 5268.
- C. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
  - 1. Type: Shredded hardwood, ground or shredded bark, or wood and bark chips.
  - 2. Size Range: 3 inches maximum, 1/2 inch minimum.
  - 3. Color: Natural.
- D. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements. Previously used materials may be used when approved by COR.
  - 1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- OD line posts, and 2-7/8-inch- OD corner and pull posts and 0.177-inch- diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
    - a. Height: 4 feet (1.2 m).

2. Plywood Protection-Zone Fencing: Plywood framed with four 2-by-4-inch rails, with 4-by-4-inch preservative-treated wood posts spaced not more than 8 feet apart.
  - a. Height: 4 feet.
3. Wood Protection-Zone Fencing: Constructed of two 2-by-4-inch horizontal rails, with 4-by-4-inch preservative-treated wood posts spaced not more than 8 feet apart, and lower rail set halfway between top rail and ground.
  - a. Height: 4 feet
4. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet apart.
  - a. Height: 4 feet .
  - b. Color: High-visibility orange, nonfading.
5. Gates: Single swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

### 3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch blue-vinyl tape around each tree trunk at 54 inches above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.
  1. Apply 4-inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

### 3.3 TREE- AND PLANT-PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
  - 1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
  - 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to COR.
  - 3. Access Gates: Install where indicated; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Maintain protection zones free of weeds and trash.
- C. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by COR.
- D. Maintain protection-zone fencing and signage in good condition as acceptable to COR and remove when construction operations are complete and equipment has been removed from the site.
  - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
  - 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

### 3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving."
- B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

### 3.5 ROOT PRUNING

- A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
  - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
  - 2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
  - 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
  - 4. Cover exposed roots with burlap and water regularly.
  - 5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."
- B. Root Pruning at Edge of Protection Zone: Prune roots flush with the edge of the protection zone, by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

### 3.6 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:
  - 1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
  - 2. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
  - 3. Cut branches with sharp pruning instruments; do not break or chop.
  - 4. Do not apply pruning paint to wounds.
- B. Chip removed branches and dispose of off-site.

### 3.7 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
  - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

### 3.8 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

### 3.9 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by COR.
  - 1. Submit details of proposed root cutting and tree and shrub repairs.
  - 2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
  - 3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
  - 4. Perform repairs within 24 hours.
  - 5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by COR.
- B. Trees: Remove and replace trees indicated to remain that are more than 66 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that COR determines are incapable of restoring to normal growth pattern.
  - 1. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.
  - 2. Provide two new tree(s) of 6-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.
    - a. Species: To be determined based on existing tree removed.
  - 3. Plant and maintain new trees as specified in Section 329300 "Plants."
- C. Soil Aeration: Where directed by COR, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch-

diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Government's property.

END OF SECTION 015639

**SECTION 016100 - DELIVERY, STORAGE, AND HANDLING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work Included: Products to be used in the work shall be properly stored and handled as described in this section. This section is not intended as a substitution for good judgment by the CONTRACTOR, nor is it intended to limit protective measures to be taken by the CONTRACTOR during construction.

**1.2 QUALITY ASSURANCE**

- A. General: The CONTRACTOR shall take the necessary measures to protect the materials and work as required.

**1.3 MANUFACTURER'S RECOMMENDATIONS**

- A. General: Unless otherwise approved by the Contracting Officer (CO), or specified herein, the CONTRACTOR shall comply with the manufacturer's recommendations on product handling, storage and protection.

**1.4 PACKAGING**

- A. General: Products shall be delivered to the job site in their manufacturer's original container with labels intact and legible. Damaged materials shall be immediately replaced at no additional cost to the Government. The CO may reject, as non-complying, any materials that do not bear the proper identification such as manufacturer, grade, quality and other pertinent information.

**1.5 PROTECTION OF SURFACES**

- A. General: The CONTRACTOR shall protect and maintain all finished surfaces from damage during storage and construction. Finished surfaces shall remain clean, unmarred and suitably protected until the work is accepted by the OWNER.

**1.6 REPAIRS AND REPLACEMENTS**

- A. General: In the event of damage, the CONTRACTOR shall make the necessary replacements and repairs as approved by the CO at no additional cost to the Government. No extension of contract time will be given for work associated with replacement and repair of damaged materials or surfaces.

1.7 DELIVERY AND STORAGE

- A. Delivery: The CONTRACTOR shall be responsible for making all the arrangements for the delivery, unloading, receiving and storage of materials.
- B. Storage: The CONTRACTOR shall store all products and materials in a protected location to prevent any damage or deterioration due to moisture, freezing temperatures or other detrimental conditions.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 016100

## SECTION 017300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Installation of the Work.
  - 3. Cutting and patching.
  - 4. Coordination of State-installed products.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
  - 8. Correction of the Work.
  
- B. Related Requirements:
  - 1. Section 010000 "General Requirements".
  - 2. Section 017700 "Closeout Procedures" for submitting final Project Record Documents, recording of accepted deviations from project documents, and final cleaning.
  
- C. Construction Phase Submissions:
  - 1. The Contractor shall identify actual brand name products used for every product, except commodity products specified by performance or description.
  - 2. Where a product is specified by performance requirements with test methods, and if so specified, the Contractor shall provide test reports showing compliance.
  - 3. The Contractor shall provide manufacturer's product literature for each brand name product.
  - 4. The Contractor shall provide the manufacturer's certification that the product used on the project complies with the contract documents.

#### 1.2 INFORMATIONAL SUBMITTALS

- A. Refer to Section 013300-Submittal Procedures.
  
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

#### 1.3 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.
2. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, resulting in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.
3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in State's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
4. Structural Elements: When cutting and patching structural elements, notify the COR of locations and details of cutting and await directions from the COR before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the State Representative for the visual and functional performance of in-place materials.
- C. Maintenance Materials:
  1. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
  2. Deliver to Project Site; obtain receipt prior to final payment.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to the COR that is necessary to adjust, move, or relocate existing utility structures, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by the State or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify the State not less than two days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without the CO's written permission.
- C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to the COR according to requirements in Section 013100 "Project Management."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings. If discrepancies are discovered, notify the State Representative promptly.
- B. Building Lines and Levels: Locate and lay out control lines and levels, including those required for mechanical and electrical work.
- C. Submit name, address and telephone number of Surveyor before starting survey work. On request, submit documentation verifying accuracy of survey work. Submit a copy of the site drawing signed by the surveyor, that the elevations and location of the work are in compliance with the Contract Documents.

### 3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by the COR.
  - 2. Allow for building movement, including thermal expansion and contraction.

- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.

- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
  - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements"

### 3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

### 3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction.
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

END OF SECTION 017300

## **SECTION 017700 - CLOSEOUT PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.
- B. Related Requirements: Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.
  - 1. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

#### **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
  
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Government unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer. Label with manufacturer's name and model number where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain COR's signature for receipt of submittals.
  - 5. Submit test/adjust/balance records.
  - 6. Submit changeover information related to Government's occupancy, use, operation, and maintenance.
  
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Advise COR of pending insurance changeover requirements.
  - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  - 3. Complete startup and testing of systems and equipment.
  - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  - 5. Instruct Governments's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
  - 6. Advise COR of changeover in heat and other utilities.
  - 7. Participate with COR in conducting inspection and walkthrough with local emergency responders.
  - 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  - 9. Complete final cleaning requirements, including touchup painting.

10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, CO will either proceed with inspection or notify Contractor of unfulfilled requirements. CO will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by COR, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

## 1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of CO's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## 1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.
2. Include the following information at the top of each page:

- a. Project name.
  - b. Date.
  - c. Name of Engineer.
  - d. Name of Contractor.
  - e. Page number.
3. Submit list of incomplete items in the following format:
    - a. PDF electronic file. CO will return annotated file.

## 1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of CO for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Government's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by Government during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
  1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
  2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.
    - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - k. Remove labels that are not permanent.
    - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

- o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
  - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - q. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
  - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

## SECTION 017823 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

#### 1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. COR will comment on whether content of operations and maintenance submittals are acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to COR.

- a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
  - b. Enable inserted reviewer comments on draft submittals.
2. Four (4) paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
- C. Initial Manual Submittal: Submit draft copy of each manual at least thirty (30) days before commencing demonstration and training. COR will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least fifteen (15) days before commencing demonstration and training. COR will return copy with comments.
1. Correct or revise each manual to comply with COR's comments. Submit copies of each corrected manual within fifteen (15) days of receipt of COR's comments and prior to commencing demonstration and training.

## PART 2 - PRODUCTS

### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
1. List of documents.
  2. List of systems.
  3. List of equipment.
  4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

- 2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS
- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Include the following information:
1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for COR.
  7. Names and contact information for major consultants to the COR that designed the systems contained in the manuals.
  8. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
  - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
  - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
  1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
  1. Fire.
  2. Flood.
  3. Gas leak.
  4. Water leak.
  5. Power failure.
  6. Water outage.
  7. System, subsystem, or equipment failure.
  8. Chemical release or spill.

- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
  - 1. Instructions on stopping.
  - 2. Shutdown instructions for each type of emergency.
  - 3. Operating instructions for conditions outside normal operating limits.
  - 4. Required sequences for electric or electronic systems.
  - 5. Special operating instructions and procedures.

## 2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  - 2. Performance and design criteria if Contractor has delegated design responsibility.
  - 3. Operating standards.
  - 4. Operating procedures.
  - 5. Operating logs.
  - 6. Wiring diagrams.
  - 7. Control diagrams.
  - 8. Piped system diagrams.
  - 9. Precautions against improper use.
  - 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
  - 1. Product name and model number. Use designations for products indicated on Contract Documents.
  - 2. Manufacturer's name.
  - 3. Equipment identification with serial number of each component.
  - 4. Equipment function.
  - 5. Operating characteristics.
  - 6. Limiting conditions.
  - 7. Performance curves.
  - 8. Engineering data and tests.
  - 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
  - 1. Startup procedures.
  - 2. Equipment or system break-in procedures.
  - 3. Routine and normal operating instructions.
  - 4. Regulation and control procedures.
  - 5. Instructions on stopping.
  - 6. Normal shutdown instructions.

7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.5 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
  1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  1. Include procedures to follow and required notifications for warranty claims.

## 2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures,

maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

## PART 3 - EXECUTION

### 3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Forest Service's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section 017700 "Closeout Procedures" for general closeout procedures.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit one (1) paper-copy set(s) of marked-up record prints.
      - 2) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:
      - 1) Submit one (1) paper-copy set(s) of marked-up record prints.
      - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities.

## PART 2 - PRODUCTS

### 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Locations of concealed internal utilities.
    - i. Changes made by Change Order or Work Change Directive.
    - j. Changes made following Engineer's written orders.
    - k. Details not on the original Contract Drawings.
    - l. Field records for variable and concealed conditions.
    - m. Record information on the Work that is shown only schematically.
  3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.

### 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and record Drawings where applicable.

### 2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders and record Drawings where applicable.

### 2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

## PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's reference during normal working hours.

END OF SECTION 017839

## **SECTION 017900 - DEMONSTRATION AND TRAINING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for instructing Government's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
- B. Unit Price for Instruction Time: Payment for Instruction Time is to be included in prices of equipment. Additional payment will not be made for training and instruction.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

#### **1.4 QUALITY ASSURANCE**

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

- C. Preconstruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training including, but not limited to, the following:
  - 1. Inspect and discuss locations and other facilities required for instruction.
  - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, and facilities needed to avoid delays.
  - 3. Review required content of instruction.
  - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

## 1.5 COORDINATION

- A. Coordinate instruction schedule with Governmmnet's operations. Adjust schedule as required to minimize disrupting Forest Service's operations and to ensure availability of Forest Service's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by COR.

## PART 2 - PRODUCTS

### 2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Operating standards.
    - c. Regulatory requirements.
    - d. Equipment function.
    - e. Operating characteristics.
    - f. Limiting conditions.
    - g. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Emergency manuals.

- b. Operations manuals.
  - c. Maintenance manuals.
  - d. Project record documents.
  - e. Identification systems.
  - f. Warranties and bonds.
  - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
- a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Required sequences for electric or electronic systems.
  - l. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.

- g. Instruction on use of special tools.
- 8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

#### 3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Government for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Government's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Government will furnish an instructor to describe Forest Service's operational philosophy.
  - 2. Forest Service will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Government, through COR, with at least fourteen (14) days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

- F. Cleanup: Collect used and leftover educational materials and give to Government. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

## **SECTION 019100 - VSMP STORM WATER PERMIT REQUIREMENTS**

### **PART 1 – GENERAL**

#### **1.01 SUMMARY**

- A. The Virginia Stormwater Management Program (VSMP) general permit for construction activity discharge is issued and regulated by the Virginia Department of Conservation and Recreation (VDCR). The VSMP general storm water permit generally governs storm water discharges from construction activities disturbing one (1) acre or more of land.
- B. The Government has applied to Virginia DEQ for plan approval. The Contractor will obtain coverage under the VSMP general storm water permit for the work.
- C. This specification shall define the responsibilities of the Contractor relative to the requirements of the VSMP general storm water permit for the work.

#### **1.02 REFERENCES**

- A. General Virginia Stormwater Management Program (VSMP) Permit Regulations for Discharge of Storm Water from Construction Activities, 4 VAC50-60-380 and 390.

#### **1.03 RESPONSIBILITIES**

- A. The Contractor shall be responsible for complying with all requirements of the VSMP general storm water permit (4 VAC50-60-380 and 390) and the SWPPP for the work.
- B. The Contractor shall sign a copy of the certification statement included on page 4 of this specification section before conducting any professional service at the site identified in the SWPPP.
- C. The Contractor shall complete all monitoring and reporting activities listed in the general permit, and shall maintain records of all such activities in accordance with the inspection form included on page 3 of this specification section.
- D. The Contractor shall ensure that all fueling, vehicle maintenance, and hazardous substance handling activities where pollutants any be spilled are completed in contained areas.

#### **1.04 SUBMITTALS**

- A. The Contractor shall submit a signed copy of the certification statement included on page 4 of this specification section to the Government before conducting any professional services at the site identified in the SWPPP.
- B. The Contractor shall maintain written records of all monitoring and report activities required by the VSMP general storm water permit and as outlined in Part 1.03.C of this

specification section above, and shall submit copies of these written records to the CO on a monthly basis along with the Application of Payment.

- C. Applications for Payment will not be approved until copies of written records of all monitoring and reporting activities required by the VSMP general storm water permit are issued to the CO.

**PART 2 - PRODUCTS**

NOT APPLICABLE TO THIS SECTION

**PART 3 - EXECUTION**

NOT APPLICABLE TO THIS SECTION

**VSMP INSPECTION REPORT**

**PROJECT:** Grindstone Recreation Area Wastewater System Replacement **REPORT NO.:** \_\_\_\_\_

**OWNER:** USDA Forest Service **DATE:** \_\_\_\_\_

**CONTRACTOR(S):** \_\_\_\_\_

**CHECK LIST**

Yes	No	N/A	MS	<b>MINIMUM STANDARDS</b>
			1	<b>Have all denuded areas requiring temporary stabilization been stabilized? Seeded? Yes/No Mulched? Yes/No Graveled? Yes/No</b> Remarks:
			2	<b>Are all stockpiles adequately stabilized with seeding and/or controlled with sediment trapping measures?</b> Remarks:
			3	<b>Does permanent vegetation provide adequate stabilization?</b> Remarks:
			4	<b>Have sediment trapping facilities been constructed as a first step in trench dewatering?</b> Remarks:
			5	<b>For perimeter sediment trapping measures, are earthen structures stabilized?</b> Remarks:
			6	<b>Are sediment basins installed where needed?</b> Remarks:
			7	<b>Are finished cut and fill slopes adequately stabilized?</b> Remarks:
			8&9	<b>Are on site channels and outlet adequately stabilized?</b> Remarks:
			10	<b>Do all operational storm sewer inlets have adequate inlet protection?</b> Remarks:
			11	<b>Are storm water conveyance channels adequately stabilized with channel lining and/or protection?</b> Remarks:
			12	<b>Is in-stream construction conducted using measures to minimize channel damage?</b> Remarks:
			13	<b>Are temporary stream crossings of non-erodible materials installed where applicable?</b> Remarks:
			14	<b>Are all applicable regulations pertaining to working in or crossing live watercourses met?</b> Remarks:
			15	<b>Is necessary re-stabilization of in-stream construction complete?</b> Remarks:
			16	<b>Are utility trenches stabilized properly?</b> Remarks:
			17	<b>Are soil and mud kept off public roadways as intersections with site access roads?</b> Remarks:
			18	<b>Have all temporary control structures that are no longer needed been removed? Have all control structure repairs and sediment removal been performed?</b> Remarks:
			19	<b>Are properties and waterways downstream from development adequately protected from erosion and sediment deposition due to increases in peak stormwater runoff?</b> Remarks:

Additional Comments: \_\_\_\_\_

I certify the above report to be correct and complete to the best of my knowledge.

Signed: \_\_\_\_\_ Responsible Land Disturber Certification No. \_\_\_\_\_

CONTRACTOR'S CERTIFICATION STATEMENT  
GENERAL PERMIT FOR DISCHARGE OF STORMWATER FROM  
CONSTRUCTION ACTIVITIES  
AUTHORIZATION TO DISCHARGE UNDER THE VIRGINIA STORMWATER MANAGEMENT  
PROGRAM  
AND THE VIRGINIA STORMWATER MANAGEMENT ACT

Project Site: USDA-FS Grindstone Recreation Area Wastewater System Replacement  
Troutdale, VA

I certify under penalty of law that I understand the terms and conditions of this Virginia Stormwater Management Program (VSMP) general permit that authorizes the storm water discharges from the construction activity identified as part of this certification.

Submitted on: \_\_\_\_\_

Respectfully Submitted,

\_\_\_\_\_  
Title

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Firm

\_\_\_\_\_  
Business Address

END OF SECTION 019100

## **SECTION 024119 - SELECTIVE DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Demolition and removal of selected portions of a structure.
  - 2. Demolition and removal of selected site elements.
  - 3. Repair procedures for selective demolition operations.
- B. Related Sections include the following:
  - 1. Division 1 Section "Summary" for use of the premises and phasing requirements.
  - 2. Division 1 Section "Construction Progress Documentation" for preconstruction photographs taken before selective demolition.
  - 3. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
  - 4. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

#### **1.3 DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to the Government.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

#### **1.4 MATERIALS OWNERSHIP**

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Forest Service's property, demolished materials shall become Contractor's property and shall be removed from Project site and legally disposed of.

1. Items to be returned to Forest Service include water valves, pumps, and motors.

#### 1.5 SUBMITTALS

- A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects, engineers, and owners, and other information specified.
- B. Schedule of Selective Demolition Activities: Indicate the following:
  1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Forest Service's on-site operations are uninterrupted.
  2. Interruption of utility services.
  3. Coordination for shutoff, capping, and continuation of utility services.
- C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

#### 1.6 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Professional COR Qualifications: Comply with Division 1 Section "Quality Requirements."
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Preconstruction Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

#### 1.7 PROJECT CONDITIONS

- A. Conduct selective demolition so Forest Service operations will not be disrupted and to ensure safety of public. Provide COR a schedule of demolition operations and not less than 72 hours' notice to Forest Service of activities that will affect Forest Service's operations.
- B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
  1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- C. Government assumes no responsibility for condition of areas to be selectively demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Government as far as practical.
  - D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
    1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify COR. Hazardous materials will be removed by Government under a separate contract.
  - E. Storage or sale of removed items or materials on-site will not be permitted.
  - F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
    1. Maintain fire-protection facilities in service during selective demolition operations.
- 1.8 WARRANTY
- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.
    1. If possible, retain original installer or fabricator to patch the exposed Work listed below that is damaged during selective demolition. If it is impossible to engage original installer or fabricator, engage another recognized experienced and specialized firm.

## PART 2 - PRODUCTS

### 2.1 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
  1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that all existing utilities have been identified, disconnected, and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly report to the COR before proceeding.
- E. Engage a professional COR to survey condition and determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

### 3.2 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
- B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by CO and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Forest Service and to authorities having jurisdiction.
  - 1. Provide at least 72 hours' notice to Government if shutdown of service is required during changeover.
- C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
  - 1. Forest Service will arrange to shut off private utilities when requested by Contractor.
  - 2. Arrange to shut off indicated utilities with utility companies, including either securing approval from the utility companies to do the work or arranging for the utility companies to do the work themselves. All work shall be in accordance with the utility companies' requirements.
  - 3. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
  - 4. Cut off pipe or conduit in existing feature to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

### 3.3 PREPARATION

- A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Government and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
  - 2. Erect temporary protection, such as walks, fences, barricades, signage, and flagmen, where required by authorities having jurisdiction.
  - 3. Protect existing site improvements, appurtenances, and landscaping to remain.
  - 4. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
- C. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
- D. Temporary Enclosures: Provide temporary enclosures for protection of existing construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
- E. Temporary Shoring: Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.

### 3.4 POLLUTION CONTROLS

- A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
  - 1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

### 3.5 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 4. Maintain adequate ventilation when using cutting torches.
  - 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 6. Dispose of demolished items and materials promptly.
  - 7. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
  
- B. Existing Facilities: Comply with Government's requirements for using and protecting existing facilities during selective demolition operations.
  
- C. Removed and Salvaged Items: Comply with the following:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to Forest Service.
  - 4. Transport items to Forest Service's storage area designated by COR.
  - 5. Protect items from damage during transport and storage.
  
- D. Removed and Reinstalled Items: Comply with the following:
  - 1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
  - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  - 3. Protect items from damage during transport and storage.
  - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
  
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by COR, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

- F. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- G. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

### 3.6 PATCHING AND REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
  - 1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.
- C. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

### 3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Government's property and legally dispose of them.
- D. Any pumps and/or valves removed by the Contractor are to be returned to the Government for salvage.

END OF SECTION 024119

## SECTION 033000 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Slabs-on-grade.
  - 2. Sidewalks.
  - 3. Footings.
  - 4. Foundation and retaining walls.
  - 5. Curb and curb and gutter.
  - 6. Thrust blocking for pressure pipe.
  - 7. Miscellaneous indicated Work.
- B. Related Sections include the following:
  - 1. Division 31 Section "Earthwork" for drainage fill under slabs-on-grade.

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Welding certificates.
- D. Qualification Data: For Installer and manufacturer.

- E. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - 1. Location of construction joints is subject to approval of the COR.
- G. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional COR detailing fabrication, assembly, and support of formwork.
  - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
- H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
  - 1. Aggregates.
- I. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Steel reinforcement and accessories.
  - 5. Waterstops.
  - 6. Curing compounds.
  - 7. Bonding agents.
  - 8. Repair materials.
- J. Field quality-control test and inspection reports.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
  2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specification for Structural Concrete."
  2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
  2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1 or better.
    - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    - c. Structural 1, B-B or better; mill oiled and edge sealed.
    - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
  3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
- 2.3 STEEL REINFORCEMENT
- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed bars, ASTM A 767/A 767M, Class I zinc coated after fabrication and bending.
- C. Plain-Steel Wire: ASTM A 82, galvanized.
- D. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from galvanized steel wire into flat sheets.
- 2.4 REINFORCEMENT ACCESSORIES
- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

- B. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
  - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
  - 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

## 2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type I. Supplement with the following:
    - a. Fly Ash: ASTM C 618, Class C.
    - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable.

## 2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
  1. Available Products:
    - a. Boral Material Technologies, Inc.; Boral BCN.
    - b. Euclid Chemical Company (The); Eucon CIA.
    - c. Grace Construction Products, W. R. Grace & Co.; DCI.
    - d. Master Builders, Inc.; Rheocrete CNI.
    - e. Sika Corporation; Sika CNI.
    - f. Or Approved Equal
  - D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
    1. Available Products:
      - a. Axim Concrete Technologies; Catexol 1000CI.
      - b. Boral Material Technologies, Inc.; Boral BCN2.
      - c. Cortec Corporation; MCI 2000.
      - d. Grace Construction Products, W. R. Grace & Co.; DCI-S.
      - e. Master Builders, Inc.; Rheocrete 222+.
      - f. Sika Corporation; FerroGard-901.
      - g. Or Approved Equal

## 2.7 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
  1. Available Manufacturers:
    - a. Greenstreak.
    - b. Progress Unlimited, Inc.
    - c. Williams Products, Inc.
    - d. Or Approved Equal
  2. Profile: Flat, dumbbell with center bulb.
  3. Dimensions: 4 inches by 3/16 inch thick; nontapered.
- B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Available Manufacturers:
  - a. Bometals, Inc.
  - b. Greenstreak.
  - c. Meadows, W. R., Inc.
  - d. Murphy, Paul Plastics Co.
  - e. Progress Unlimited, Inc.
  - f. Tamms Industries, Inc.
  - g. Vinylex Corp.
  - h. Or Approved Equal
2. Profile: Flat, dumbbell with center bulb.
3. Dimensions: 4 inches by 3/16 inch thick; nontapered.

## 2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  1. Available Products:
    - a. Axim Concrete Technologies; Cimfilm.
    - b. Burke by Edoco; BurkeFilm.
    - c. ChemMasters; Spray-Film.
    - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
    - e. Dayton Superior Corporation; Sure Film.
    - f. Euclid Chemical Company (The); Eucobar.
    - g. Kaufman Products, Inc.; Vapor Aid.
    - h. Lambert Corporation; Lambco Skin.
    - i. L&M Construction Chemicals, Inc.; E-Con.
    - j. MBT Protection and Repair, Div. of ChemRex; Confilm.
    - k. Meadows, W. R., Inc.; Sealtight Evapre.
    - l. Metalcrete Industries; Waterhold.
    - m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
    - n. Sika Corporation, Inc.; SikaFilm.
    - o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
    - p. Unitex; Pro-Film.
    - q. US Mix Products Company; US Spec Monofilm ER.
    - r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
    - s. Or Approved Equal
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Available Products:

- a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
- b. Burke by Edoco; Aqua Resin Cure.
- c. ChemMasters; Safe-Cure Clear.
- d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
- e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
- f. Euclid Chemical Company (The); Kurez DR VOX.
- g. Kaufman Products, Inc.; Thinfilm 420.
- h. Lambert Corporation; Aqua Kure-Clear.
- i. L&M Construction Chemicals, Inc.; L&M Cure R.
- j. Meadows, W. R., Inc.; 1100 Clear.
- k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
- l. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
- m. Tamms Industries, Inc.; Horncure WB 30.
- n. Unitex; Hydro Cure 309.
- o. US Mix Products Company; US Spec Maxcure Resin Clear.
- p. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
- q. Or Approved Equal

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating.

1. Available Products:

- a. Anti-Hydro International, Inc.; AH Clear Cure WB.
- b. Burke by Edoco; Spartan Cote WB II.
- c. ChemMasters; Safe-Cure & Seal 20.
- d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
- e. Dayton Superior Corporation; Safe Cure and Seal (J-18).
- f. Euclid Chemical Company (The); Aqua Cure VOX.
- g. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
- h. Lambert Corporation; Glazecote Sealer-20.
- i. L&M Construction Chemicals, Inc.; Dress & Seal WB.
- j. Meadows, W. R., Inc.; Vocomp-20.
- k. Metalcrete Industries; Metcure.
- l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.
- m. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
- n. Tamms Industries, Inc.; Clearseal WB 150.
- o. Unitex; Hydro Seal.
- p. US Mix Products Company; US Spec Hydrasheen 15 percent
- q. Vexcon Chemicals, Inc.; Starseal 309.
- r. Or Approved Equal

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating.

1. Available Products:

- a. Burke by Edoco; Spartan Cote WB II 20 Percent.
- b. ChemMasters; Safe-Cure Clear.
- c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
- d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
- e. Euclid Chemical Company (The); Diamond Clear VOX.
- f. Kaufman Products, Inc.; SureCure Emulsion.
- g. Lambert Corporation; Glazecote Sealer-20.
- h. L&M Construction Chemicals, Inc.; Dress & Seal WB.
- i. MBT Protection and Repair, Div. of ChemRex; MasterKure-N-Seal VOC.
- j. Meadows, W. R., Inc.; Vocomp-20.
- k. Metalcrete Industries; Metcure 0800.
- l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
- m. Sonneborn, Div. of ChemRex; Kure-N-Seal.
- n. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
- o. Tamms Industries, Inc.; Clearseal WB STD.
- p. Unitex; Hydro Seal 18.
- q. US Mix Products Company; US Spec Radiance UV-25
- r. Vexcon Chemicals, Inc.; Starseal 0800.
- s. Or Approved Equal

H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Available Products:

- a. Burke by Edoco; Cureseal 1315.
- b. ChemMasters; Spray-Cure & Seal Plus.
- c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315.
- d. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
- e. Euclid Chemical Company (The); Super Diamond Clear.
- f. Kaufman Products, Inc.; Sure Cure 25.
- g. Lambert Corporation; UV Super Seal.
- h. L&M Construction Chemicals, Inc.; Lumiseal Plus.
- i. Meadows, W. R., Inc.; CS-309/30.
- j. Metalcrete Industries; Seal N Kure 0.
- k. Sonneborn, Div. of ChemRex; Kure-N-Seal 5.
- l. Tamms Industries, Inc.; LusterSeal 300.
- m. Unitex; Solvent Seal 1315.
- n. US Mix Products Company; US Spec CS-25
- o. Vexcon Chemicals, Inc.; Certi-Vex AC 1315
- p. Or Approved Equal

I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Available Products:

- a. Burke by Edoco; Cureseal 1315 WB.
- b. ChemMasters; Polyseal WB.
- c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
- d. Euclid Chemical Company (The); Super Diamond Clear VOX.
- e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
- f. Lambert Corporation; UV Safe Seal.
- g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
- h. Meadows, W. R., Inc.; Vocomp-30.
- i. Metalcrete Industries; Metcure 30.
- j. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
- k. Tamms Industries, Inc.; LusterSeal WB 300.
- l. Unitex; Hydro Seal 25.
- m. US Mix Products Company; US Spec Radiance UV-25.
- n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.
- o. Or Approved Equal

## 2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Reglets: Fabricate reglets of not less than 0.0217-inch-thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- D. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than **0.0336 inch** thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

## 2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  1. Fly Ash: 25 percent.
  2. Combined Fly Ash and Pozzolan: 25 percent.
  3. Ground Granulated Blast-Furnace Slag: 50 percent.
  4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
  5. Silica Fume: 10 percent.

6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
  7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

## 2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
  2. Minimum Cementitious Materials Content: 470 lb/cu. yd.
  3. Slump Limit: 4 inches, plus or minus 1 inch.
  4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

## 2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

### PART 3 - EXECUTION

#### 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
  1. Class A, 1/8 inch for smooth-formed finished surfaces.
  2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  1. Install keyways, reglets, recesses, and the like, for easy removal.
  2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Chamfer exterior corners and edges of permanently exposed concrete.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  - 3. Install dovetail anchor slots in concrete structures as indicated.

### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
  - 1. Leave formwork for slabs and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved COR.

### 3.4 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
  - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

### 3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

### 3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by COR.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 3. Locate joints for slabs in the middle third of spans.
  - 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

- D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.7 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

### 3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by COR.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.
  3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  4. Slope surfaces uniformly to drains where required.
  5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.9 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view.
- B. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
  2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.10 FINISHING SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
  1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  1. Apply a trowel finish to surfaces exposed to view.
  2. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
  1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

### 3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

### 3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by COR. Remove and replace concrete that cannot be repaired and patched to COR's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by COR.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to COR's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to COR's approval.

### 3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Government will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
  2. Steel reinforcement welding.
  3. Verification of use of required design mixture.
  4. Concrete placement, including conveying and depositing.
  5. Curing procedures and maintenance of curing temperature.
  6. Verification of concrete strength before removal of shores and forms from slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
  2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  5. Compression Test Specimens: ASTM C 31/C 31M.
    - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
  6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
  7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
  9. Test results shall be reported in writing to COR, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
  10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by COR but will not be used as sole basis for approval or rejection of concrete.
  11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by COR. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by COR.
  12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION

## SECTION 034100 - PRECAST CONCRETE

### PART 1 -GENERAL

#### 1.1 DESCRIPTION

- A. Work Included: Furnish and install all precast concrete structures in accordance with the plans and as specified herein.
- B. Related Sections: Additional Sections of the Documents which are referenced in this Section include:
  - 1. Division 33 – Sanitary Sewerage
  - 2. Division 33 – Advantex Equipment

#### 1.2 REFERENCES

- A. General: The work shall comply with the most recent standards or tentative standards as published at the date of the contract and as listed in this specification using the abbreviation shown.
- B. American Society for Testing and Materials (ASTM):
  - 1. C 443- Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gasket
  - 2. C 478- Standard Specification for Precast Reinforced Concrete Manhole Sections
- C. American Association of State Highway and Transportation Officials Standards (AASHTO):
  - 1. M 198- Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

#### 1.3 SYSTEM DESCRIPTION

- A. General: The eccentric design manhole shall be used, except as shown on the plans.

### PART 2 -PRODUCTS

#### 2.1 MANHOLES

- A. Precast Concrete Manholes: shall meet the following requirements:
  - 1. Precast manhole shall conform to ASTM C 478.
  - 2. Minimum inside diameter shall be 48-inches unless noted on plans, with minimum of 5-inch thick walls. All manholes shall have monolithic bases except when a new manhole is installed on an existing line. See project details.
  - 3. Drop manholes shall be as shown in the project details.

- B. Joints: Joints shall be the O-ring joint conforming to ASTM C 443 or butyl rubber rope meeting AASHTO M 198, Type B.
- C. Steps: Manhole steps, according the project details, shall be provided in all manholes and shall be on 16-inch center maximum.
- D. Pipe Connections:
  - 1. Provision of the indicated pipe connections in manholes shall be made by means of an approved flexible, watertight gasket or boot.
  - 2. Pipe connections in wetwells, through pipe sleeves, shall be in accordance with Division 33 – Sewer Collection System.
  - 3. Existing lines shall be grouted into place.

## 2.2 SEPTIC TANK

- A. General: Tanks shall be constructed of precast concrete having a minimum compressive strength of 5,000 psi. Each tank shall contain two access hatches at least 24 inches square or diameter to be located above the inlet and outlet of each tank. All concrete shall be rodded or vibrated to minimize honeycombing or major surface blemishes. The interiors of all tanks shall receive a mastic or bituminous epoxy coating.

## 2.3 METER VAULTS

- A. General: Precast concrete meter vaults shall be in accordance with Division 33 – Water Distribution.
- B. Confined Access: Access to meter vaults shall be provided by one of the following methods:
  - a. Steps: When possible, manhole steps, according to the project details, shall be provided in all meter vaults and shall be on 16-inch center maximum.
  - b. Ladder: Where vault access opening is not flush with the vault wall, an access ladder must be installed. The ladder may be installed vertical or at an angle, but must be OSHA approved with 250 pound capacity. An extension bracket shall be installed at the top of the ladder to maintain a fixed distance from the interior vault wall to the hatch opening. Ladder shoes shall be installed on the bottom of the ladder. Both ends of the ladder shall be attached to the vault structure with masonry screws. Where longer ladders are cut to accommodate the height of the vault, care shall be taken to eliminate sharp edges being exposed.
- C. Meter Accessories: Provisions shall be made to accommodate the touch read pads to be installed in the top of the meter vault, either by coring the concrete or through another method approved by the COR.

## PART 3 -EXECUTION

### 3.1 INSTALLATION

- A. General: The subgrade and bedding for the precast structure shall be prepared similar to that for pipe. All structures shall be installed level. Shaped bottoms shall be formed with concrete as shown on the plans and shall be smooth conforming to the dimensions shown. Joints shall be sealed with a double ring of butyl rubber rope caulk to form a watertight seal. When leveling of

frames is required manhole frames shall be set level on a full bed of mortar to the proper grade prior to the application of the butyl caulk.

### 3.2 TESTS

- A. Leakage Testing: Testing shall be conducted for each precast structure or manhole in accordance with one of the following methods:
- B. Vacuum Testing: Unless otherwise approved by the Government, manholes shall be tested by the vacuum method. Vacuum testing shall be in accordance with Division 33 – Sewer Collection System.
- C. Exfiltration Testing: When permitted by the Government, an exfiltration test shall be conducted on each manhole. Testing shall be in accordance with Division 33 – Sewer Collection System.

END OF SECTION

## SECTION 260500 – BASIC ELECTRICAL MATERIALS & METHODS

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Structural Performance: Design, COR, fabricate, and install hangers and supports to withstand structural loads specified in "Project Conditions" Paragraph below.

### PART 2 - PRODUCTS

#### 2.1 RACEWAYS

- A. Raceways:
  - 1. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.
  - 2. FMC: Zinc-coated steel.
  - 3. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.
  - 4. LFMC: Zinc-coated, flexible steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
  - 5. RNC: NEMA TC 2, Type EPC-40-PVC, with NEMA TC3 fittings.
  - 6. Raceway Fittings: Specifically designed for raceway type used in Project.
- B. Wireways: Sheet metal sized and shaped, with hinged screw covers.
- C. Surface Raceways:
  - 1. Metal: Galvanized steel with snap on covers.

#### 2.2 CONDUCTORS AND CABLES

- A. Conductors:
  - 1. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
  - 2. Conductors, Larger Than No. 10 AWG: Stranded copper.
  - 3. Insulation: Thermoplastic, rated at 75 deg C minimum.
  - 4. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

#### 2.3 ELECTRICAL IDENTIFICATION MATERIALS

- A. Conductor Identification Materials: Color-Coding Conductor Tape: Self-adhesive vinyl tape 1 to 2 inches wide.
- B. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, polyethylene tape with continuous metallic strip or core.
- C. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with circuit identification legend machine printed by thermal transfer or equivalent process.

- D. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- E. Metal-Backed, Butyrate Warning Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
- F. Equipment Identification Labels: Engraved, laminated acrylic or melamine label; punched or drilled for screw mounting. White letters on a dark-gray background; red letters for emergency systems.
- G. Fasteners: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

#### 2.4 SUPPORT AND ANCHORAGE COMPONENTS

- A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.
- B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly, and provide finish suitable for the environment in which installed.
  - 1. Channel Dimensions: Selected for structural loading.
- C. Raceway and Cable Supports: As described in NECA 1.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and fittings.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded malleable-iron body and insulating wedging.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud.
  - 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened Portland cement concrete.
  - 3. Concrete Inserts: Steel or malleable-iron, slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
  - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  - 5. Through Bolts: Structural type, hex head, high strength; complying with ASTM A 325.
  - 6. Toggle Bolts: All-steel springhead type.
  - 7. Hanger Rods: Threaded steel.

2.5 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized-steel sheet.
- D. Sleeve Seals: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Carbon or Stainless steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 GENERAL ELECTRICAL EQUIPMENT INSTALLATION REQUIREMENTS

- A. Install electrical equipment to provide for ease of disconnecting the equipment with minimum interference to other installations.
- B. Install electrical equipment to allow right of way for piping and conduit installed at required slope.
- C. Install electrical equipment to ensure that connecting raceways, cables, and wireways are clear of obstructions and of the working and access space of other equipment.
- D. Install required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- E. Comply with NECA 1.

3.2 RACEWAY AND CABLE INSTALLATION

- A. Outdoor Raceways Applications:
  - 1. Exposed or Concealed: RSC or IMC.
  - 2. Underground, Single Run: RNC.
  - 3. Connection to Vibrating Equipment: LFMC.
  - 4. Boxes and Enclosures: Metallic, NEMA 250, Type 3R or Type 4.

- B. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch thick concrete cover.
  - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  - 2. Space raceways laterally to prevent voids in concrete.
  - 3. Install conduit larger than 1-inch trade size, parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
  - 4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above finished grade or pads.
- C. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
- D. Install pull wires in empty raceways.
- E. Connect motors and equipment subject to vibration, noise transmission, or movement with a 72-inch maximum length of flexible conduit.

### 3.3 WIRING METHODS

- A. Service Entrance: Provide per the construction drawings.
- B. Exposed Feeders, Branch Circuits, and Class 1 Control Circuits: Type THHN-THWN, single conductors in raceway.
- C. Feeders and Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and underground: Type XHHW, single conductors in raceway. Where any part of the circuit is underground the cable shall be type XHHW.

### 3.4 IDENTIFICATION

- A. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive color coding tape-in bands or snap-around, color-coding bands:
  - 1. Power-Circuit Conductor Identification: For No. 3 AWG conductors and larger, at each location where observable, identify phase using color-coding conductor tape.
- B. Locations of Underground Lines: Identify with metallic underground-line warning tape for power, lighting, communication, and control wiring.
- C. Warning Labels for Enclosures for Power and Lighting: Comply with 29 CFR 1910.145; identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

- D. Equipment Identification Labels:
  - 1. Labeling Instructions:
    - a. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.
  - 2. Equipment to Be Labeled:
    - a. Panelboards, electrical cabinets, and enclosures.
    - b. Disconnect switches.
    - c. Enclosed circuit breakers.
    - d. Motor starters.
    - e. Push-button stations.
    - f. Power transfer equipment.
    - g. Contactors.
    - h. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
- E. Verify identity of each item before installing identification products.
- F. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- G. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
  - 1. Colors for 120/208-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red
    - c. Phase C: Blue
  - 2. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points.
- H. Underground-Line Warning Tape: Continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade.

### 3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Fasten hangers and supports securely in place, with provisions for thermal and structural movement. Install with concealed fasteners unless otherwise indicated.
- B. Separate dissimilar metals and metal products from contact with wood or cementitious materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.
- C. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- D. Multiple Raceways or Cables: Install on trapeze-type supports fabricated with steel slotted channel.

- E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods, unless otherwise indicated or required by Code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  - 6. To Light Steel: Sheet metal screws.
  
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.6 SLEEVE AND SLEEVE SEALS INSTALLATION

- A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs.
- B. Extend sleeves installed in floors 2 inches above finished floor level.
- C. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

END OF SECTION 260500

## **SECTION 260502 – TESTING & PLACING IN SERVICE**

### **PART 1 – GENERAL**

- 1.1 Description: Provide all material, equipment, labor, and supervision to perform electrical tests in accordance with the requirements of this specification. Notify the Government at least 3 working days in advance of tests.
- 1.2 Quality assurance: Final acceptance will depend upon meeting requirements of specified tests.
  - 1.2.1 Perform all tests in accordance with manufacturer's recommendations. Should manufacturer's recommendations conflict with these specifications, contact the Government for instructions.
  - 1.2.2 Material or equipment failing tests shall be repaired or replaced at the Contractor's expense.
  - 1.2.3 Record all test results and incorporate into a legible report. Four bound copies of all test reports shall be delivered to the Government at the end of test period.

### **2 PART 2 - PRODUCTS**

- 2.1 The contractor shall employ appropriate testing devices and personnel trained in their use.

### **3 PART 3 - EXECUTION**

- 3.1 System Tests
  - 3.1.1 Perform equipment tests as required in equipment sections of this specification.
  - 3.1.2 Upon completion of equipment tests, function test each Division 26 electrical system specified to verify total system operation.
  - 3.1.3 Test all interlocks, safety devices, and fail safe functions in addition to design function.
- 3.2 Instruct Government personnel in proper operation and maintenance of equipment.

END OF SECTION 260502

## **SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.
  - 2. Foundation steel electrodes.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Burndy; Part of Hubbell Electrical Systems.
  - 2. Dossert; AFL Telecommunications LLC.
  - 3. ERICO International Corporation.
  - 4. Fushi Copperweld Inc.
  - 5. Galvan Industries, Inc.; Electrical Products Division, LLC.
  - 6. ILSCO.
  - 7. O-Z/Gedney; A Brand of the EGS Electrical Group.
  - 8. Siemens Power Transmission & Distribution, Inc.
  - 9. Or Approved Equal

#### **2.2 SYSTEM DESCRIPTION**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

#### **2.3 CONDUCTORS**

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

## 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

## 2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad 3/4 inch by 10 feet.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
1. Bury at least 24 inches below grade.
- C. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  2. Underground Connections: Welded connectors.
  3. Connections to Structural Steel: Welded connectors.

### 3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

### 3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

### 3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Water Heater and Heat-Tracing: Install a separate insulated equipment grounding conductor to electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- C. Metallic Fences: Comply with requirements of IEEE C2.
  - 1. Grounding Conductor: Bare copper, not less than No. 6 AWG.
  - 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
  - 3. Barbed Wire: Strands shall be bonded to the grounding conductor.

### 3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  - 2. For grounding electrode system, install at least three rods spaced at least two-rod lengths from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  3. Bond each aboveground portion of metallic piping system downstream from equipment shutoff valve.
- E. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
1. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
  2. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  3. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  4. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
- F. Grounding system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System: 20 ohms.
- I. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

## **SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

#### **1.3 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. IBC: International Building Code.
- C. IMC: Intermediate metal conduit.
- D. RMC: Rigid metal conduit.

#### **1.4 SUBMITTALS**

- A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support component used.
- B. Welding certificates.
- C. Field quality-control test reports.

#### **1.5 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.
- B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.
  - 1. Manufacturers:
    - a. Cooper B-Line; a division of Cooper Industries.
    - b. ERICO International Corporation.
    - c. Allied Support Systems; Power-Strut Unit.
    - d. GS Metals Corp.
    - e. Michigan Hanger Co., Inc.; O-Strut Div.
    - f. National Pipe Hanger Corp.
    - g. Thomas & Betts Corporation.
    - h. Unistrut; Tyco International, Ltd.
    - i. Wesanco, Inc.
    - j. Or Approved Equal.
  - 2. Finishes:
    - a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
    - b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-3.
    - c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-3.
  - 3. Channel Dimensions: Selected for structural loading.

- C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
1. Manufacturers:
    - a. Allied Support Systems; Aickinstrut Unit.
    - b. Cooper B-Line; a division of Cooper Industries.
    - c. Fabco Plastics Wholesale Limited.
    - d. Seasafe, Inc.
    - e. Or Approved Equal.
  2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
  3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
  4. Rated Strength: Selected to suit structural loading.
- D. Raceway and Cable Supports: As described in NECA 1.
- E. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- F. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- G. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- H. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers:
      - 1) Hilti, Inc.
      - 2) ITW Construction Products.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co. Inc.
      - 5) Or Approved Equal.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Manufacturers:

- 1) Cooper B-Line; a division of Cooper Industries.
  - 2) Empire Tool and Manufacturing Co., Inc
  - 3) Hilti, Inc.
  - 4) ITW Construction Products.
  - 5) MKT Fastening, LLC.
  - 6) Powers Fasteners.
  - 7) Or Approved Equal.
- 
3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
  6. Toggle Bolts: All-steel springhead type.
  7. Hanger Rods: Threaded steel.

### 2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where Table 1 lists maximum spacing less than stated in NFPA 70-2002. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 for installation requirements, except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70-2002.

- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000.
- C. Anchor equipment to concrete base.
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

## **SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

##### **A. Section Includes:**

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes/Pullboxes and boxes for exterior underground cabling.

#### **1.3 DEFINITIONS**

- A. GRC: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.

### **PART 2 - PRODUCTS**

#### **2.1 METAL CONDUITS, TUBING, AND FITTINGS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company; a division of John Maneely Company.
13. Or approved equal.

- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch, minimum.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
  - 2. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: compression.
  - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
  - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Anamet Electrical, Inc.
  - 3. Arnco Corporation.
  - 4. CANTEX Inc.
  - 5. CertainTeed Corp.
  - 6. Condux International, Inc.
  - 7. Electri-Flex Company.
  - 8. Kraloy.
  - 9. Lamson & Sessions; Carlon Electrical Products.
  - 10. Niedax-Kleinhuis USA, Inc.
  - 11. RACO; a Hubbell company.
  - 12. Thomas & Betts Corporation.

- 13. Or approved equal.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.
- E. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- F. Fittings for LFNC: Comply with UL 514B.
- G. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- H. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper B-Line, Inc.
  - 2. Hoffman; a Pentair company.
  - 3. Mono-Systems, Inc.
  - 4. Square D; a brand of Schneider Electric.
  - 5. Or approved equal.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 4 unless otherwise indicated, and sized according to NFPA 70.
  - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

## 2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Allied Moulded Products, Inc.
  - 2. Hoffman; a Pentair company.
  - 3. Lamson & Sessions; Carlon Electrical Products.
  - 4. Niedax-Kleinhuis USA, Inc.
  - 5. Or approved equal.
- B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Adalet.
  - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
  - 3. EGS/Appleton Electric.
  - 4. Erickson Electrical Equipment Company.
  - 5. FSR Inc.
  - 6. Hoffman; a Pentair company.
  - 7. Hubbell Incorporated; Killark Division.
  - 8. Kraloy.
  - 9. Milbank Manufacturing Co.
  - 10. Mono-Systems, Inc.
  - 11. O-Z/Gedney; a brand of EGS Electrical Group.

12. RACO; a Hubbell Company.
  13. Robroy Industries.
  14. Spring City Electrical Manufacturing Company.
  15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
  16. Thomas & Betts Corporation.
  17. Wiremold / Legrand.
  18. Or approved equal.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 pounds shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.
- I. Device Box Dimensions: Minimum 4 inches square by 2-1/8 inches deep.
- J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  2. Nonmetallic Enclosures: Plastic or Fiberglass.
- K. Cabinets:
1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  2. Hinged door in front cover with flush latch and concealed hinge.
  3. Key latch to match panelboards.
  4. Metal barriers to separate wiring of different systems and voltage.
  5. Accessory feet where required for freestanding equipment.
  6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC
  2. Underground Conduit: RNC, Type EPC-80-PVC.
  3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC
  4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
- D. Install nonferrous conduit or tubing for circuits operating above 60 Hz.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Complete raceway installation before starting conductor installation.
- C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- F. Support conduit within 12 inches of enclosures to which attached.
- G. Raceways Embedded in Slabs:
1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
  2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
  4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

5. Change from ENT to GRC or IMC before rising above floor.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- I. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- L. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- N. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- P. Surface Raceways:
  1. Install surface raceway with a minimum 2-inch radius control at bend points.
  2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- Q. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- R. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- S. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

#### A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
  - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

### 3.4 PROTECTION

#### A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

## **SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Identification for conductors and communication and control cable.
  - 2. Equipment identification labels.
  - 3. Miscellaneous identification products.

#### **1.3 SUBMITTALS**

- A. Product Data: For each electrical identification product indicated.

#### **1.4 QUALITY ASSURANCE**

- A. Comply with NFPA 70-2002.
- B. Comply with 29 CFR 1910.145.

#### **1.5 COORDINATION**

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

## PART 2 - PRODUCTS

### 2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

### 2.2 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
- B. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal conductors.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.

- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  - 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

END OF SECTION 260553

## SECTION 262416 - PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

#### 1.2 SUMMARY

##### A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.

#### 1.3 SUBMITTALS

A. **Product Data:** For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. **Shop Drawings:** For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.

C. **Field Quality-Control Reports:**

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. **Panelboard Schedules:** For installation in panelboards. Submit final versions after load balancing.

E. **Operation and Maintenance Data:** For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2002, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70-2002.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

#### 1.6 PROJECT CONDITIONS

- A. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by the Government or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Government no fewer than two days in advance of proposed interruption of electric service.
  - 2. Do not proceed with interruption of electric service without Forest Service's written permission.
  - 3. Comply with NFPA 70-2002.

#### 1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Keys: Two spares for each type of panelboard cabinet lock.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and surface-mounted cabinets.
  - 1. Rated for environmental conditions at installed location.

- a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Finishes:
  - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
  - b. Back Boxes: Galvanized steel.
4. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses:
  1. Material: Hard-drawn copper, 98 percent conductivity.
  2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
  1. Main and Neutral Lugs: Mechanical type.
  2. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

## 2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
  5. Or Approved Equal.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: As indicate.

- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports."
- C. Mount top of trim 74 inches above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Install overcurrent protective devices and controllers not already factory installed.
- F. Install filler plates in unused spaces.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- H. Comply with NECA 1.

#### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 16 Section "Electrical Identification."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Government's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 16 Section "Electrical Identification."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 16 Section "Electrical Identification."

### **3.4 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### **3.5 ADJUSTING**

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as indicated

END OF SECTION 262416

## **SECTION 262713 - ELECTRIC SERVICE AND METERING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes equipment for electricity metering by utility company.

#### **1.3 DEFINITIONS**

- A. KY Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay opening and closing in response to the rotation of the disk in the meter.

#### **1.4 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, store, and handle modular meter center according to NECA 400.

#### **1.6 COORDINATION**

- A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:
  1. Comply with requirements of utilities providing electrical power services.
  2. Relocation of underground and overhead existing electrical services.
  3. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Meters will be furnished by utility company.
- B. Meter Sockets: Comply with requirements of electrical-power utility company.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Provide Current Transformer compartment where required by utility company.
- C. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Measure no-load and full load current and voltage per phase.
  - 2. Submit test report as part of prefinal punch list.

END OF SECTION 262713

## **SECTION 262726 – WIRING DEVICES**

### **PART 1 - GENERAL**

#### **1.1 SECTION REQUIREMENTS**

- A. Submittals: Product Data.
- B. Quality Assurance: Wiring devices shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

### **PART 2 - PRODUCTS**

#### **2.1 DEVICES**

- A. Convenience Receptacles: NEMA WD 1, NEMA WD 6, Configuration 5-20R, and UL 498.
- B. Duplex GFCI Convenience Receptacles: 125 V, 20 A, straight blade, non-feed through type. NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- C. Snap Switches: NEMA WD 1 and UL 20. Single-pole, double-throw, momentary contact, center-off switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
- D. Wall Plates, Unfinished Areas: Galvanized steel with metal screws.
- E. Wall Plates, Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet locations.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Install devices and assemblies plumb, level, and square with building lines.
- C. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- D. Install unshared neutral conductors on line and load side of dimmers.

END OF SECTION 262726

## **SECTION 262820 - SWITCHES AND BREAKERS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Nonusible switches.
  - 2. Molded-case circuit breakers (MCCBs).
  - 3. Enclosures.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Field quality-control reports.
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2002, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70-2002.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  2. Altitude: Not exceeding 6600 feet.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  1. Notify Government no fewer than seven days in advance of proposed interruption of electric service.
  2. Indicate method of providing temporary electric service.
  3. Do not proceed with interruption of electric service without Government's written permission.
  4. Comply with NFPA 70-2002.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

### PART 2 - PRODUCTS

#### 2.1 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Fusible Switch,: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses and lockable handle; interlocked with cover in closed position.

- B. Nonfusible Switch, NEMA KS 1, Type HD, lockable handle, interlocked with cover in closed position.

## 2.2 MOLDED-CASE CIRCUIT BREAKERS

- A. Description: NEMA AB 1, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
- B. Features and Accessories:
  - 1. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
  - 2. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

## 2.3 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  - 1. Outdoor Locations: NEMA 250, Type 4X.
  - 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Electrical Supports."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Electrical Identification."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
- C. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- D. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262820

## **SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

#### **DEFINITIONS**

- B. Nominal: Nominal discharge current.
- C. MCOV: Maximum continuous operating voltage.
- D. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
- E. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
- F. OCPD: Overcurrent protective device.
- G. SCCR: Short-circuit current rating.
- H. SPD: Surge protective device.
- I. VPR: Voltage protection rating.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Nominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For SPDs to include in maintenance manuals.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

- A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Comply with UL 1449.
- D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE SUPPRESSOR

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. ABB France.
  - 2. Advanced Protection Technologies Inc. (APT).
  - 3. Eaton Corporation.
  - 4. Emerson Electric Co.
  - 5. GE Zenith Controls.
  - 6. LEA International; Protection Technology Group.
  - 7. Leviton Manufacturing Co., Inc.
  - 8. PowerLogics, Inc.
  - 9. Schneider Electric Industries SAS.
  - 10. Siemens Industry, Inc
  - 11. Or approved equal.

- B. SPDs: Comply with UL 1449.
- C. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449.
  - 1. SPDs with the following features and accessories:
    - a. Integral disconnect switch.
    - b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
    - c. Indicator light display for protection status.
    - d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.[ Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
    - e. Surge counter.
- D. Comply with UL 1283.
- E. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- F. Protection modes and UL 1449 VPR for each pump station service voltage.
- G. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 700 V.
  - 2. Line to Ground: 700 V
  - 3. Line to Line: 1000 V.
- H. SCCR: Equal or exceed 200 kA.
- I. Nominal Rating: 20 kA.

## 2.3 ENCLOSURES

- A. Outdoor Enclosures: NEMA 250, Type 4X.

## 2.4 CONDUCTORS AND CABLES

- A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
- C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- D. Use crimped connectors and splices only. Wire nuts are unacceptable.
- E. Wiring:
  - 1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
  - 2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

#### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
  - 1. Compare equipment nameplate data for compliance with Drawings and Specifications.
  - 2. Inspect anchorage, alignment, grounding, and clearances.
  - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. An SPD will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

#### 3.3 STARTUP SERVICE

- A. Complete startup checks according to manufacturer's written instructions.
- B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

- C. Energize SPDs after power system has been energized, stabilized, and tested.

#### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Forest Service's maintenance personnel to operate and maintain SPDs.

END OF SECTION 264313

## **SECTION 265000 - LIGHTING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Solid state luminaires that use LED technology.
  - 2. Light fixture supports.

#### **1.2 SECTION REQUIREMENTS**

- A. Submittals: Product Data for each luminaire, including lamps.

#### **1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### **1.4 WARRANTY**

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Fixtures, Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### **2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS**

- A. Exterior Luminaires: Comply with UL 1598, and listed and labeled for installation in wet locations by a Nationally Recognized Testing Laboratory acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

#### **2.3 LAMPS**

- A. With characteristics as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square.
- C. Install lamps in each luminaire.
- D. Luminaire Support:
  - 1. Attached to structural members.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

END OF SECTION 265000

## SECTION 311000 - SITE CLEARING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Protecting existing vegetation to remain.
- 2. Removing existing vegetation.
- 3. Clearing and grubbing.
- 4. Stripping and stockpiling topsoil.
- 5. Removing above- and below-grade site improvements.
- 6. Disconnecting, capping or sealing, and abandoning site utilities in place.
- 7. Temporary erosion- and sedimentation-control measures.

- B. Related Sections:

- 1. Section 015000 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities, and temporary erosion- and sedimentation-control measures.
- 2. Section 024119 "Selective Demolition" for partial demolition of buildings or structures.

#### 1.3 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

- E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
- G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

#### 1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Government's property, cleared materials shall become Contractor's property and shall be removed from Project site.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
  - 1. Use sufficiently detailed photographs or videotape.
  - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

#### 1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Forest Service and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Forest Service or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Government's property will be obtained by Forest Service before award of Contract.
  - 1. Do not proceed with work on adjoining property until directed by COR.

- C. **Salvable Improvements:** Carefully remove items indicated to be salvaged and store on Government premises where indicated.
- D. **Utility Locator Service:** Notify Miss Utility for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree-protection measures are in place.
- F. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
- I. **Soil Stripping, Handling, and Stockpiling:** Perform only when the topsoil is dry or slightly moist.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. **Satisfactory Soil Material:** Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
  - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
- B. **Antirust Coating:** Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer.
  - 1. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Forest Service.

### 3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### 3.3 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by COR.

### 3.4 EXISTING UTILITIES

- A. Government will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
  - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
  - 1. Arrange with utility companies to shut off indicated utilities.
  - 2. Government will arrange to shut off indicated utilities when requested by Contractor.
- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. The Contractor shall be responsible for proper drainage of the site(s) during construction of the project. Water shall not be allowed to accumulate in any of the excavated areas. Storm or ground water collecting on the site during construction shall be removed by pumping, ditching, or other suitable means.
- E. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Engineer not less than two (2) days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Engineer's written permission.
- F. Excavate for and remove underground utilities indicated to be removed.
- G. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 024119 "Selective Demolition."

### 3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
  - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  - 2. Trunks to be decked and placed at location to be approved by the Forest Service.
  - 3. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
  - 4. Use only hand methods for grubbing within protection zones.
  - 5. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

### 3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches (150 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
  2. Do not stockpile topsoil within protection zones.
  3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
  4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

### 3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
  2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

### 3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Government's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

## SECTION 312000 - EARTH MOVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
8. Excavating well hole to accommodate elevator-cylinder assembly.

- B. Related Sections:

1. Section 013200 "Construction Progress Documentation" for recording preexcavation and earth moving progress.
2. Section 015000 "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
3. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
4. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
5. Section 312319 "Dewatering" for lowering and disposing of ground water during construction.
6. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
7. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

#### 1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
  1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  2. Final Backfill: Backfill placed over initial backfill to fill a trench.

- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by COR. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
  - 2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
  - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by COR. Unauthorized excavation, as well as remedial work directed by COR, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
  - 1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom; measured according to SAE J-1179.
  - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D 1586.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
  - 1. Geotextiles.
  - 2. Controlled low-strength material, including design mixture.
  - 3. Geofilm.
  - 4. Warning tapes.
- B. Samples for Verification: For the following products, in sizes indicated below:
  - 1. Geotextile: 12 by 12 inches (300 by 300 mm).
  - 2. Warning Tape: 12 inches (300 mm) long; of each color.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
  - 1. Classification according to ASTM D 2487.
  - 2. Laboratory compaction curve according to ASTM D 698.
- C. Blasting plan approved by authorities having jurisdiction.
- D. Seismic survey report from seismic survey agency.
- E. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

#### 1.6 QUALITY ASSURANCE

- A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," Section 312318 – Blasting, and prepare a blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
  2. Seismographic monitoring during blasting operations.
- B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
  2. Seismographic monitoring during blasting operations.
- C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- D. Preexcavation Conference: Conduct conference at Project site.

#### 1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Government and authorities having jurisdiction.
  2. Provide alternate routes around closed or obstructed traffic ways if required by Government or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Government's property will be obtained by Government before award of Contract.
1. Do not proceed with work on adjoining property until directed by COR.
- C. Utility Locator Service: Notify "Miss Utility" for area where Project is located before beginning earth moving operations.
- D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 015000 "Temporary Facilities and Controls," Section 311000 "Site Clearing," are in place.
- E. Do not commence earth moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.
- F. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
  2. Parking vehicles or equipment.
  3. Foot traffic.

4. Erection of sheds or structures.
  5. Impoundment of water.
  6. Excavation or other digging unless otherwise indicated.
  7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- F. COred Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

- J. Sand: ASTM C 33; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
  - 1. Survivability: Class 2; AASHTO M 288.
  - 2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
  - 3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
  - 4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
  - 5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
  - 6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
  - 7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
  - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
  - 1. Survivability: Class 2; AASHTO M 288.
  - 2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
  - 3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
  - 4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
  - 5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
  - 6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
  - 7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
  - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

## 2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting flowable concrete material produced from the following:
  - 1. Portland Cement: ASTM C 150, Type I.
  - 2. Fly Ash: ASTM C 618, Class C or F.
  - 3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch (19-mm) nominal maximum aggregate size.
  - 4. Foaming Agent: ASTM C 869.
  - 5. Water: ASTM C 94/C 94M.
  - 6. Air-Entraining Admixture: ASTM C 260.
- B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. (480 to 576 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.
  2. Compressive Strength: 80 psi (550 kPa), when tested according to ASTM C 495.
- C. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) compressive strength when tested according to ASTM C 495.

## 2.4 GEOFOAM

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.55-lb/cu. ft. (25-kg/cu. m) density, 25-psi (173-kPa) compressive strength.
- B. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) density, 10-psi (69-kPa) compressive strength.
1. Manufacture molded polystyrene with an inorganic mineral registered with the EPA and suitable for application as a termite deterrent.
- C. Rigid Cellular Polystyrene Geofoam: ASTM D 6817, Type EPS 19, 1.15-lb/cu. ft. (18.4-kg/cu. m) density, 5.8-psi (40-kPa) compressive strength at 1 percent deformation; 16-psi (110-kPa) compressive strength at 10 percent deformation.
- D. Connectors: Geofoam manufacturer's multibarbed, galvanized-steel sheet connectors.

## 2.5 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
1. Red: Electric.
  2. Yellow: Gas, oil, steam, and dangerous materials.
  3. Orange: Telephone and other communications.
  4. Blue: Water systems.
  5. Green: Sewer systems.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
1. Red: Electric.
  2. Yellow: Gas, oil, steam, and dangerous materials.
  3. Orange: Telephone and other communications.
  4. Blue: Water systems.
  5. Green: Sewer systems.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### 3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

### 3.3 EXPLOSIVES

- A. Explosives: Refer to Section 312318 – Blasting.
- B. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
  - 1. Perform blasting without damaging adjacent structures, property, or site improvements.
  - 2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

### 3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
  - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. 24 inches (600 mm) outside of concrete forms other than at footings.

- b. 12 inches (300 mm) outside of concrete forms at footings.
  - c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
  - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
  - e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
  - f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.
- B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by COR. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.
- 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
    - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
  - 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. 24 inches (600 mm) outside of concrete forms other than at footings.
    - b. 12 inches (300 mm) outside of concrete forms at footings.
    - c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
    - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    - e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
    - f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

### 3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
  - 2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
  - 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or

minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

- D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

- A. Notify COR when excavations have reached required subgrade.
- B. If COR determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
  2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by COR, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by COR, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by COR.
  1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by COR.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring and bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete".
- D. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete".
- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
  - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.
- H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

- J. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

### 3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use COREd fill.
  - 4. Under building slabs, use COREd fill.
  - 5. Under footings and foundations, use COREd fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

### 3.14 GEOFOAM FILL

- A. Place a leveling course of sand, 2 inches (50 mm) thick, over subgrade. Finish leveling course to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.
  - 1. Place leveling course on subgrades free of mud, frost, snow, or ice.
- B. Install geofoam blocks in layers with abutting edges and ends and with the long dimension of each block at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers.
- C. Install geofoam connectors at each layer of geofoam to resist horizontal displacement according to geofoam manufacturer's written instructions.
- D. Cover geofoam with subdrainage geotextile before placing overlying soil materials.

### 3.15 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

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### 3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
  - 3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
  - 4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

### 3.17 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
  - 2. Walks: Plus or minus 1 inch (25 mm).
  - 3. Pavements: Plus or minus 1/2 inch (13 mm).
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

### 3.18 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Section 334600 "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter

material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
  2. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.

### 3.19 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
  1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
  2. Place base course material over subbase course under hot-mix asphalt pavement.
  3. Shape subbase course and base course to required crown elevations and cross-slope grades.
  4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
  5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
  6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

### 3.20 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

### 3.21 FIELD QUALITY CONTROL

- A. Special Inspections: Contractor will engage a qualified special inspector to perform the following special inspections:
  1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
  2. Determine that fill material and maximum lift thickness comply with requirements.
  3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Contractor will engage a qualified geotechnical CORing testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by COR.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
  2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.
  3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 1000 feet (305 m) or less of trench length, but no fewer than two tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.22 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by COR; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Government's property.
- B. Transport surplus satisfactory soil to designated storage areas on Government's property. Stockpile or spread soil as directed by COR.
  - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Government's property.

END OF SECTION 312000

## SECTION 312319 - DEWATERING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes construction dewatering.
- B. Related Requirements:
  - 1. Section 312000 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

#### 1.3 ALLOWANCES

- A. Dewatering observation wells are part of dewatering allowance.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.
  - 3. Review geotechnical report.
  - 4. Review proposed site clearing and excavations.
  - 5. Review existing utilities and subsurface conditions.
  - 6. Review observation and monitoring of dewatering system.

#### 1.5 ACTION SUBMITTALS

- A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.
  - 1. Include plans, elevations, sections, and details.
  - 2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
  - 3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.

4. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.
- D. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

#### 1.8 FIELD CONDITIONS

- A. Project-Site Information: A geotechnical report has not been completed..
  1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
- B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
  1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
  2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.

3. Prevent surface water from entering excavations by grading, dikes, or other means.
  4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
  5. Remove dewatering system when no longer required for construction.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
  2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Government and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 015000 "Temporary Facilities and Controls," during dewatering operations.

### 3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
1. Space well points or wells at intervals required to provide sufficient dewatering.
  2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.
- C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

- D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

### 3.3 OPERATION

- A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
  - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
  - 2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
  - 3. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.
- C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.
- D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

### 3.4 FIELD QUALITY CONTROL

- A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.
  - 1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
  - 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
  - 3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Survey-Work Benchmarks: Resurvey benchmarks monthly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.
- C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.
- D. Prepare reports of observations.

3.5 PROTECTION

- A. Protect and maintain dewatering system during dewatering operations.
- B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 312319

## SECTION 312513 - EROSION CONTROLS

### PART 1 – GENERAL

#### 1.1 DESCRIPTION

1. Work Included: Furnish all labor, materials, supplies, equipment, and appurtenances necessary for the complete and satisfactory construction and maintenance of the erosion control measures shown on the plans. Properties and natural waterways adjacent to the site of land disturbance shall be protected from sedimentation by the use of the erosion control and storm water drainage measures shown on the plans and as may be deemed necessary by the Government during construction.
2. Related Sections: Additional Sections of the Documents which are referenced in this Section include:
  - 1) Section 013300 – Submittal Procedures
  - 2) Section 016100 – Delivery, Storage, and Handling
  - 3) Section 329200 – Lawns and Grasses
3. Temporary Measures: Temporary erosion and sediment control shall be achieved by using the stated measures where indicated on the plans or as required for erosion control. Said measures shall be constructed and made workable prior to beginning site excavation and grading work. Refer to the VESCH for descriptions of additional measures.
4. Permanent Measures: Permanent erosion and sediment control shall be achieved by seeding and landscaping as detailed in Section 329200 – Lawns and Grasses. The Contractor shall schedule excavation, fill, finish grading, and seeding work in such a manner as to minimize exposure to erosive forces. Seeding of exposed areas shall commence as soon as possible after excavating, backfilling, grading, or other operations have been completed and shall be maintained until an acceptable stand of turf has been developed. Slope protection along indicated areas shall be installed as soon as the grading is complete.

#### 1.2 REFERENCES

1. General: The work shall comply with the most recent standards or tentative standards as published at the date of the contract and as listed in this specification using the abbreviation shown.
2. American Society for Testing and Materials (ASTM):
  - 1) D 448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction
3. Virginia Department of Conservation and Recreation Virginia Erosion and Sediment Control Handbook (VESCH):
  - 1) 3.02 Construction Entrance
  - 2) 3.03 Construction Road Stabilization

- 3) 3.09 Temporary Diversion Dike
  - 5) 3.17 Storm Water Conveyance Channel
  - 6) 3.19 Riprap
  - 7) 3.29 Surface Roughening
  - 8) 3.31 Temporary Seeding
  - 9) 3.32 Permanent Seeding
4. Virginia Department of Transportation - Road and Bridge Specifications (VDOT):
- 1) 414 Riprap

### 1.3 QUALITY ASSURANCE

- 1. General: All erosion control measures shall be in accordance with the Virginia Erosion and Sediment Control Handbook (VESCH), and all revisions and addenda. Methods used on site shall include, but shall not be limited to VESCH Standard and Specifications, Chapter 3.
- 2. Performance Requirements: The erosion control measures shall be installed such that the erosion of disturbed ground and the siltation of storm drain pipes and inlets will be prevented.
- 3. Regulatory Requirements: All phases of the construction work shall comply with or exceed the minimum state requirements for controlling erosion and sedimentation from "land disturbing activities" as outlined in the "Virginia Erosion and Sediment Control Handbook" (VESCH), and all revisions and addenda thereto.

### 1.4 MAINTENANCE

- 1. Maintenance Service: The erosion control measures shall be maintained by the Contractor until a vegetative groundcover is achieved, which in the opinion of the Government, is mature enough to control soil erosion and to survive severe weather conditions.

### 1.5 SUBMITTALS

- 1. General: Shall be in accordance with Section 01330 – Submittal Procedures.
- 2. Materials: The Contractor shall submit to the COR shop plans or catalog cuts for:
  - 1) Materials list of items proposed to be provided under this Section.
  - 2) Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

### 1.6 PRODUCT HANDLING

- 1. General: Shall be in accordance with Section 016100 - Delivery, Storage, and Handling.

### 1.7 SITE CONDITIONS

1. Environmental Requirements: Properties and natural waterways adjacent to the site of land disturbance shall be protected from sedimentation by the use of the erosion control measures shown on the plans and in compliance with pertinent erosion and sediment control practices.
2. Vegetation: When conditions detrimental to plant growth are encountered such as rubble fill, adverse drainage conditions or obstructions, the Contractor shall notify the Forest Service before planting.
3. Planting Time: See VESCH 3.32 and Section 329200 – Lawns and Grasses.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

1. Silt Fence: The silt fence used as a sediment barrier shall utilize extra strength synthetic filter fabrics.
2. Stone: Stone used to construct the temporary construction entrance shall be ASTM D 448 #1 or #2 stone as shown on the plans.
3. Soil Stabilization Mat: Mat shall be a degradable multi-layered soil stabilization blanket consisting of a netting of polyethylene, nylon, vinyl, or other material intertwined with a natural organic or manmade mulch, a jute mesh or excelsior mat specifically manufactured for maintaining soil slopes until vegetation becomes established. Soil stabilization mat shall be provided by a manufacturer from VDOT's "Approved Products List" as described in VESCH 3.36.
4. Riprap: Riprap shall be a rubble stone riprap, 50 to 150 pounds each, similar to VDOT 414 Class I (50 to 150 pounds) unless otherwise noted on the plans. Stone shall be placed to the depth indicated in accordance with VDOT 414
5. Gravel Outlet Structures: Gravel outlet structures shall be constructed of ASTM D 448 #2 stone or its equivalent.
6. Permanent Seeding: Seeding shall be in accordance with Section 02920 – Lawns and Grasses.

## PART 3 - EXECUTION

### 3.1 PREPARATION

1. General: See Virginia Erosion and Sediment Control Handbook for appropriate installation procedures.
2. Surface Preparation for Stabilization Mat: Any storm drainage channel in which soil stabilization mat is to be installed shall be prepared for installation of the mat according to the mat manufacturer's recommendations.

Any areas which are to be covered with a soil stabilization mat shall be protected from erosion prior to the installation of the mat. The protection shall include, but not be limited to, the installation and maintenance of silt fences, straw bale barriers, and temporary diversion dikes.

3. Rip Rap: Excavation of slopes, ditches, or roadways where riprap is to be placed shall be of sufficient depth to achieve finished grades shown on the plans or details. Rip Rap shall be installed in accordance with VESCH 3.19.

4. Cut and Fill Slope Preparation: Cut and fill slopes shall be constructed in a manner which will minimize erosion, in accordance with the following:
  - 1) All slopes steeper than 3:1 shall require surface roughening, either stair-step grading, grooving, furrowing, or tracking, if stabilized with vegetation, in accordance with VESCH 3.29.
  - 2) Areas with grades less than 3:1 shall have the soil surface lightly roughened and loosened to a depth of 4 inches prior to seeding.
  - 3) Areas which have been graded and will not be stabilized immediately shall be roughened to reduce runoff velocity until seeding takes place.
  - 4) Slopes with a stable rock face do not require roughening or stabilization.

### 3.2 INSTALLATION AND APPLICATION

1. Silt Fence: Silt fences shall be installed in accordance with the following:
  - 1) Installed height of silt fence shall not exceed 36 inches.
  - 2) Filter fabric splice joints shall occur only at a support post, minimum 6 inch overlap, and securely sealed.
  - 3) Posts shall be spaced a maximum of 10 feet on centers at the barrier location and driven securely into the ground (minimum of 12 inches). When extra strength fabric is used without wire support fence, post spacing shall not exceed 6 feet on centers.
  - 4) A trench shall be excavated approximately 4 inches wide and 4 inches deep along the line of posts and upslope from the barrier. Eight inches of fabric shall be extended into the trench. The trench shall be backfilled and the soil compacted over the filter fabric.
  - 5) For extra strength filter fabric installation utilizing closer post spacing, the wire mesh support fence may be eliminated. In such case, the fabric is attached to the upslope side of the posts using heavy-duty wire staples, minimum 1 inch long, or tie wires.
  - 6) Filter fabric shall not be stapled to existing trees.
  - 7) Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.
2. Stone and Riprap:
  - 1) Stone on the temporary construction entrance shall be installed to a minimum depth of 1 foot.
  - 2) Riprap shall be installed to the depth of 18 inches or as indicated on the plans, in accordance with VDOT 414. Stone shall be placed such that top of stone be within +/-2 inches of the finished grades shown on the plans or details.
3. Temporary Diversion Dike:
  - 1) A temporary diversion ridge of compacted soil shall be located at the top and/or base of sloping disturbed areas in accordance with VESCH 3.09. Dike shall divert storm runoff

from higher drainage areas away from unprotected slopes to a sediment trapping facility or to a stabilized outlet.

- 2) The minimum allowable height measured from the upslope side of the dike shall be 18 inches (except where dike is part of the proposed silt trap).
  - 3) Sideslopes shall be 1.5:1 or flatter. Minimum base width is 4.5 feet.
  - 4) The channel behind the dike shall have positive grade to a stabilized outlet. Channel slope less than or equal to 2 percent shall require no stabilized outlet. Slope greater than 2 percent shall be stabilized in accordance with VESCH 3.17.
4. Construction Access Routes: Wherever construction vehicle access routes intersect paved public roads, provisions must be made to minimize the transport of sediment (mud) by runoff or vehicle tracking onto the paved surface (VESCH 3.02 and 3.03). Where sediment is transported onto a public road surface, the roads shall be cleaned thoroughly at the end of each day. Sediment shall be removed from roads by shoveling or sweeping and be transported to a sediment controlled disposal area. Street washing shall be allowed only after sediment is removed in this manner.
  5. Temporary Seeding; Provide temporary seeding in accordance with Section 02920 – Seeding.
    - 1) Provide temporary seeding of any areas when planting time does not permit permanent seeding within 30 days after completion of subgrades and on soil stockpiles.
  6. Straw Bale Barriers: Straw bale barriers shall be placed in a single row, lengthwise, along the contour and embedded in the soil to a depth of three inches. Bales must be securely anchored in place by stakes or steel reinforcing-bars to prevent displacement. Barriers shall be inspected frequently and repair or replacement must be made promptly if needed.
  7. Silt Fence: Burlap or geotechnical fabric filter barriers shall be constructed by setting 1 inch x 2 inches x 3 feet stakes and excavating a 4 inches x 4 inches trench along the line of stakes. Staple fabric to stakes and extend into trench. Backfill and compact excavated soil, anchoring fabric.
  8. Gravel Outlet Structures: The bases and side slopes of the gravel shall be placed so as to conform to the dike configuration. The invert of the outlet shall be not less than six inches lower than the top of the adjoining earth dike, and the gravel shall extend to the top of the dike. Discharge from the outlet structure shall be onto an already stabilized area or watercourse. The gravel outlet structure shall be inspected for silt accumulation after each runoff-producing rain. If structure ceases to function properly due to silt accumulation, the silt shall be removed and gravel shall be replaced.

### 3.3 MAINTENANCE

1. Maintenance Service: The erosion control measures shall be maintained by the Contractor until all work covered by this contract is completed and permanent stabilization of disturbed areas has been achieved.

### 3.4 FIELD QUALITY CONTROL

1. Silt Fence Inspection: Silt fences and filter barriers shall be inspected by the Contractor immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.
  - 1) Decomposed or ineffective silt fence or filter barriers shall be replaced promptly.

- 2) Sediment deposits shall be removed when deposits reach approximately one-half the height of the barrier. Sediment shall be removed from the site and disposed at an approved waste area.
  - 3) Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, then prepared and seeded.
2. Construction Entrance Inspection: The Contractor shall inspect the construction entrance periodically. The stone in the construction entrance shall be replaced when, in the opinion of the Government, an excessive amount of mud is being carried into the public right-of-way.
  3. Disposal: All temporary erosion and sediment control measures shall be disposed of within 30 days after final site stabilization is achieved or after the temporary measures are no longer needed, unless otherwise authorized by the Government. Trapped sediment and other disturbed soil areas resulting from disposition of temporary measure shall be permanently stabilized to prevent further erosion and sedimentation.

END OF SECTION 312513

## SECTION 313000 - EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES

### PART 1-GENERAL

#### 1.1 DESCRIPTION

- A. Work Included: Excavation and preparation of trenches as shown on the plans and specified herein, backfilling and site restoration.
- B. Related Sections: Additional Sections of the Documents which are referenced in this Section include:
  - 1. Section 329000 – Turf and Grasses
  - 2. Section 333000 – Sanitary Sewerage

#### 1.2 REFERENCES

- A. General: The work shall comply with the most recent standards or tentative standards as published at the date of the contract and as listed in this specification using the abbreviation shown.
- B. American Society for Testing and Materials Publications (ASTM) :
  - 1. D 448-Standard Classification for Sizes of Aggregate for Road and Bridge Construction
  - 2. D 698-Test Method for Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400 ft-lbf/ft)
  - 3. D 1556-Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
  - 4. D 2167-Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
  - 5. D 2487-Standard Classification of Soils for Engineering Purposes (unified Soil Classification System)
- C. Virginia Department of Labor and Industry - Occupational Safety and Health Standards for the Construction Industry
  - 1. Subpart P-Excavations, Trenching, and Shoring
  - 2. Subpart U-Blasting and the Use of Explosives

#### 1.3 DEFINITIONS

- A. Controlled Fill: Controlled fill is required beneath all areas on which final grade is not placed on original excavated soil.
- B. Classified Excavation: For the purposes of payment, material shall not be classified.
- C. Satisfactory Materials: Materials classified by ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, and CL are satisfactory as fill for overlot grading and are satisfactory in-situ.
- D. Unsatisfactory Materials: Materials classified by ASTM D 2487 as OL, OH, MH, CH, and PT are unsatisfactory in-situ and as fill. Unsatisfactory materials also include those materials

containing roots and other organic matter, trash, debris, frozen materials, and stones larger than 6 inches. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

- E. Cohesionless and Cohesive Materials: Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have plasticity index of zero.
- F. Degree of Compaction: Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 698, abbreviated below as a percent of laboratory maximum density.
- G. Topsoil: Material obtained from excavations, suitable for topsoils, is defined as the upper 6 inches of existing soil cover. Topsoil shall consist of friable clay loam, free from roots, stones, and other undesirable material and shall be capable of supporting a good growth of grass.
- H. Rock: Rock shall consist of boulders measuring 1/2 cubic yard or more and materials that cannot be removed without systematic drilling and blasting such as rock material in ledges, bedded deposits, unstratified masses and conglomerate deposits, and below ground concrete or masonry structures, exceeding 1/2 cubic yard in volume. Pavements will not be considered as rock. All excavation is unclassified. No payment will be made for rock excavation
- I. Unyielding Material: Unyielding material shall consist of rock and gravelly soils with stones greater than 18 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.
- J. Unstable Material: Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.
- K. Select Granular Material: Select granular material shall consist of well-graded sand, gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall not contain more than 10 percent by weight of material passing a No. 200 mesh sieve. The maximum allowable aggregate size shall be 1 inch, or the maximum size recommended by the pipe manufacturer, whichever is smaller.
- L. Initial Backfill Material: Initial backfill material shall consist of select granular material or satisfactory materials free from rocks 1 inch or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

#### 1.4 QUALITY ASSURANCE

- A. Testing Results: Copies of all laboratory and field test reports shall be submitted to the COR within 72 hours of the completion of the test.

### PART 2-PRODUCTS

#### 2.1 PLASTIC MARKING TAPE

- A. General: Plastic marking tape shall be acid and alkali-resistant polyethylene film, 2-inches wide with minimum thickness of 0.004-inches. The tape shall be installed directly above the pipe, at a depth of 12 to 18 inches below finished grade unless otherwise shown. The tape shall not be made

of any metallic materials. Tape color shall be as specified in Table 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1.  
Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Blue:	Water Systems
Green:	Sewer Systems (including sewer force main)

2.2 TRACER WIRE

- A. General: Tracer wire shall be solid (not stranded) # 12 A.W.G. or larger insulated wire. Where insulation is compromised and will be buried, wire should be encapsulated in pure silicone caulk and wrapped with electrical tape.

PART 3-EXECUTION

3.1 GENERAL

- A. Classification: Excavation and material shall be unclassified for purposes of payment. No extra payment will be considered for any trench excavation regardless of the type of material encountered including rock.

3.2 CLEARING

- A. General: Only that portion of the work area actually needed for construction shall be cleared or used by heavy equipment unless directed otherwise by the Government. In no case shall clearing or debris from clearing operations be taken past right-of-way lines or permanent easement lines onto private property. Areas disturbed by construction operations shall be protected from erosion by suitable methods outlined in the Virginia Erosion and Sediment Control Handbook. Equipment and materials shall be stored only in approved areas.

3.3 EXCAVATION AND PREPARATION OF TRENCH

- A. General: Depth of trenches shall provide a minimum of 36” cover, measured from the top of pipe, unless otherwise noted on the plans and cut sheets. Depth of cover in VDOT right-of-way may be as required by VDOT.
- B. Gravity Sewer Trench: The trench shall be excavated to allow for a depth of ¼ of the pipes outside diameter or a minimum of 4 inches of ASTM D 448 #68 aggregate bedding in earth and 6 inches of aggregate bedding in rock.
- C. Pressure Pipe Trench: For force main and water main, the trench shall be excavated so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground between bell holes. Bell holes shall be excavated to accommodate each bell. Any part of the bottom of the trench excavated below the specified grade shall be brought back to grade with approved material and compacted in accordance with the specifications. The finished subgrade shall be prepared accurately by means of hand tools. If PVC pressure pipe is used, 4-inches of

ASTM D 448 #68 stone shall be required for bedding. Where the pipe is in rock, 6 inches of bedding, #68 stone, will be required.

- D. Width: Width shall be sufficient to allow pipe installation without walking or standing on pipe. The trench width at a point 12 inches above the top of the pipe shall not be less than 6 inches nor more than 12 inches on each side of the pipe's largest diameter unless otherwise directed.
- E. Unsuitable Material: Wet or otherwise unsuitable soil at the subgrade shall be removed and replaced with approved sound materials at no cost to the GOVERNMENT. Excess or unsuitable materials shall be disposed of by the CONTRACTOR.
- F. Rock Excavation: Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least 6-inches below and on each side of all pipe, manholes, valves or other appurtenances and overdepth shall be backfilled with 6-inches of ASTM D 448 #10 (PVC) or #26 (Ductile Iron) aggregate bedding.
- G. Topsoil: Topsoil shall be stripped from excavation area and stockpiled separately from other backfill material in approved area until needed for finish backfill and grading.
- H. Trench Protection: The CONTRACTOR shall furnish and erect such sheathing, bracing and shoring, and shall furnish necessary signs, barricades, and temporary lighting as may be pertinent for the protection of his work, employees, the public, adjacent structures, and to guard against contingencies which might give rise to delays in the work. Sheathing left in place shall be at the CONTRACTOR's expense. Responsibility for preservation of trench banks and other excavated spaces and the prevention of injury to any persons or property shall rest entirely with the CONTRACTOR. Normally, a maximum of 200 feet of trench will be allowed open at any one time. Trench construction and safety shall be governed by the Virginia Occupational Safety and Health Standards for the Construction Industry, Subpart P. No excavation within the VDOT right-of-way or otherwise will be allowed to remain open overnight unless special permission is obtained.
- I. Pumping, Bailing, and Draining: The CONTRACTOR shall remove by appropriate means any water which may accumulate or be found in the trenches or other excavations and shall keep the excavations clear of water while work is being installed, unless approval to the contrary is granted by the GOVERNMENT.
- J. Roadway Protection: No cleated equipment shall be used on pavements. Road drainage shall not be clogged, and shoulders, ditches, roadside drainage facilities and pavement affected by trenching operations shall be maintained in condition satisfactory to VDOT. Entrances shall not be blocked except for short periods as arranged with the property Government, and ingress and egress to adjacent property shall be maintained at all times. The CONTRACTOR shall be responsible for the repair of any damaged drainage structures. Private roads shall be restored to an equal or better condition of that prior to construction.

### 3.4 WORK WITHIN ROAD RIGHT-OF-WAY

- A. General: CONTRACTOR shall work within VDOT right-of-way as required by the GOVERNMENT and approved by VDOT. Placement of excavated material on existing pavement shall be avoided if possible. Placement of excavated material on existing pavement shall be permitted upon approval of a written request to the VDOT and provided a stone dust or sand layer is first placed on the pavement.

- B. Traffic Control: All traffic control and directional signs shall be supplied by the CONTRACTOR. Typical traffic control for utility work on road rights-of-way shall comply with VDOT traffic control details. See Appendix D – VDOT Traffic Control.
- C. Traffic Routing: Traffic shall not be blocked or re-routed without permission from the VDOT. Where one way traffic is permitted to be maintained, it shall be flagged 24 hours per day. Traffic shall at all times be properly protected by adequate lights, barricades and signs, and also flagmen when needed.
- D. Erosion and Siltation Control: At all locations straw barriers, silt fences, silt settlement basins, brush barriers or other measures are to be utilized in prevention of erosion and siltation control.
- E. Trenches: No trench within VDOT right-of-way can remain open overnight.
- F. Roadway Crossings: Except where specifically noted on the plans, cutting of existing road pavement will not be allowed. All crossings of VDOT roads shall be made by boring, jacking, or tunneling unless otherwise noted. If the crossing cannot be made by any of the above methods, the permittee must contact the local VDOT Residency. In cases where the GOVERNMENT is the permittee, the CONTRACTOR shall contact the GOVERNMENT, and the GOVERNMENT will contact VDOT. In the event of a failed bore attempt, casing shall be left in place and ends sealed with concrete, or if casing is not abandoned in place the excavation shall be pumped full with a portland cement grout. Wherever pavement is permitted to be cut, not over one-half width shall be disturbed at one time; and on crossings, the first opening shall be completely restored to satisfactory travelable condition before the second half can be opened. Where the pavement is disturbed, or deemed weakened, it, in its entirety, or such portions of it as deemed desirable by the VDOT shall be restored or replaced in a manner directed by and to the satisfaction of the VDOT. When pavement must be cut, the cuts shall be made in a straight line, parallel to the pipe, and 6-inches wider than the trench, on each side, so that an undisturbed shoulder will be provided under the new work. Sidewalks or curb and gutter disturbed by construction shall be removed and replaced at existing joints. Cutting shall be done neatly so that a uniform, straight joint will result to provide a bond with the original concrete or pavement.
- G. Roadway Crossings Through Casings: When special conditions require use of casings, care shall be taken to maintain the proposed plan grade. Before pushing the pipe through casing, chocks or skids shall be attached to the pipe to keep the pipe centered in the casing and to prevent damage when installation is made. Care shall be taken to ensure that the installed pipeline is well secured to prevent movement as detailed in the project details.

### 3.5 UNDERGROUND UTILITIES

- A. General: The CONTRACTOR shall contact the appropriate utility companies and have utilities located prior to starting construction. Locations of existing facilities should be determined by the CONTRACTOR far enough in advance of the construction to provide for modification in design, if required.

### 3.6 COORDINATION

- A. General: The CONTRACTOR shall notify the property Government in advance of commencing work and in the event of the necessity of disrupting utility or other services to such property, he shall notify the Government or responsible person in charge of such utility or other services and arrange for the disruption and restoration or such service in a manner which will result in a minimum of inconvenience to parties concerned.

### 3.7 BACKFILLING

- A. **Materials:** All backfill materials shall be free from mud, refuse, construction debris, organic material, boulders, frozen or otherwise unsuitable material, select initial backfill shall be free from stones over 1-1/2 – inch. From one foot above the top of the pipe to the original ground elevation, however, material containing stones up to 5-inches in their greatest dimension may be used, unless otherwise specified. The CONTRACTOR may backfill with the excavated material, provided it meets the conditions as stated above.
  
- B. **Gravity Sewer Bedding:** Bedding shall be required on all gravity sewer lines, and shall be in accordance with the project details. Bedding material shall extend from the excavated trench bottom to the pipe springline (midpoint). Bedding material shall be compacted to 95 percent of maximum density as measured by ASTM D 698. Special care shall be taken to backfill under the pipe and to tamp this material into place to provide a firm bed. Material shall be deposited on both sides of the pipe simultaneously and compacted into place by tamping. From the centerline of the pipe to a depth of one-foot above the top of the pipe, the trench shall be backfilled with approved material in 6-inch layers and compacted in accordance with the specifications. Mechanical or pneumatic tampers must be used in this operation. Compaction equipment must not come into contact with the pipe.
  
- C. **Pressure Pipe Bedding:** Bedding for ductile iron pressure pipe shall only be required when trench is in rock, unless shown otherwise on plans, and shall be in accordance with the project details. Bedding material for ductile iron pipe in rock shall be 6-inches of compacted VDOT #10 OR #26 aggregate beneath the pipe. Where PVC pressure pipe is used, bedding material shall extend from the excavated trench bottom to the pipe springline (midpoint) unless otherwise approved by the GOVERNMENT. Bedding material shall be compacted to 95 percent of maximum density as measured by ASTM D 698. Special care shall be taken to backfill under the pipe and to tamp this material into place to provide a firm bed. Material shall be deposited on both sides of the pipe simultaneously, and compacted into place by tamping. From the initial bedding to a depth of one foot above the top of the pipe, the trench shall be backfilled with approved material in 6-inch layers and compacted in accordance with the specifications. Mechanical or pneumatic tampers must be used in this operation. Compaction equipment must not come into contact with the pipe.
  
- D. **Backfilling to Grade:** Initial backfill shall be with select material as stated above and compacted prior to placement of remaining backfill. Backfilling shall be carried up evenly in increments of one foot. Minimum required density shall be the density of the adjacent undisturbed material. Backfill in trenches outside of proposed pavement areas or street rights-of-way, or in other areas when allowed, shall be compacted to a dry density equal to or greater than the density of the undisturbed soil surrounding the trench. Each layer of earth shall be compacted into place by tamping before the next layer is applied. A hydro-hammer shall not be used for compaction. All pipelines shall have a minimum of 18-inches of cover before any rolling equipment is used. Care shall be taken to prevent damage to pipe or other structures during compaction. Damage to pipelines or other structures resulting from compaction shall be corrected by the CONTRACTOR without expense to the GOVERNMENT.
  
- E. **Backfilling in Controlled Areas:** Backfill under pavement, proposed pavement, or in areas within VDOT right-of-way shall be in layers of selected earth not more than 6-inches in thickness, and each layer shall be compacted to a minimum of 95 percent of maximum density when tested in accordance with ASTM D 698. Compaction shall be by pneumatic tampers or by hand and in accordance with instructions in this Section as modified herein. All pipelines shall have a minimum of 18-inches of cover before any rolling equipment is used. The top course of backfill directly under pavement shall consist of aggregate base material meeting the requirements of VDOT #21 A stone. The depth of this course shall be at least 12-inches, except where otherwise required by VDOT. Moisture content shall be within 20 percent of optimum.

- F. **Marking of Pipelines:** A plastic marking tape (see PART 2 of this section) of the appropriate color shall be required on all pipe lines. The marking tape shall be buried 12 to 18-inches below the finished surface in accordance with the project details. As required by the contract drawings, a copper wire (size #12 - encased in a protective jacket to protect it from corrosion) will be installed parallel to (see 2.2 – Tracer Wire), and at the same depth as, all pipe (PVC and Ductile Iron Pipe) and looped up through all valve boxes, air release valve boxes, blow-off boxes, and around manholes with excess wire brought up to the top of the valve boxes and manholes (for use in connecting locating equipment to the wire). The copper wire shall be one continuous run with no splicing permitted unless two spools of wire are being spliced together. The wires shall be stripped on each connecting end of the protective jacket or coating, and wire ends shall be connected with appropriate sized wire nuts. Silicone shall be used to fill in the void inside the wire nut after splicing the copper wire, and the wire nut shall be wrapped with electrical tape.
- G. **Fill:** Materials for fill areas shown on the plans shall be secured from excavation after rejection of any unsuitable materials. Rock or rocky material may be incorporated into fills if size and shape permit, if placed in lower portion of fills where the stability will not be affected, and if placed in such a manner that the perviousness will not be increased. Material shall be spread in layers with moisture controlled and then compacted to a minimum density as stated above.
- H. **Finished Surfaces:** Uniformly smooth grading of disturbed areas shall be required after backfill and compaction. Road shoulders shall have a minimum depth of 6-inches of VDOT #25 or #26 crusher run aggregate, compacted to a minimum of 95 percent of maximum density as measured by ASTM D 698. Ditches and gutters shall be finished to drain readily. In grass or lawn areas, the last 4-inches of compacted fill will consist of topsoil or an approved soil which will support turf growth after fertilizing and seeding. Settlement or other damage that occurs prior to acceptance of this work shall be repaired and grades satisfactorily re-established.
- I. **Quality Assurance:** The CONTRACTOR will be responsible for and shall repair any settlement in the backfill or pavement for a period of one year after completion of the work.

### 3.8 BACKFILL TESTING

- A. **General:** Normal testing frequency of compaction testing performed by an independent laboratory shall be at the expense of the CONTRACTOR. Projects initiated and/or funded by the GOVERNMENT shall have compaction testing performed at the expense of the CONTRACTOR unless otherwise noted in the project contract.
- B. **Testing Requirements:** The CONTRACTOR shall demonstrate the adequacy of backfill compaction by performing density testing of the completed trench in backfill areas as designated by the GOVERNMENT. Density testing shall be performed at three depths for each test location: surface, mid-depth, and near maximum trench depth. In grass and lawn areas outside of VDOT right-of-way the testing shall be performed at two depths for each test location: under the topsoil backfill, and near the maximum trench depth. The character of the backfill material will be observed during the excavation for density testing to determine conformance with the specifications. Density testing shall be performed using nuclear field density equipment or conventional weight-volume methods. If the weight-volume method is used, volume shall be determined by using the sand replacement test (ASTM D 1556) or liquid displacement methods (ASTM D 2167). If nuclear methods are used, the trench correction effect shall be accounted for by recalibrating the nuclear gauge on its calibration block at the location of each test prior to taking the density measurement. Backfill in roadway or parking areas such as VDOT rights-of-way or in areas designated by the GOVERNMENT shall be compacted to a minimum of 95% density as measured by ASTM D 698. The density of the backfill outside of VDOT right-of-way or other controlled areas shall be equal to or greater than the density of the undisturbed material in the immediate area adjacent to the area under test. The CONTRACTOR shall furnish all

equipment, tools, and labor to conduct the testing. Testing shall be performed by an independent testing laboratory qualified to perform such tests and approved by the GOVERNMENT. All testing shall be witnessed by the GOVERNMENT. The test shall be repeated until satisfactory results are obtained. The CONTRACTOR shall be charged for all retests at the normal rates for inspection services.

1. Normal Testing Frequency: One test shall be performed within the first 500-feet of pipe installed by each crew. This test will be used as an initial evaluation of the compaction methods being used. Beyond the initial 500-feet, one test shall be performed in each 1,000-foot section of pipe installed or fraction thereof. Testing shall progress as each 1,000-foot section is completed. The location of the test within each section shall be selected by the Inspector. Testing which indicated that unacceptable material has been incorporated into the backfill, or that insufficient compaction is being obtained shall be followed by expanded testing to determine the limits of the unacceptable backfill. Normal testing shall be performed at the CONTRACTOR's expense.
2. Expanded Testing Requirements: If normal testing within a test section indicated unacceptable backfill, the GOVERNMENT may require additional testing within the same test section to determine the limits of unacceptable backfill. Additional testing required by the GOVERNMENT shall not exceed testing of 4 additional locations within the test section. Unacceptable backfill within the limits established by the testing shall be removed and replaced by the CONTRACTOR at no additional cost to the GOVERNMENT. If the CONTRACTOR fails to schedule testing on a consistent basis (as per the satisfaction of the GOVERNMENT), then payment for work performed will be withheld until such testing is completed. Additional testing beyond that required may be performed by the CONTRACTOR at his expense to further delineate limits of unacceptable backfill.
3. Additional Testing: Testing beyond the normal frequency or expanded testing required which is requested by the GOVERNMENT, shall be at the GOVERNMENT's expense.

### 3.9 SITE RESTORATION

- A. Replacement of Property: The CONTRACTOR shall restore all pavement, sidewalks, curbing, gutter, fences, poles, culverts, utilities or other such property and surface structures removed or disturbed as a part of the work to a condition equal or better to that before the work began.
- B. Pavement Repair and Replacement: Pavement, if disturbed, shall be repaired or replaced in accordance with the technical details.
- C. Drainage Improvements: The CONTRACTOR shall restore and/or repair all drainage ways and swales including paved or concrete channels as part of this work to a condition equal to that before the work began. Damaged drainage facilities shall be replaced. Restored ditches and swales shall provide positive drainage from roadways. Drainage restoration within VDOT rights-of-way shall be to the satisfaction of the Virginia Department of Transportation.
- D. Cleanup: The CONTRACTOR shall at all times keep the site cleaned to the satisfaction of the Inspector. In all cases, the CONTRACTOR shall "broom" the surfaces of paved streets immediately following backfilling. All surplus materials shall be removed and disposed of from the site of the work unless directed otherwise by the GOVERNMENT. Where material is placed on the pavement, a layer of stone dust or sand shall be applied first to facilitate clean-up.
- E. Seeding: Shall be in accordance with Section 329200 – Turf and Grasses.

END OF SECTION 313000

## **SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes temporary excavation support and protection systems.
- B. Related Requirements:
  - 1. Section 312000 "Earth Moving" for excavating and backfilling and for controlling surface-water runoff and ponding.

#### **1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review geotechnical report.
  - 2. Review existing utilities and subsurface conditions.
  - 3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
  - 4. Review proposed excavations.
  - 5. Review proposed equipment.
  - 6. Review monitoring of excavation support and protection system.
  - 7. Review coordination with waterproofing.
  - 8. Review abandonment or removal of excavation support and protection system.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.
- B. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.
  - 1. Include plans, elevations, sections, and details.
  - 2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.

3. Indicate type and location of waterproofing.
4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.
- D. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

#### 1.6 FIELD CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
  1. Notify Government no fewer than two (2) days in advance of proposed interruption of utility.
  2. Do not proceed with interruption of utility without Government's written permission.
- B. Project-Site Information: A geotechnical report has not been prepared for this Project
  1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements..
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.
  1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.

2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

## 2.2 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
  1. Corners: Site-fabricated mechanical interlock.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.
- E. Shotcrete: Comply with Section 033713 "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.
- F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- H. Tiebacks: Steel bars, ASTM A 722/A 722M.
- I. Tiebacks: Steel strand, ASTM A 416/A 416M.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
  1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Government and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

- C. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

### 3.2 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

### 3.3 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.
- B. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches (1500 mm). Accurately align exposed faces of sheet piling to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment.
- C. Cut tops of sheet piling to uniform elevation at top of excavation.

### 3.4 TIEBACKS

- A. Drill, install, grout, and tension tiebacks.
- B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
  - 1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.
- C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### 3.5 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
  - 1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
  - 2. Install internal bracing if required to prevent spreading or distortion of braced frames.

3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### 3.6 FIELD QUALITY CONTROL

- A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.
- B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
- C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

### 3.7 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
  1. Remove excavation support and protection systems to a minimum depth of 48 inches (1200 mm) below overlying construction and abandon remainder.
  2. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."
  3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION 315000

## SECTION 321216 - ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Cold milling of existing asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt overlay.
5. Asphalt surface treatments.

- B. Related Requirements:

1. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
  - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
  - b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.
2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
3. Job-Mix Designs: For each job mix proposed for the Work.

- B. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:

1. Paving Fabric: 12 by 12 inches (300 by 300 mm) minimum.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Material Certificates: For each paving material.
- C. Material Test Reports: For each paving material, by a qualified testing agency.
- D. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or VDOT.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Virginia DOT for asphalt paving work.
  1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

#### 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
  1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
  2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
  3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
  4. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
  5. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

### PART 2 - PRODUCTS

#### 2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.

- B. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242/D 242M, rock or slag dust, hydraulic cement, or other inert material.

## 2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320, PG 64-22.
- B. Asphalt Cement: ASTM D 3381/D 3381M for viscosity-graded material.
- C. Cutback Prime Coat: ASTM D 2027, medium-curing cutback asphalt, MC-30 or MC-70.
- D. Emulsified Asphalt Prime Coat: ASTM D 977 emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- E. Tack Coat: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- F. Fog Seal: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
- G. Water: Potable.
- H. Undersealing Asphalt: ASTM D 3141/D 3141M; pumping consistency.

## 2.3 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires, asphalt shingles, or glass from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.
- B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.
- C. Sand: ASTM D 1073, Grade No. 2 or No. 3.
- D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

- E. Joint Sealant: ASTM D 6690, Type I, hot-applied, single-component, polymer-modified bituminous sealant.

## 2.4 MIXES

- A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent or more than 15 percent by weight.
  - 1. Surface Course Limit: Recycled content no more than 10 percent by weight.
- B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
  - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
  - 2. Base Course: 6 inch.
  - 3. Surface Course: 2 inch.
- C. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
  - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
  - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

### 3.2 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
  - 1. Mill to a depth of 1-1/2 inches (38 mm).
  - 2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
  - 3. Control rate of milling to prevent tearing of existing asphalt course.

4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch (25 mm) after milling, before wearing course is laid.
7. Handle milled asphalt material according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."
8. Keep milled pavement surface free of loose material and dust.
9. Do not allow milled materials to accumulate on-site.

### 3.3 PATCHING

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
  1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- D. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

### 3.4 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.
  1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).
  1. Clean cracks and joints in existing hot-mix asphalt pavement.
  2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
  3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

### 3.5 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
  - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
  - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  - 2. Protect primed substrate from damage until ready to receive paving.
- D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
  - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  - 2. Protect primed substrate from damage until ready to receive paving.
- E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### 3.6 PAVING GEOTEXTILE INSTALLATION

- A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd.
- B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (and transverse joints 6 inches).
- C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

### 3.7 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
  - 2. Place hot-mix asphalt surface course in single lift.
  - 3. Spread mix at a minimum temperature of 250 deg F.
  - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
  - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
  - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
  - 2. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.8 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Clean contact surfaces and apply tack coat to joints.
  - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
  - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
  - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
  - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
  - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.9 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent or greater than 100 percent.
  2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.10 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  1. Base Course: Plus or minus 1/2 inch.
  2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
  1. Base Course: 1/4 inch.
  2. Surface Course: 1/8 inch.
  3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.11 SURFACE TREATMENTS

- A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.
- B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.
  - 1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
  - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    - a. One core sample will be taken for every 1000 sq. yd or less of installed pavement, with no fewer than three cores taken.
    - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 WASTE HANDLING

- A. General: Handle asphalt-paving waste according to approved state waste management plan.

END OF SECTION

## SECTION 323113 - CHAIN LINK FENCES AND GATES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Chain-link fences.
- 2. Gates: Motor operated, horizontal slide, and swing.

- B. Related Sections:

- 1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete equipment bases/pads for gate operators and controls and post footings.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:

- 1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet (3.66 m) high, and post spacing not to exceed 10 feet (3 m).
- 2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:
  - a. Wind Loads: 90.
  - b. Exposure Category: B.
  - c. Fence Height: 10 feet (3 m).
  - d. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe.

- C. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
  - 1. Fence and gate posts, rails, and fittings.
  - 2. Chain-link fabric, reinforcements, and attachments.
  - 3. Accessories: Barbed wire and Barbed tape.
  - 4. Gates and hardware.
  - 5. Gate operators, including operating instructions.
  - 6. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.
  - 1. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: Prepared on Samples of size indicated below:
  - 1. Polymer-Coated Components: In 6-inch (150-mm) lengths for components and on full-sized units for accessories.
- E. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified factory-authorized service representative.
- B. Product Certificates: For each type of chain-link fence, operator, and gate, from manufacturer.
- C. Product Test Reports: For framing strength according to ASTM F 1043.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
  - 1. Polymer finishes.

2. Gate hardware.
3. Gate operator.

#### 1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.
  1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.
- D. Mockups: Build mockups to set quality standards for fabrication and installation.
  1. Include 10-foot (3 m) length of fence and gate.
- E. Preinstallation Conference: Conduct conference at Project site.
  1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
  2. Review sequence of operation for each type of gate operator.
  3. Review coordination of interlocked equipment specified in this Section and elsewhere.
  4. Review required testing, inspecting, and certifying procedures.

#### 1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

#### 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Faulty operation of gate operators and controls.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
1. Fabric Height: As indicated on Drawings.
  2. Steel Wire Fabric: Wire with a diameter of 0.148 inch (3.76 mm).
    - a. Mesh Size: 2 inches (50 mm).
    - b. Aluminum-Coated Fabric: ASTM A 491, Type I, 0.30 oz./sq. ft. (92 g/sq. m).
    - c. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. (366 g/sq. m) with zinc coating applied after weaving.
    - d. Zn-5-Al-MM Aluminum-Mischmetal-Coated Fabric: ASTM F 1345, Type III, Class 1, 0.60 oz./sq. ft. (183 g/sq. m).
    - e. Polymer-Coated Fabric: ASTM F 668, Class 1 over aluminum-coated steel wire.
      - 1) Color: Black, complying with ASTM F 934.
    - f. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
  3. Aluminum Wire Fabric: ASTM F 1183, with mill finish, and wire diameter of 0.148 inch (3.76 mm).
    - a. Mesh Size: 2 inches (50 mm).
  4. Selvage: Knuckled at both selvages.

### 2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
1. Fence Height: As indicated on Drawings.
  2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe.
    - a. Line Post: 2.375 inches (60 mm) in diameter.
    - b. End, Corner and Pull Post: 2.875 inches (73 mm).
  3. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
    - a. Line Post: 4.0 inches (102 mm) in diameter.
    - b. End, Corner and Pull Post: 6.625 inches (168 mm) in diameter.

4. Horizontal Framework Members: Intermediate, top, and bottom rails complying with ASTM F 1043.
  - a. Top Rail: 1.66 inches (42 mm) in diameter.
5. Brace Rails: Comply with ASTM F 1043.
6. Metallic Coating for Steel Framing:
  - a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating per ASTM A 653/A 653M.
  - b. Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
  - c. External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- (0.0076-mm-) thick, zinc-pigmented coating.
  - d. Type C, Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) coating.
  - e. Coatings: Any coating above.
7. Polymer coating over metallic coating.
  - a. Color: Match chain-link fabric, complying with ASTM F 934.

### 2.3 TENSION WIRE

- A. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:
  1. Type I, aluminum coated (aluminized).
  2. Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
    - a. Class 3: Not less than 0.8 oz./sq. ft. (244 g/sq. m) of uncoated wire surface.
    - b. Class 4: Not less than 1.2 oz./sq. ft. (366 g/sq. m) of uncoated wire surface.
    - c. Class 5: Not less than 2 oz./sq. ft. (610 g/sq. m) of uncoated wire surface.
    - d. Matching chain-link fabric coating weight.
  3. Type III, Zn-5-Al-MM alloy with the following minimum coating weight:
    - a. Class 60: Not less than 0.6 oz./sq. ft. (183 g/sq. m) of uncoated wire surface.
    - b. Class 100: Not less than 1 oz./sq. ft. (305 g/sq. m) of uncoated wire surface.
    - c. Matching chain-link fabric coating weight.
- B. Polymer-Coated Steel Wire: 0.148-inch- (3.8-mm-) diameter, tension wire complying with ASTM F 1664, Class 1 over aluminum-coated steel wire.
  1. Color: Match chain-link fabric, complying with ASTM F 934.

- C. Aluminum Wire: 0.192-inch- (4.88-mm-) diameter tension wire, mill finished, complying with ASTM B 211 (ASTM B211M), Alloy 6061-T94 with 50,000-psi (344-MPa) minimum tensile strength.

## 2.4 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single and/or double swing gate types. Provide automated vehicular gates that comply with ASTM F 2200.
  - 1. Gate Leaf Width: As indicated.
  - 2. Gate Fabric Height: As indicated.
- B. Pipe and Tubing:
  - 1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
  - 2. Aluminum: Comply with ASTM B 429/B 429M; mill finish.
  - 3. Gate Posts: Round tubular steel.
  - 4. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (300 mm) to attach barbed wire or tape assemblies.
- E. Hardware:
  - 1. Hinges: 360-degree inward and outward swing.
  - 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
  - 3. Padlock and Chain: Government furnished.
  - 4. Lock: Manufacturer's standard internal device.
  - 5. Closer: Manufacturer's standard.

## 2.5 HORIZONTAL-SLIDE GATES

- A. General: Comply with ASTM F 1184 for gate posts and single and/or double sliding gate types. Provide automated vehicular gates that comply with ASTM F 2200.
  - 1. Classification: Type I Overhead Slide.
    - a. Gate Leaf Width: As indicated.
    - b. Gate Fabric Height: As indicated.
  - 2. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
    - a. Gate Frame Width and Height: As indicated.
- B. Pipe and Tubing:

1. Zinc-Coated Steel: Protective coating and finish to match fence framing.
  2. Aluminum: Comply with ASTM B 429/B 429M; mill finish.
  3. Gate Posts: Comply with ASTM F 1184. Provide round tubular steel posts.
  4. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (300 mm) as required to attach barbed wire or tape assemblies.
- E. Overhead Track Assembly: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
- F. Hardware:
1. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
  2. Padlock and Chain: Government furnished.
  3. Lock: Manufacturer's standard internal device.
  4. Hangers, roller assemblies, and stops fabricated from galvanized steel.

## 2.6 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Post Caps: Provide for each post.
1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches (152 mm) long.
  2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

- H. Barbed Wire Arms: Pressed steel or cast iron, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts , integral with post cap; for each post unless otherwise indicated, and as follows:
  - 1. Provide line posts with arms that accommodate top rail or tension wire.
  - 2. Provide corner arms at fence corner posts, unless extended posts are indicated.
  - 3. Type I, single slanted arm.
  - 4. Type II, single vertical arm.
  - 5. Type III, V-shaped arm.
  - 6. Type IV, A-shaped arm.
  
- I. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
  - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
    - a. Hot-Dip Galvanized Steel: 0.148-inch- (3.76-mm-) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
    - b. Aluminum: ASTM B 211 (ASTM B 211M); Alloy 1350-H19; 0.148-inch- (3.76-mm-) diameter, mill-finished wire.
  
- J. Finish:
  - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.
    - a. Polymer coating over metallic coating.
  - 2. Aluminum: Mill finish.

## 2.7 BARBED WIRE

- A. Steel Barbed Wire: Comply with ASTM A 121, for two-strand barbed wire, 0.099-inch- (2.51-mm-) diameter line wire with 0.080-inch- (2.03-mm-) diameter, four-point round barbs spaced not more than 5 inches (127 mm) o.c.
  - 1. Aluminum Coating: Type A.
  - 2. Zinc Coating: Type Z, Class 3.
  
- B. Polymer-Coated, Galvanized-Steel Barbed Wire: Comply with ASTM F 1665 two-strand barbed wire, 0.080-inch- (2.03-mm-) diameter line wire with 0.080-inch- (2.03-mm-) diameter, four-point round aluminum alloy or galvanized-steel barbs spaced not more than 5 inches (127 mm) o.c.:
  - 1. Polymer Coating: Class 1 over aluminum-coated steel wire.
    - a. Color: Match chain-link fabric, complying with ASTM F 934.

## 2.8 BARBED TAPE

- A. Wire-Reinforced Tape: ASTM F 1910; with four-point, needle-sharp barbs permanently cold clenched around a core wire.
  - 1. Core Wire: High-tensile-strength, zinc-coated steel.
- B. Clips: Stainless steel, 0.065 inch (1.7 mm) thick by 0.375 inch (9.5 mm) wide, capable of withstanding a minimum 150-lbf (667-N) pull load to limit extension of coil, resulting in a concertina pattern when deployed.
- C. Tie Wires: Stainless steel, 0.065 inch (1.7 mm) in diameter.
- D. Fabrication: Continuous coils of barbed tape as defined in ASTM F 1379 for the following characteristics:
  - 1. Configuration: Single coil.
  - 2. Style: Helical pattern.
  - 3. Coil Diameter(s): 24 inches (610 mm).
  - 4. Coil Loop Spacing(s): 12 inches (300 mm).
  - 5. Barb Length Classification: Medium, 0.4-inch (10.2-mm) barb.
  - 6. Barb Spacing: 4 inches (102 mm) o.c.
  - 7. Barb Set: Straight.

## 2.9 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

## 2.10 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
  - 1. Material above Finished Grade: Copper.
  - 2. Material on or below Finished Grade: Copper.
  - 3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Connectors and Grounding Rods: Comply with UL 467.
  - 1. Connectors for Below-Grade Use: Exothermic welded type.
  - 2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches (16 by 2440 mm).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
  - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

### 3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
  - 1. Install fencing on established boundary lines inside property line.

### 3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    - a. Exposed Concrete: Extend 2 inches (50 mm) above grade; shape and smooth to shed water.
    - b. Concealed Concrete: Top 2 inches (50 mm) below grade to allow covering with surface material.
    - c. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

- d. Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
  3. Mechanically Driven Posts: Drive into soil to depth of 30 inches (762 mm). Protect post top to prevent distortion.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- D. Line Posts: Space line posts uniformly at 96 inches (2440 mm) o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
  1. Locate horizontal braces at midheight of fabric 72 inches (1830 mm) or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
  1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches (152 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.
  2. Extended along top of barbed wire arms and top of fence fabric for supporting barbed tape.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Intermediate and Bottom Rails: Install and secure to posts with fittings.
- I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch (25.4 mm) between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) o.c.

- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
  - 1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.
- M. Privacy Slats: Install slats in direction indicated, securely locked in place.
  - 1. Vertically, for privacy factor of 70 to 75.
  - 2. Diagonally, for privacy factor of 80 to 85.
- N. Barbed Wire: Install barbed wire uniformly spaced as indicated on Drawings. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.
- O. Barbed Tape: Comply with ASTM F 1911. Install barbed tape uniformly in configurations indicated and fasten securely to prevent movement or displacement.

### 3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

### 3.6 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:
  - 1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
    - a. Gates and Other Fence Openings: Ground fence on each side of opening.
      - 1) Bond metal gates to gate posts.
      - 2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.
- C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

- D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:
  - 1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
  - 2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.
- E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- F. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- G. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

### 3.7 FIELD QUALITY CONTROL

- A. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.
  - 1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
  - 2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
  - 3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.8 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Automatic Gate Operator: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.
  - 1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lubricate hardware, gate operator, and other moving parts.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Forest Service's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

## SECTION 329200 - LAWNS AND GRASSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Seeding.
  - 2. Sodding.
  - 3. Lawn renovation.
- B. Related Sections include the following:
  - 1. Section "Site Clearing" for topsoil stripping and stockpiling.
  - 2. Section "Earthwork" for excavation, filling and backfilling, and rough grading.

#### 1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
  - 1. Certification of each seed mixture for turfgrass sod, identifying source, including name and telephone number of supplier.

- C. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.
- D. Qualification Data: For landscape Installer.
- E. Material Test Reports: For existing surface soil and imported topsoil.
- F. Planting Schedule: Indicating anticipated planting dates for each type of planting.
- G. Maintenance Instructions: Recommended procedures to be established by Government for maintenance of lawns during a calendar year. Submit before expiration of required maintenance periods.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.
  - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
- B. Delete paragraph below if no testing is required that involves Contractor's selecting soil-testing laboratory. Revise to name laboratories or to add other specific qualifications.
- C. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- D. Retain paragraph and subparagraph below for imported topsoil or topsoil to be reused. Cation exchange capacity measures the ability of soil particles to hold and release nutrients; the higher the number, the more fertile the soil. Sandy soils have a lower cation exchange capacity than clay soils. Sodium absorption ratio levels below 4 do not interfere with plant growth. Saline soils have a sodium absorption ratio level of 4 to 13; sodic soils, more than 13 and a pH greater than 8.5; saline-sodic soils, more than 13 and a pH less than 8.5.
- E. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
  - 1. Report suitability of topsoil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

1.7 SCHEDULING

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
  - 1. Spring Planting: March 15 – May 15
  - 2. Fall Planting: August 15 – October 15
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 LAWN MAINTENANCE

- A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
  - 1. Seeded Lawns: 90 days from date of Substantial Completion.
    - a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.
  - 2. Sodded Lawns: 60 days from date of Substantial Completion.
- B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.
  - 1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.
- C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches
  - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
  - 2. Water lawn at a minimum rate of 1 inch per week.
- D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
  - 1. Mow grass 2 to 3 inches high.
- E. Lawn Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
  - 1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to lawn area.

## PART 2 - PRODUCTS

### 2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: Use seed noted on construction plans. Invasive grass species shall not be installed.

### 2.2 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 5 to 10 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.
  - 1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
    - a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.
    - b. Topsoil shall be noxious weed and invasive species seed free.

### 2.3 INORGANIC SOIL AMENDMENTS

- A. Limestone is used to raise pH and neutralize acidic soils. Add percentages of carbonates, calcium, and magnesium. Revise to a pelleted form of limestone with a water-soluble binder that speeds breakdown if required.
- B. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
  - 1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.
  - 2. Class: Class O, with a minimum 95 percent passing through No. 8 sieve and a minimum 55 percent passing through No. 60 sieve.
  - 3. Provide lime in form of dolomitic limestone.
- C. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.
- D. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

- E. Aluminum Sulfate: Commercial grade, unadulterated.
- F. Perlite: Horticultural perlite, soil amendment grade.
- G. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.
- H. Sand: Clean, washed, natural or manufactured, free of toxic materials.
- I. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- J. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

## 2.5 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch 3/4-inch 1/2-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
  - 1. Organic Matter Content: 50 to 60 percent of dry weight.
  - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
  - 1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with at least 0.15 lb of ammonium nitrate or 0.25 lb of ammonium sulfate per cubic foot of loose sawdust or ground bark.
- D. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

## 2.6 PLANTING ACCESSORIES

- A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

## 2.7 FERTILIZER

- A. Organic fertilizers are derived from several sources. Bonemeal example below is organic and primarily phosphorous, has an alkaline reaction, and is nonburning. Other organic fertilizers include blood meal, cottonseed meal, seaweed meal, soybean meal, alfalfa meal, and blends of these materials. Revise descriptions and name proprietary products if required.

- B. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4percent nitrogen and 20 percent phosphoric acid.
- C. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- D. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
  - 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
  - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- E. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight or as determined by soil test by qualified soil-testing agency.

## 2.8 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long. Erosion Control blankets shall be used in all seeded areas. Erosion control blankets shall be EC-2 matting as defined by the Virginia Erosion & Sediment Control Manual.

## 2.9 PLANTING SOIL MIX

- A. Apply soil amendments and fertilizers at rates determined by laboratory soil analysis of the soils at the job site. The Contractor is responsible for including appropriate quantities of soil amendments in his/her bid in order to insure an acceptable stand of turf grass. Contractor may be permitted to amend imported topsoil in different proportions to produce satisfactory planting soil, depending on tests of imported or manufactured soils.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
  - 1. Protect adjacent and adjoining areas from hydroseeding overspray.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

### 3.3 LAWN PREPARATION

- A. Limit lawn subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Government's property.
  - 1. Apply fertilizer directly to subgrade before loosening.
  - 2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
    - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    - b. Mix lime with dry soil before mixing fertilizer.
  - 3. Spread planting soil mix to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
    - a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil mix.
    - b. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
  - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
  - 2. Loosen surface soil to a depth of at least of 6 inches Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches of soil. Till soil to a homogeneous mixture of fine texture.
    - a. Apply fertilizer directly to surface soil before loosening.
  - 3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
  - 4. Legally dispose of waste material, including grass, vegetation, and turf, off Government's property.

- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.
- E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

### 3.3 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph .Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
  - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
- B. Sow seed at the rate of 5 to 8 lb/1000 sq. ft.
- C. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray. Protect all seeded areas with 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

### 3.4 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
  - 1. Mix slurry with nonasphaltic tackifier.
  - 2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 1500-lb/acre (15.3-kg/92.9 sq. m) dry weight but not less than the rate required to obtain specified seed-sowing rate.
  - 3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry application at a minimum rate of 500-lb/acre (5.1-kg/92.9 sq. m) dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lb/acre (10.2 kg/92.9 sq. m).

### 3.5 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
  2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

### 3.6 LAWN RENOVATION

- A. Renovate existing lawns within the limits of work.
- B. Renovate existing lawn damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
1. Reestablish lawn where settlement or washouts occur or where minor regrading is required.
- C. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury in soil.
- D. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.
- E. Mow, dethatch, core aerate, and rake existing lawn.
- F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Governmentr's property.
- H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).
- I. Apply soil amendments and initial fertilizers required for establishing new lawns and mix thoroughly into top 4 inches (100 mm) of existing soil. Provide new planting soil to fill low spots and meet finish grades.
- J. Apply sod as required for new lawns.
- K. Water newly planted areas and keep moist until new lawn is established.

### 3.7 SATISFACTORY LAWNS

- A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm)

- B. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.
- C. Satisfactory Plugged Lawn: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass; and areas between plugs are free of weeds and other undesirable vegetation.
- D. Satisfactory Sprigged Lawn: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants; and areas between sprigs are free of weeds and other undesirable vegetation.
- E. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

### 3.8 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.
- C. Remove erosion-control measures after grass establishment period.

END OF SECTION

## SECTION 330136 – TELEVISION INSPECTION OF SEWER LINES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Work Included: This section includes all the equipment, labor, and materials necessary to perform all work for television inspection of sewer lines.

#### 1.2 SUBMITTALS

- A. Submit a written description of procedures to be used to the Government, including product literature for all digital video equipment including, but not limited to cabling, camera, monitor, footage counter, digital video titling device, and recorder.
- B. Submit a written/printed copy of television inspection logs to the Government. Logs shall record defects according to NASSCO's Pipeline Assessment and Certification Program (PACP) or/and Manhole Assessment and Certification Program (MACP).
- C. Submit 2 copies of visual and audio recording to the Government. The Government will review the inspections, not for accuracy of content, but to make sure that the required information is provided and the recording is of acceptable quality. If the Government determines that the recording is defective or not of adequate quality, the Contractor shall TV inspect again at the Contractor's expense.

#### 1.3 QUALITY ASSURANCE

- A. Comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction over this part of the work.
- B. The Contractor shall comply with the latest revision of the Virginia Occupational Safety and Health Standards for the Construction Industry as adopted by the Safety and Health Codes Commission of Virginia.
- C. The Contractor shall comply with Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, "Virginia Erosion and Sedimentation Control Handbook," latest revision.
- D. The television inspection shall be performed one section of line at a time
- E. Inspection shall be performed in accordance with NASSCO's Pipeline Assessment and Certification Program (PACP) or/and Manhole Assessment and Certification Program (MACP).

#### 1.3 COORDINATION

- A. The contractor shall completely remove and dispose of all dirt, debris, rubbish and surplus, and unsuitable materials at the end of each work day at no additional cost to the GOVERNMENT.
- B. Whenever the contractor desires to use a hydrant for water supply, the contractor shall obtain the permission of the Government. All costs associated with the use of water supplied from

hydrants shall not be paid for separately but shall be deemed to be included in the bid. Operation of hydrant shall be in accordance with the Town of Crewe Backflow Prevention Program. Use of an RPZ device or air gap is required.

## PART 2 – PRODUCTS

### 2.1 DIGITAL VIDEO SYSTEM

- A. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100 percent humidity conditions. The camera, television monitor, and other components of the digital video system shall be capable of producing picture quality to the satisfaction of the COR; and if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection.
- B. Recordings of all sewer line inspections shall be made on DVD. The audio portion of the composite digital video shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report.
- C. A footage counter device, which measures the distance traveled by the camera in the sewer, shall be accurate to plus or minus 2 feet in 1,000 feet.
- D. Digital video equipment shall include genlocking capabilities to the extent that computer generated data (i.e., footage, date, size, address and location, etc.) as determined by the Government can be overlaid onto digital video, and both indicated on the television monitor and permanently recorded on the digital inspection.

## PART 3 – EXECUTION

### 3.1 TELEVISION INSPECTION OF SEWER LINES

- A. Move the camera through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case pull television camera at a speed greater than 30 feet per minute. Use manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions to move the camera through the sewer line.
- B. If, during the inspection operation, the television camera will not pass through the entire section, set up equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire section, the obstruction shall be cleared by cleaning, root removal, or point repair as directed by the COR and the section reinspected.
- C. When manually operated winches are used to pull the television camera through the line, set up telephones or other suitable means of communication between the two manholes of the section being inspected to insure good communications between members of the crew.
- D. Measurement for location of defects shall be aboveground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole,

will not be allowed. Check accuracy of the distance meter by use of a walking meter, roll-a-tape, or other suitable device. The accuracy shall be satisfactory to the COR.

- E. The camera image shall be down the center axis of the pipe when the camera is in motion. The Contractor is required to provide a 360-degree radial view of the pipe interior using a camera with pan and tilt capabilities for 8-inch diameter and larger pipes. Points of interest shall also be digitally recorded and shall include, but not be limited to, defective joints, ovality, debris, sediment, cracked pipes, holes, or blockages.

### 3.2 DOCUMENTATION OF THE TELEVISION RESULTS

- A. Television Inspection Logs: Develop and keep printed location records that clearly show the location in relation to an adjacent manhole of each infiltration point observed during inspection. In addition, record other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, presence of scale and corrosion, and other discernible features.
- B. Photographs: Take digital photographs or digital video stills of any defects or points of interest recorded on the inspection report. If no defects are present provide one still image of pipe for information purposes.
- C. Videotape Recordings: A visual and audio recording of all areas of the lines shall be performed and produced in a format that may be replayed in a standard CD/DVD player/recorder device.

END OF SECTION

**SECTION 330137 – SEWER FLOW CONTROL**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: This section includes all the equipment, labor, and materials necessary to perform all work for sewer flow control for lining, televising, or replacing existing sewers or improvements at the wastewater pumping stations.

1.2 SUBMITTALS

Submit the following:

- A. Written description of flow control;
- B. Capacities of all equipment to be used, including standby equipment;
- C. Design calculations of peak flows in bypassed pipes; and
- D. Locations of temporary sewer plugs and bypass discharge lines.

1.3 QUALITY ASSURANCE

- A. Comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction over this part of the work.
- B. The Contractor shall comply with the latest revision of the Virginia Occupational Safety and Health Standards for the Construction Industry as adopted by the Safety and Health Codes Commission of Virginia.
- C. The Contractor shall comply with Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, “Virginia Erosion and Sedimentation Control Handbook,” latest revision.

D. DEPTH OF FLOW

Depth of flow shall not exceed that shown below for the respective pipe sizes as measured in the manhole when performing television inspection.

- 1) 6-INCH - 10-INCH PIPE.....20% OF PIPE DIAMETER
- 2) 12-INCH and LARGER PIPE..... 25% OF PIPE DIAMETER

E. FLOW CONTROL PRECAUTIONS

When flow in a sewer line is plugged, blocked, or bypassed, sufficient precautions shall be taken to protect the sewer lines from damage that might result from sewer surcharging. Overflows or discharges onto the ground or into streams shall not be allowed.

1.4 COORDINATION

- A. The contractor shall completely remove and dispose of all dirt, debris, rubbish and surplus, and unsuitable materials at the end of each work day at no additional cost to the GOVERNMENT. Spoils shall not be stored or drained onto the ground or into local streams or waterbodies.
- B. Whenever the contractor desires to use a hydrant for water supply, the contractor shall obtain the permission of the Government. All costs associated with the use of water supplied from hydrants shall not be paid for separately but shall be deemed to be included in the bid. Operation of hydrant shall be in accordance with the Forest Service's Backflow Prevention Program. Use of an RPZ device or air gap is required.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PLUGGING OR BLOCKING

- A. A sewer line plug shall be inserted into the line upstream of the section being worked. The plug shall be so designed that all or any portion of the sewage can be released. During TV inspection, flow shall be reduced to within the limits specified herein. After the work has been completed, flow shall be restored to normal.

3.2 PUMPING AND BYPASSING

- A. Provide the pumps, conduits, and other equipment to divert the flow of sewage around the section in which work is to be performed. The bypass system shall be of sufficient capacity to handle 1.25 times the maximum gravity flow of the pipeline section being bypassed. The contractor shall provide all necessary labor and equipment to setup and operate the equipment in a manner to prevent all spills, overflows, and releases. This shall include manning the equipment continuously or providing auto-dialer equipped machinery for fail safe operation.
- B. All pumps shall be equipped with sound attenuation measures that reduce noise levels to maximum of 75 decibels at a distance of 30 feet from the equipment during all periods of operation. If equipment is operated between the hours of 8:00 PM and 6:00 AM, this equipment shall also be provided with sound attenuation enclosure consisting of a three- sided enclosure with roof constructed of 2 x 4 lumber frame with ½-inch plywood sheathing and 2-inch Styrofoam panels attached to the inside of the entire enclosure. The enclosure shall be portable to allow the enclosure to be moved when bypass pumping equipment is moved.
- C. Bypass pumping equipment shall include pumps, conduits, engines, and related equipment necessary to divert the flow or sewage around the section in which work is to be performed. In addition, the contractor shall maintain at the same location and in operable condition, duplicate equipment to be used in case there is equipment failure. In this event, the Contractor shall promptly repair or replace the failed equipment to the satisfaction of the Forest Service.

3.3 PLUGGED OR BYPASSED SEWER LINES

- A. Plugged or bypassed sewer lines shall not be allowed to overflow or discharge onto the ground or into streams. The maximum allowable level of surcharge in any sewer line during bypass pumping or plugging shall be 1 foot above the crown of the pipe, as measured in

the first adjacent manhole upstream of the bypass pumping operation. Once flow levels exceed this depth, flow control measures shall be immediately removed by the Contractor from the sewer line until flows decrease or larger pumps are obtained by the Contractor.

- B The Contractor will be solely responsible for any legal actions taken by the state regulatory agencies if such overflows occur during construction.
- C The new sewer line may be used by the Contractor to carry the sanitary flows only after the new pipe has passed inspection and testing. Any “temporary” connections to the new sewer line shall be approved by the COR

END OF SECTION

## SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping joining materials.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Sleeves.
  - 5. Identification devices.
  - 6. Grout.
  - 7. Flowable fill.
  - 8. Piped utility demolition.
  - 9. Piping system common requirements.
  - 10. Equipment installation common requirements.
  - 11. Painting.
  - 12. Concrete bases.
  - 13. Metal supports and anchorages.

#### 1.3 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- C. ABS: Acrylonitrile-butadiene-styrene plastic.
- D. CPVC: Chlorinated polyvinyl chloride plastic.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Dielectric fittings.
  - 2. Identification devices.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.
- C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete."

## PART 2 - PRODUCTS

### 2.1 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
  - 1. ABS Piping: ASTM D 2235.
  - 2. CPVC Piping: ASTM F 493.
  - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  - 4. PVC to ABS Piping Transition: ASTM D 3138.
- H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

### 2.2 TRANSITION FITTINGS

- A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Transition Couplings NPS 1-1/2 (DN 40) and Smaller:
  - 1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
  - 2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 (DN 50) and Larger:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cascade Waterworks Mfg. Co.
  - b. Dresser, Inc.; DMD Div.
  - c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
  - d. JCM Industries.
  - e. Smith-Blair, Inc.
  - f. Viking Johnson.
  - g. Approved Equal.
3. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Manufacturers: Subject to compliance with requirements.
2. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Colonial Engineering, Inc.
  - b. NIBCO INC.
  - c. Spears Manufacturing Co.
  - d. Approved Equal.
3. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cascade Waterworks Mfg. Co.
  - b. Fernco, Inc.
  - c. Mission Rubber Company.
  - d. Plastic Oddities.
  - e. Approved Equal.
3. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

### 2.3 DIELECTRIC FITTINGS

- A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. EpcO Sales, Inc.
    - d. Hart Industries, International, Inc.
    - e. Watts Water Technologies, Inc.
    - f. Zurn Plumbing Products Group; Wilkins Div.
    - g. Approved Equal.
  3. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.
    - a. Pressure Rating: 250 psig (1725 kPa) at 180 deg F (82 deg C).
    - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.
- C. Dielectric Flanges:
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.

- c. Epco Sales, Inc.
  - d. Watts Water Technologies, Inc.
  - e. Approved Equal.
3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.
- a. Pressure Rating: 300 psig (2070 kPa).
  - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Approved Equal.
  - 3. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.
    - a. Pressure Rating: 150 psig (1035 kPa) minimum.
    - b. Gasket: Neoprene or phenolic.
    - c. Bolt Sleeves: Phenolic or polyethylene.
    - d. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Calpico, Inc.
    - b. Lochinvar Corporation.
    - c. Approved Equal.
  - 3. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 (DN 80) and smaller.
    - a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
    - b. End Connections: Threaded.

F. Dielectric Nipples:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Perfection Corporation.
  - b. Precision Plumbing Products, Inc.
  - c. Victaulic Company.
  - d. Approved Equal.
3. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
  - a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
  - b. End Connections: Threaded or grooved.

2.4 SLEEVES

- A. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- B. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.5 IDENTIFICATION DEVICES

- A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.
- B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
  1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
  2. Location: Accessible and visible.

- C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches (30 mm) for ducts, and 3/4 inch (20 mm) for access door signs and similar operational instructions.
  - 1. Material: Fiberboard.
  - 2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.
- D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
- E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
- F. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.
- G. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
- H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.
- I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
  - 1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.
- J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.
  - 1. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.
  - 2. Color: Comply with ASME A13.1, unless otherwise indicated.
- K. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.
  - 1. Material: 0.032-inch- (0.8-mm-) thick, polished brass or aluminum.
  - 2. Material: 0.0375-inch- (1-mm-) thick stainless steel.
  - 3. Material: 3/32-inch- (2.4-mm-) thick plastic laminate with 2 black surfaces and a white inner layer.
  - 4. Material: Valve manufacturer's standard solid plastic.
  - 5. Size: 1-1/2 inches (40 mm) in diameter, unless otherwise indicated.
  - 6. Shape: As indicated for each piping system.
- L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

- M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
  2. Thickness: 1/16 inch (1.6 mm), unless otherwise indicated.
  3. Thickness: 1/16 inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.
  4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.
- N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
1. Green: Cooling equipment and components.
  2. Yellow: Heating equipment and components.
  3. Brown: Energy reclamation equipment and components.
  4. Blue: Equipment and components that do not meet criteria above.
  5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
  6. Terminology: Match schedules as closely as possible. Include the following:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.
- O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
1. Size: 3-1/4 by 5-5/8 inches (83 by 143 mm).
  2. Fasteners: Brass grommets and wire.
  3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
- P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.
1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

## 2.6 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

## 2.7 FLOWABLE FILL

### A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft. (1840- to 2325-kg/cu. m).
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
4. Aggregates: ASTM C 33, natural sand, fine.
5. Admixture: ASTM C 618, fly-ash mineral.
6. Water: Comply with ASTM C 94/C 94M.
7. Strength: 100 to 200 psig (690 to 1380 kPa) at 28 days.

## PART 3 - EXECUTION

### 3.1 PIPED UTILITY DEMOLITION

- A. Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
  1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
  3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
  5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Government.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 3.2 DIELECTRIC FITTING APPLICATIONS

- A. Dry Piping Systems: Connect piping of dissimilar metals with the following:
  1. NPS 2 (DN 50) and Smaller: Dielectric unions.
  2. NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Dielectric flanges.

- B. Wet Piping Systems: Connect piping of dissimilar metals with the following:
  - 1. NPS 2 (DN 50) and Smaller: Dielectric couplings or dielectric nipples.
  - 2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric nipples.
  - 3. NPS 2-1/2 to NPS 8 (DN 65 to DN 200): Dielectric nipples or dielectric flange kits.
  - 4. NPS 10 and NPS 12 (DN 250 and DN 300): Dielectric flange kits.

### 3.3 PIPING INSTALLATION

- A. Install piping according to the following requirements and utilities Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Sleeves are not required for core-drilled holes.
- J. Permanent sleeves are not required for holes formed by removable PE sleeves.
- K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
- L. Verify final equipment locations for roughing-in.

- M. Refer to equipment specifications in other Sections for roughing-in requirements.

### 3.4 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
- I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
  - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

### 3.6 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

### 3.7 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Section 099600 "Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish per Section 099600.

C. All pipes, valves, flow meters, and any other portions of water main or ferrous metals exposed inside of the pump station or water treatment plant shall be painted.

### 3.8 IDENTIFICATION

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
  - 1. Stenciled Markers: According to ASME A13.1.
  - 2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
  - 3. Locate pipe markers on exposed piping according to the following:
    - a. Near each valve and control device.
    - b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
    - c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
    - d. At manholes and similar access points that permit view of concealed piping.
    - e. Near major equipment items and other points of origination and termination.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
  - 1. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
  - 2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

### 3.9 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Section 055000 "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.11 GROUTING

- A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 330500

## SECTION 333000-SANITARY SEWERAGE UTILITIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

#### 1.2 SUMMARY

- A. This Section includes gravity-flow, nonpressure and force-main, pressure sanitary sewerage outside the building, with the following components:
  - 1. Special fittings for expansion and deflection.
  - 2. Cleanouts.
  - 3. Corrosion-protection piping encasement.
  - 4. Pre-cast concrete manholes.
- B. Related sections include the following:
  - 1. Section 312000 – “Earth Moving”
  - 2. Section 315000 – “Excavation, Support, and Protection”

#### 1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Pipe.
  - 2. Pipe fittings
  - 3. Pre-cast concrete manholes, including frame and cover.
  - 4. Cast-in-place concrete manholes & other structures, including frame and cover.
- B. Shop Drawings: For the following:
  - 1. Each class of cast-in-place concrete.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.

- C. Handle manholes according to manufacturer's written rigging instructions.

## 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Construction Manager & Forest Service no fewer than 30 days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of service without Construction Manager' & Forest Service's written permission.
  
- B. Utility Maintenance and Coordination
  - 1. Before the work is started, the contractor shall notify all companies, corporations, municipalities and individuals who own utilities on the construction site, in the right of way or immediately adjacent to the construction area of the work to be performed. The contractor shall arrange to have the various utilities located and identified according to the respective utility owner's records and shall propose a method of protection to the respective owner for approval. Any cost incurred with removing, relocating, or repairing utilities shall be borne by the contractor unless indicated otherwise.
  - 2. The location of existing utilities shown on the drawings was taken in part from existing records, proposed alignments and elevations from field surveys, and may not represent exact locations. The contractor shall excavate to locate buried utilities far enough in advance of laying pipe to allow for adjustments in pipe laying both horizontally and vertically. When the work is approaching an existing utility or structure that may be in conflict with, or connected to, the work, the Contractor shall excavate test pits to verify the location, size, and elevation of the existing utility or structure. By taking the precaution the Contractor may adjust the work or have the existing utility relocated as necessary. Failure to take such precautions may result in the Contractor adjusting the work or having the existing utility relocated, at his expense.
  - 3. The following procedure shall be exercised when excavating to locate existing utilities.
    - a. Contractor shall clear proposed utility alignment of site obstruction such as pavement, curb & gutter and any physical objects as shown on the plans. It shall be the contractor's responsibility to maintain and/or re-establish the existing utility markings upon completion of demolition activities.
    - b. Upon removal of impervious areas and other obstructions along the proposed alignment the contractor shall identify the type of utility crossing and determine the appropriate probing equipment to sufficiently protect the existing utility from damage.
    - c. Contractor shall probe along the proposed utility alignment for a horizontal length of not less than 5 feet on each side of the existing utility.
  - 4. The Contractor shall maintain the drainage structures, culverts and flows at all times during the work. The Contractor shall pay for all personal injury and all property damage which occurs as a result of failing to facilitate drainage.

5. The Contractor shall repair or replace any existing storm water, sanitary sewer or water distribution utility damaged or misaligned during or due to the work. All other utilities shall be repaired or replaced by the respective Utility Company(s) at the expense of the Contractor.
6. The Contractor shall coordinate all work within the vicinity of the existing utilities with the respective Utility Company. The work shall be conducted in a manner to avoid unnecessary service interruption and in accordance with the rules and regulations of the respective Utility Company.

## 1.7 PROJECT CONDITIONS

- A. Separation of Water Lines and Sanitary Sewer Lines: Follow the VDH and DEQ standards for separation of water mains and sanitary sewer lines.
  1. Parallel Installation
    - a. Normal Conditions – Water lines shall be constructed at least 10 feet horizontally from a sewer or sewer manhole. The distance shall be measured edge-to-edge.
    - b. Unusual Conditions – When local conditions prevent a horizontal separation of at least 10 feet, the water line may be laid closer to a sewer or sanitary sewer manhole provide that the bottom (invert) of the water line is at least 18 inches above the top (crown) of the sewer. When this separation cannot be obtained, the sewer shall be constructed of AWWA approved Ductile Iron Pipe pressure tested in place without leakage prior to backfilling. The sewer manhole shall be of watertight construction tested in place.
  2. Crossings
    - a. Normal Conditions – Water lines crossing over sewers shall be laid to provide at least 18 inches between the bottom of the water line and top of the sewer whenever possible.
    - b. Unusual Conditions – When local conditions prevent a vertical separation described above, the following procedures shall be used.

Sewers under water lines shall be constructed of the materials described above under Parallel Installation, Unusual Conditions.

Water Lines Under Sewers shall be additionally protected by (1) a vertical separation of at least 18 inches between the bottom of the sewer and top of the water line (2) adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking of the water line (3) that the length of the water line be centered at the point of the crossing so that joints shall be equal distant and as afar as possible from the sewer.
- B. Separation of Wells: No sewer shall pass within 50 feet of a drinking water supply well, source or structure unless special construction and pipe materials are used to obtain adequate protection.

## PART 2 - PRODUCTS

### 2.1 GRAVITY SEWER

- A. Polyvinyl Chloride (PVC) Pipe: PVC pipe shall be SDR 35 furnished in 20-foot nominal lengths, conforming to ASTM Specification D.3034.

- B. Ductile Iron (DI) Pipe: Ductile iron pipe shall be centrifugally cast in accordance with AWWA C.151. Pipe. Unless noted otherwise, pipe sizes 12 inches and smaller shall be Thickness Class 50, pipe sizes greater than 12 inches shall be Pressure Class 350. Pipe shall be in nominal 18-foot or 20-foot lengths and joints shall be push-on in compliance with AWWA C.111 and be cement lined in accordance with AWWA C.104.
1. All ductile iron pipe used for sanitary sewer uses is to have Protecto 401 ceramic epoxy lining, or approved equal.

## 2.2 FORCEMAIN PIPING

- A. Polyvinyl chloride (PVC) pipe: shall be made from clean, virgin, PVC compound conforming to ASTM D 1784, and meet the following requirements. Pipe shall be SDR 14 bell and spigot pressure pipe, conforming to AWWA C900 Standard, rated at 200 psi working pressure, unless otherwise shown on the plans.
- B. Ductile Iron (DI) Pipe: Ductile iron pipe shall be centrifugally cast in accordance with AWWA C.151. Pipe. Unless noted otherwise, pipe sizes 12 inches and smaller shall be Thickness Class 50, pipe sizes greater than 12 inches shall be Pressure Class 350. Pipe shall be in nominal 18-foot or 20-foot lengths and joints shall be push-on in compliance with AWWA C.111 and be cement lined in accordance with AWWA C.104.
1. All ductile iron pipe used for sanitary sewer uses is to have Protecto 401 ceramic epoxy lining, or approved equal.

## 2.3 FITTINGS

- A. Tees or wyes installed shall be the same type as the main gravity sewer pipe. Plugs or caps used shall be those manufactured specifically for the type of pipe used. They shall be secured such that they will be watertight and will withstand the internal pressure applied by air or exfiltration testing. Pressure pipe fittings shall be cast or ductile iron in compliance with AWWA C.110 or C.153 and AWWA C.104. The proper adapter and/or transition gasket shall be supplied with PVC pressure pipe. Pipe ends shall be prepared for installation in accordance with the manufacturer's directions.

## 2.4 JOINTS

- A. Ductile Iron Joints: Jointing material for mechanical or slip-on joints in ductile iron pipe shall conform to the requirements of AWWA C.111. Where sewer pipe is installed in casing, locked gaskets or restrained joints such as "Mega-Lug", "AquaGrip" or "Lock Tyton" shall be used
- B. Polyvinyl Chloride Pipe Joints: PVC piping joints shall be the gasket, push-on type, such as "Ring-Tite" or equal unless otherwise indicated. Joint assembly shall be made according to the manufacturer's directions and shall comply with the guidelines for installation of PVC pipe as developed by the Uni-Bell Plastic Pipe Association. PVC pipe joints with cast iron fittings shall be installed in accordance with manufacturer's directions in compliance with these specifications. Integral bells shall be required. Where sewer pipe is installed in casing, locked gaskets or restrained joints such as "Mega-Lug", "AquaGrip" or "Lock Tyton" shall be used. Alternately, Yellowmine with restrained joints may be used at road crossings in steel casing

- C. Pipe Couplings: Watertight, semi-flexible couplings for connection different types of sewer pipe, or plain ends, shall be FERNCO Series 1000 with #305 stainless steel clamps or approved equal.

## 2.5 MANHOLES

- A. Normal Traffic Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints. All precast manholes shall be certified to be VDOT compliant.
1. Diameter: 48 inches minimum, unless otherwise indicated.
  2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
  3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
  4. Riser Sections: 6-inch minimum thickness, and of length to provide depth indicated.
  5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
  6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
  7. Resilient Pipe Connectors: ASTM C 923 cast or fitted into manhole walls, for each pipe connection.
  8. Steps: All manholes shall have steps conforming to ASTM C478.
  9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

## 2.6 FRAME & COVER

- A. Standard Frame and Cover: Standard Frames and Covers: Manhole frames and covers shall be manufactured from class 30 gray iron, meeting the requirements of ASTM A48, Standard Specification for Gray Iron Castings and certified to be VDOT compliant. Standard manhole frames and covers shall be manufactured to the dimensions and configurations shown on Standard Details. The bearing surface of the frames and covers shall be machined and the cover shall seat firmly into the frame without rocking. Covers are to be embossed along the perimeter with the words "Sanitary Sewer". Acceptable castings are the US Foundry 710 ring and DP cover, East Jordon Iron Works 2027 frame and cover, or approved equal. All castings are to be USA made.
- B. Flat Top Manhole: Standard Frames and Covers: Manhole frames and covers shall be manufactured from class 30 gray iron, meeting the requirements of ASTM A48, Standard Specification for Gray Iron Castings. Standard manhole frames and covers shall be manufactured to the dimensions and configurations shown on Standard Details. The bearing surface of the frames and covers shall be machined and the cover shall seat firmly into the frame without rocking. Covers are to be embossed along the perimeter with the words "Sanitary Sewer". Acceptable castings are Vulcan V-1883 or approved equal.
- C. Water Proof: Standard Frames and Covers: Manhole frames and covers shall be manufactured from class 30 gray iron, meeting the requirements of ASTM A48, Standard Specification for Gray Iron Castings. Standard manhole frames and covers shall be manufactured to the dimensions and configurations shown on Standard Details. The bearing surface of the frames and covers shall be machined and the cover shall seat firmly into the

frame without rocking. Covers are to be embossed along the perimeter with the words "Sanitary Sewer". Acceptable castings are Capitol Foundry MH-3000-WT/C or approved equal.

## 2.7 MARKING TAPE

- A. Marking tape shall be required on all pipelines. Detectable mylar marking tape shall be similar to Lineguard, Inc. utility marking tape, Type II or equal. The tape shall bear the printed identification "CAUTION: SEWER LINE BELOW". The printing shall be under mylar (reverse printed) so as to be readable through the clear mylar. Surface painting on the tape is not acceptable. The tape shall comply with the color coding of the Underground Utilities Damage Prevention Act.

## 2.8 VALVES

- A. Plug Valves: provide eccentric plug valves that are cast iron or ductile iron body, resilient seated as per ASTM D2000-BG and AWWA C517 suitable for wastewater service. Working pressure shall be at least 250-psi and have a minimum of 85 percent full port opening. Valves shall have cast iron valve boxes and operate with a two-inch square wrench nut. Plug valves shall be quarter-turn, non-lubricated with a resilient encapsulated plug. Plug valves 4-inches and larger shall include a totally enclosed and sealed worm gear actuator with position indicator and externally adjustable open and close stops. Exposed valves shall be operated with a hand wheel or lever operator. Buried service actuators shall be packed with grease and sealed for temporary submergence to 20 feet of water. Exposed worm shafts shall be stainless steel. Valve ends shall be mechanical joint or flanged as indicated on the drawings. Valves exterior shall be coated with an epoxy coating. Valves shall be Val-Matic Series # 5800R (Flanged) and 5900R (Mechanical Joint), Dezurik PEC, or equal.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312333.

### 3.2 PIPING APPLICATIONS

- A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
  1. Use watertight joints to join gravity-flow, sewer piping.
  2. Use pressure-type pipe couplings for force-main joints.
  3. Refer to part 2 of this section for detailed specifications for pipe & fitting products. Use pipe, fittings, and joining methods according to applications indicated.

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### 3.3 EXCAVATION AND TRENCH PREPARATION PIPING

- A. Width: Width shall be sufficient to allow laying without walking or standing on pipe and shall not be less than six inches on each side of pipe's largest diameter. The maximum clear width at top of pipe shall not be more than outside diameter of the pipe plus two feet.
- B. Bell holes shall be excavated to accommodate each bell.
- C. Rock Excavation: Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least six inches below and on each side of all pipe, valves, and fittings. Before pipe is laid, subgrade shall be made by backfilling with approved material and shall be tamped and graded. Commercial stone shall be as shown on the plans and standard details or shall be VDOT #26 for ductile iron pipe and #10 for PVC pipe when not specified.
- D. Excavation to Grade: Trench shall be excavated so as to provide a uniform and continuous bearing and support for pipe on solid and undisturbed ground between bell holes. Any part of bottom of trench excavated below specified grade shall be brought back to grade with approved material, thoroughly compacted. Finished subgrade shall be prepared accurately by means of hand tools.
- E. Unsuitable Material: Wet or otherwise unsuitable soil at subgrade shall be removed and replaced with approved sound materials as part of original contract cost and at no additional cost to the Government. Excess or unsuitable material shall be legally disposed of by Contractor.
- F. Topsoil Storage: Topsoil to be used in landscaping shall be stockpiled separately from other backfill material.
- G. Trench Protection: Contractor shall furnish and erect such sheathing, bracing, and shoring, and shall furnish necessary signs, barricades, and temporary lighting as may be pertinent, for protection of the work, employees, public, and adjacent structures. Sheathing left in place shall be at Contractor's expense. Maximum of 200 feet of trench will be allowed open at any one time. No excavation within VDOT right-of-way or elsewhere will be allowed to remain open overnight unless special permission is obtained.
- H. Pumping, Bailing, and Ditching: Contractor shall remove by appropriate means any water which may accumulate in trenches or other excavations and shall keep excavations clear of water while work is being installed.
- I. Road or Driveway Crossings:
  - 1. All VDOT road crossings must be bored unless otherwise shown on plans. Driveways may be open cut unless otherwise shown on plans. All driveways must be restored to conditions equivalent to existing conditions.
  - 2. Wherever road pavement is to be cut, not over one-half width shall be disturbed at one time. On crossings, first opening shall be completely restored to satisfactory travelable condition before second half can be opened. Where this is not possible, steel crossing plates must be used to maintain access at all times. Where pavement is disturbed, or deemed weakened, it, in its entirety, or such portions of it as deemed desirable by VDOT shall be restored or replaced in a manner directed by and to the satisfaction of VDOT.

3. When pavement must be cut, cut shall be made in a straight line, parallel to pipe and six inches wider than trench, on each side, so that an undisturbed shoulder will be provided under new work. Sidewalks or curb and gutter disturbed by construction shall be removed and replaced at existing joints. Cutting shall be done neatly so that a uniform, straight joint will result to provide a bond with original concrete or pavement.
- J. Erosion and Siltation Control: Within all easements and rights-of-way, straw barriers, silt fencing, settlement basins, brush barriers, and all other means necessary for adequate erosion and siltation control are to be utilized. All work shall be done according to the latest edition of the Virginia Erosion and Sediment Control Handbook.

### 3.4 PIPING AND JOINT CONSTRUCTION AND INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.
- F. Install gravity-flow, drainage piping according to the following:
  1. Install piping pitched down in direction of flow, at indicated slope.
  2. Install piping with 36-inch minimum cover.
- G. Install force-main, pressure piping according to the following:
  1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
  2. Install piping with 36-inch minimum cover.
  3. Install PVC pressure piping according AWWA M23 or ASTM D 2774 and ASTM F 1668.

### 3.5 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.

- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Construct cast-in-place manholes as indicated.
- D. Form continuous concrete channels and benches between inlets and outlet.
- E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.
- F. Install manhole cover inserts in frame and immediately below cover.

### 3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Install piping so cleanouts open in direction of flow in sewer pipe.
  - 1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

### 3.7 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to existing building's sanitary drains.
- B. Connect force-main piping to existing sanitary force mains.
- C. Make connections to existing piping and underground manholes.
  - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
  - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches) of concrete with 28-day compressive strength of 3000 psi).
  - 3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

### 3.8 CLOSING ABANDONED SANITARY SEWERAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
  1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
  2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
  1. Remove manhole and close open ends of remaining piping.
  2. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Section 312000 Earth Moving.

### 3.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
  1. Submit separate report for each system inspection.
  2. Defects requiring correction include the following:
    - 1) Alignment: Less than full diameter of inside of pipe is visible between structures.
    - 2) Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - 3) Crushed, broken, cracked, or otherwise damaged piping.
    - 4) Infiltration: Water leakage into piping.
    - 5) Exfiltration: Water leakage from or around piping.
  3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  4. Submit separate report for each test.
  5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    - a. Allowable leakage is maximum of 50 gallons per inch of nominal pipe size per mile of pipe, during 24-hour period.
    - b. Close openings in system and fill with water.
    - c. Purge air and refill with water.
    - d. Disconnect water supply.
    - e. Test and inspect joints for leaks.
    - f. Option: Test ductile-iron piping according to AWWA C600. Use test pressure of at least 10 psig.
  6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
  7. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.
    - a. Ductile-Iron Piping: Test according to AWWA C600.
    - b. PVC Piping: Test according to AWWA M23.
  8. Manholes: Perform hydraulic test according to ASTM C 969.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### 3.10 CLEANING

- A. Clean interior of piping of dirt and superfluous material. Flush with potable water.

END OF SECTION

## SECTION 465300 - ADVANTEX EQUIPMENT

### PART 1 - GENERAL

#### 1.01 DEFINITIONS

Wherever used in these specifications and printed with initial bold capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof.

1. *Bid* – The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the work to be performed.
2. *Bidder* – The individual or entity who submits a Bid directly to the Government.
3. *Contractor* – The individual or entity with whom Government has entered into the agreement.
4. *Contracting Office Representative (COR)* – The individual or entity named as such in the agreement.
5. *Inspector* - The specific individual designated by the Government, COR, Contractor, and Manufacture to ensure quality control by inspecting and certifying that the installation of the AdvanTex<sup>®</sup> treatment system is in compliance with the Manufactures recommendations and requirements.
6. *Manufacture* – A supplier, fabricator, distributor, material man, or vendor having a direct contract with Contractor or Government to furnish materials or equipment to be incorporated in the work by contractor.
7. *Government* – The individual or entity with whom Contractor has entered into the agreement and for whom the work is to be performed.
8. *Operator* – The individual or entity with whom the government has entered into an agreement and for whom operation and maintenance shall be performed.

#### 1.02 GENERAL DESCRIPTION

- A. The **MANUFACTURER** shall furnish a complete advanced treatment package(s), consisting of a pump vault, biotube effluent screen, discharge assembly, ball valve, check valve, splice box, treatment system, recirculating splitter valve, and controls.

#### 1.03 SUBMITTALS

- A. Product Data: Drawings and technical data sheets clearly specifying the materials of construction, equipment compatibility, along with drawings for each unique package being supplied.

#### 1.04 OR-EQUAL EVALUATIONS

- A. Throughout the equipment specifications you will find the term “or approved equal.” For this project, this term “approved equal” shall mean equal in the judgment of the **COR**. Should the **CONTRACTOR** seek approval of a product other than the brand or brands named in the specifications, it shall furnish written evidence that such product conforms in

all respects to the specified requirements, and that it has been used successfully elsewhere under similar conditions. It will not be the responsibility of the **MANUFACTURE** specified within these specifications to provide research, documentation, or data supporting the difference between the “or equal” and the specified product. This will be the sole responsibility of the **CONTRACTOR** seeking the approval.

B. Where the specified requirements involve conformance to recognized codes or standards, the **BIDDER** shall furnish evidence of such conformance in the form of test or inspection reports, prepared by a recognized agency, and bearing an authorized signature. Manufacturer’s standard data and catalog cut sheets will not be considered sufficient in themselves, and the COR will not be responsible for seeking further data from the manufacturer, or for otherwise researching the product. Failure to provide complete data will be cause for rejection of the product. The submission shall include any impacts that could be expected from the alternative product and shall also indicate any product that would require a license or royalty, the actual fees, and a note that these fees would be handled by the **BIDDER**. The **BIDDER** shall provide submissions; meeting the above parameters no less than TWO WEEKS prior to **BID** opening for review by the **COR**. **CONTRACTORS** seeking approval of “or equal” products or systems shall provide, at minimum, the following.

C. Product/System submittals, including, but not limited to;

1. The number of years the **MANUFACTURER** has been in business of manufacturing relevant products/systems
  - a. Size of company, including
    - 1) Number of employees related to relevant products/systems
    - 2) Number of engineers on staff related to relevant products/systems
  - b. Product specifications and a detailed description of how each product or component is “equal” to the specified product, system, or component. A side by side comparison is required.
    - 1) Equipment/system warranty along with exclusions
    - 2) Performance claims, including, but not limited to;
      - a) Treatment design
        - Surface area
        - Maintenance frequency
      - b) Pump motor description
        - Manufacturer and origin
        - Length of service
        - Number of units in operation
        - Life-cycle cost (repair and replacement frequency)
        - Warranty
      - c) Pump liquid end description
        - Manufacturer and origin

- Length of service
  - Number of units in operation
  - Life-cycle cost (repair and replacement frequency and cost). Note liquid ends must be remove-able and repairable and cleanable.
  - Warranty
- d) Corrosion resistance
- e) Pump Lead description
- Lead must be SOOW, extra heavy duty cord (600V) CSA approved.
- f) Control panel components
- Manufacturer and origin
  - Length of service
  - Number of units in operation
  - Warranty
  - Enclosure description
- c. Evidence of successfully obtaining approval for a system with similar permit requirements with the regulating authority
- d. Summary of product/system track record and history, including, but not limited to;
- 1) Number of similarly sized systems
  - 2) Detailed summary of, at minimum, ten (10) similarly sized systems, at least five (5) years old, including, but not limited to;
    - Project name, location, and application
    - Years in operation
    - Current average daily flows and design flows
    - Operation name and contact information
2. **BIDDER** shall specify and furnish documentation related to manufacturer (or representative) support services, including, but not limited to;
- a. Installation training program and support material
  - b. Installation oversight program and support material
  - c. Operator training program and support material
  - d. Startup services program and support material

#### 1.05 EXPERIENCE CLAUSE

The equipment furnished shall be manufactured and supplied by a company experienced in the design and manufacture of advanced treatment systems. **MANUFACTURERS** shall have a minimum ten (10) years' experience in the design and manufacturer of advanced treatment systems of similar size and equipment specified. **MANUFACTURERS** shall have at minimum of twenty-five (25) successful installations of advanced treatment systems.

#### 1.06 MANUFACTURER

The **MANUFACTURER** shall be Orenco Systems<sup>®</sup>, Inc. or approved equal. The **MANUFACTURER** shall furnish a complete factory built advanced treatment system, each

consisting of a pump vault, effluent screen, discharge assembly, ball valve, check valve, splice box, treatment system, recirculating splitter valve, and controls. The **MANUFACTURER** shall supply detailed installation and O&M instructions. The **MANUFACTURER shall** also provide the following support personnel:

- Professional engineer or personnel under the direct supervision of a professional engineer dedicated to supporting the project through design, construction, and O&M.
- Asset Management Department dedicated to assisting operators with operational and maintenance activities.

#### 1.07 WARRANTY

The advanced treatment system **MANUFACTURER** shall provide a three (3) year warranty for the entire treatment system, including, but not limited to the pump, pump vault, hose and valve assembly, control panel, and splice box. Warranty term shall ensue after **GOVERNMENT'S** acceptance and system startup procedures are complete. The **MANUFACTURER** shall submit detailed exclusions from the warranty or additional cost items required to maintain the equipment in warrantable condition. The warranty shall be documented in product literature.

#### 1.08 SERVICABILITY

The advanced treatment system components shall be completely serviceable, with easy access to the pump(s), effluent screen, treatment system, and floats. The pump shall be designed for removal without removing the effluent screen and floats.

#### 1.09 PUMPS

The pump must be approved for use in pump vault as described in these specifications. Pump shall be 1/2 to 3/4 hp, 230 VAC, single phase, 60 Hz, two-wire motor, with 10 foot long extra heavy duty (SOOW) electrical cord with ground. The pumps must be submersible High-Head Effluent pumps. Pumps shall be UL and CSA listed for use with effluent. The pumps must have a minimum 24-hour run dry capability without water lubrication. The pumps shall have a 1/8- inch bypass orifice to ensure flow circulation for motor cooling and to prevent air bind. The pump shall have a floating impeller design to protect against up thrust and increase pump life. The pumps liquid ends must be repairable (by replacing impellers and/or diffusers) for better long-term cost of governmentship. The motor must be rated for continuous use and frequent cycling, at least 100 cycles per day. The motor cable must be suitable for Class 1, Division 1 and 2 applications. The pumps shall be lightweight for easy removal and maintenance. The pump intake screen must be 1/8-inch mesh polypropylene. The pump shall have internal thermal overload protection and internal lightning protection. All pumps shall undergo 3-point (Dead head, Design Flow, and Design Flow + 30%) wet testing at the factory to confirm performance.

#### 1.10 TANKS GENERAL

- A. The **MANUFACTURER** shall provide the structural design and certification to the COR for review. The design shall be in accordance with accepted engineering practice. Precast concrete or fiberglass tanks shall have been designed by a registered engineer and

approved by state or local regulatory agencies or authorities.

B. Loading Criteria:

- a. There shall be 140 lbs./cu.ft. for minimum weight of saturated backfill, or 127 lbs./cu.ft. for unsaturated backfill (500 lbs./sq.ft. minimum).
- b. Minimum lateral loading shall be 62.4 lbs./cu.ft. Lateral loading shall be determined from the ground surface.
- c. The tank shall also support a concentrated wheel load of 2500 lbs.

C. There are four (4) typical loading conditions that should be analyzed:

1. 4 ft. Bury + Full Exterior Hydrostatic Load
2. 4 ft. Bury + Full Exterior Hydrostatic Load + 2500 lb. Wheel Load.
3. 1 ft. Bury + 2500 lb. Wheel Load.
4. Tank Full, Interior Hydrostatic Load and Unsupported by Soil.

*Load Case 4 represents the tank full of liquid at 62.4 lbs/cu.ft. This condition addresses seam and haunch stress-strain relationships that occur during watertightness testing, as well as poor soil bedding conditions that provide inadequate support.*

- D. Tanks requiring deep burial (>48") or subject to truck or heavy traffic loading require special consideration. (A minimum soil cover of 12" shall be used, unless specified otherwise by manufacturer.)
- E. All tanks shall be structurally sound and watertight and shall be guaranteed in writing by the tank **MANUFACTURER** for a period of two years from the date of final acceptance. **MANUFACTURER'S** signed guarantee shall accompany BIDS. The tank guarantee/warranty shall be furnished at the time of submittal. Tank warranty shall not be limited liability to replacement cost of the tanks. The septic tank shall be capable of withstanding long-term hydrostatic loading, in addition to the soil loading, due to a water table maintained at ground surface.
- F. Tanks shall be manufactured and furnished with access openings 20" in diameter and of the configuration shown on the manufacturer's drawings. Modification of completed tanks will not be permitted.
- G. Inlet plumbing shall include an inlet tee that penetrates 18" into the liquid from the inlet flow line. (The depth may vary depending on the tank's height; in all cases, though, the inlet should extend to a level below the bottom of the maximum scum depth.) The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack.
- H. Tanks shall be capable of successfully withstanding an aboveground static hydraulic test and shall be individually tested.
- I. All tanks shall be installed in strict accordance with the manufacturer's recommended installation instructions.

1.11 CONCRETE TANKS

- A. Walls, bottom and top of reinforced concrete tanks shall be designed across the shortest dimension using one-way slab analysis. Stresses in each face of monolithically constructed tanks may be determined by analyzing the tank cross-section as a continuous

- fixed frame.
- B. The walls and bottom slab shall be poured monolithically; alternatively, water stops may be provided.
  - C. Reinforcing steel shall be ASTM A-615 Grade 60,  $f_y = 60,000$  psi. Details and placement shall be in accordance with ACI 315 and ACI 318.
  - D. Concrete shall be ready-mix with cement conforming to ASTM C150, Type II. It shall have a cement content of not less than six (6) sacks per cubic yard and maximum aggregate size of 3/4". Water/cement ratio shall be kept low ( $0.35 \pm$ ), and concrete shall achieve a minimum compressive strength of 4000 psi in 28 days. The Contractor shall submit a concrete mix design to the COR for review and approval. Three (3) concrete sample cylinders shall be taken and tested for each tank manufactured until the manufacturer and COR are satisfied that the minimum compression strength is being obtained. To ensure compliance, the manufacturer shall then make and set three (3) sample cylinders for a minimum of 20% of the remaining tanks at the discretion of the COR. If the minimum compressive strength is not being obtained, the manufacturer shall be required to make and test sample cylinders for each tank manufactured. Calcium chloride will not be allowed in the mix design. The cost of testing cylinders shall be the tank manufacturer's responsibility. The tank manufacturer may supply a Swiss hammer for compressive testing in the field in lieu of sample cylinders.
  - E. Tanks may be protected by applying a heavy cement-base waterproof coating, on both inside and outside surfaces, in compliance with Council of American Building Officials (CABO) report #NRB-168; 6181; however, the tank should be watertight without the addition of seal coatings.
  - F. Form release used on tank molds shall be Nox Crete™ or approved equal. Diesel or other petroleum products are not acceptable.
  - G. Tanks shall not be moved from the manufacturing site to the job site until the tank has cured for seven (7) days or has reached two-thirds of the design strength.
  - H. Tanks shall be manufactured and furnished with access openings of the size and configuration to accommodate individual packaged pump systems. For 24" diameter access risers, the tank manufacturer shall cast in place a flanged tank adapter to facilitate the bonding of a 24" diameter access riser. The flanged tank adapter shall be made of 1/4" thick ABS and shall have an outside diameter of 27" and an inside diameter of 22-3/4". The flanged adapter shall be Orenco Systems®, Inc. Model PRTA24 or COR-approved equal. The adapter must have an overall height of no less than 3" to allow 1-1/2" exposed for sufficient bonding area once the adapter is installed in the tank. For 21" and 30" diameter access risers, either a grooved tank adapter plate (Model RRFTA or RRFTA30) or a flanged tank adapter (Model PRTA30) may be installed in the tank. The adapter shall be manufactured of fiberglass or ABS and shall accommodate either a 21" or 30" diameter access riser.
  - I. The septic tank and the top slab shall be sealed with a preformed flexible plastic gasket. The flexible plastic gasket shall be equal to the flexible butyl resin sealant congeal CS-102 or CS- 202 as manufactured by Concrete Sealants, Inc. of New Carlisle, Ohio, and shall conform to federal specification SS-S-00210(2iOA) and AASHTO M-198. A mechanical fastening method shall be used if the seasonal groundwater level may reach the top slab seam of the tank.
  - J. In order to demonstrate watertightness, tanks shall be tested at the factory and again on-site prior to acceptance. Inlets to the septic tank will be watertight pipe seal Cast-A-Seal™ (Manufactured by Press-Seal Gasket Corporation) or approved equal. Each tank shall be

tested at the factory, prior to shipping, by filling with water to the soffit and letting stand. After 24 hours, the tank shall be refilled to the soffit and the exfiltration rate shall be determined by measuring the water loss during the next two (2) hours. Any leakage shall be cause for rejection. After installation is completed and before backfilling, each tank shall be filled with water to a point 2” above the top of the tank and the water loss measured after a twenty four-hour period. After it has been determined that there is no leakage, test the access riser seam. Backfill to a minimum depth of 2” above the riser seam to prevent damage from hydrostatic uplift. Fill the tank to a point 2” above the riser seam (the field test period may be reduced to not less than two (2) hours). No tank will be accepted if there is any leakage over the two (2) hour period.

1.12 FIBERGLASS TANKS

A. The **MANUFACTURER** shall be Xerxes, Corp., Containment Solutions, Inc., or approved equal. The **MANUFACTURER** shall supply detailed installation, O&M instructions, and warranty terms to the **COR.**

1. Method of Calculations:

- a. Fiberglass tanks shall be analyzed using finite element analysis for buried structures.
- b. Calculations shall address the following:
  - 1) Strength
  - 2) Buckling
  - 3) Deflection of 5% of the tank diameter, based on service load (including long-term deflection lag)
  - 4) Buoyancy

2. Performance testing

B. The material properties and laminates considered in this analysis shall be fiberglass reinforced polyester resin, using grades of resin and fiberglass considered acceptable for use with septic tank construction. The thicknesses for different regions of the tanks shall be described and shown in shop drawings for each individual tank.

Typical primary strength properties are listed below:

Tensile Modulus (psi)	1,000,000
Ultimate Tensile strength (psi)	10,000
Ultimate Compressive strength (psi)	21,000
Ultimate Flexural strength (psi)	18,000
Ultimate Shear In-Plane (psi)	7,000

- C. In lieu of calculations for fiberglass tanks, the supplier may elect in-situ performance testing.
- D. In-situ testing of each tank model shall include use of strain gauge and deflection gauge. The tank will be subjected to external forces equal to twice the actual load.
- E. Maximum initial deflection based on test loading shall not exceed 3% of the tank diameter.
- F. Performance testing will be evaluated by a Registered Professional Engineer (P.E.). The Engineer will have the sole responsibility to determine the maximum external loading on

- any of the tank models.
- G. The tank shall be constructed with a glass fiber and resin content specified by the manufacturer and with no exposed glass fibers. Any permanent metal part shall be 300 series stainless steel.
  - H. Inspections may be made by the COR in the supplier's yard, within the plant, upon delivery and again after installation. The minimum wall thickness shall be 3/16". If the wall thickness is suspected to be less than 3/16" or if delamination is suspected within any portion of the tank, the COR may drill a 1/4" diameter hole through the tank wall for inspection purposes. If the required minimum 3/16" thickness is not found, repair if feasible shall be the responsibility of the contractor. If repair is judged not feasible, the tank shall be rejected. If twenty percent (20%) or more of the tanks are rejected for any of the aforementioned reasons, each tank under this BID will become suspect of substandard quality and subject to rejection by the COR. If the required minimum 3/16" thickness is found and no delamination is present, the repair of the inspection holes shall be the responsibility of the COR.
  - I. The COR shall specify the minimum weight of each tank model that will be allowed. The manufacturer will permanently mark the weight of each tank on the top near the access hole.
  - J. The minimum tank weight shall be specified by the manufacturer's COR (e.g., 330 lbs. for 1000-gallon tanks, 450 lbs. for 1500-gallon tanks; add 30 lbs. for internal baffle).
  - K. Holes specified for the tank shall be provided by the manufacturer. Resin or other appropriate sealant shall be properly applied to all cut or ground edges so that no glass fibers are exposed and all voids are filled.
  - L. Provide EPDM gaskets, or approved equal, shall be used at the inlet to join the tank wall and the inlet piping. ABS or Schedule 40 PVC pipe and fittings shall be used at the inlets.
  - M. Inlet plumbing shall include an inlet tee that penetrates 18" into the liquid from the inlet flow line. (The depth may vary depending on the tank's height; in all cases, though, the inlet should extend to a level below the bottom of the maximum scum depth). The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack.
  - N. In order to demonstrate watertightness, tanks shall be tested at the factory and again on-site prior to acceptance. Each tank shall be tested at the factory, prior to shipping, by filling with water to the soffit and letting stand for a minimum of two (2) hours. Any leakage shall be cause for rejection. After installation is completed and before backfilling, completely fill the tank with water, to a level two (2) inches into the riser. Wait a minimum of two (2) hours (or as required by local rules) and inspect the tank for leaks. There should be no drop in liquid level and no visual leakage from seams, pinholes, or other imperfections. Once the tank is proven to be watertight, drop the water level in the tank below the invert but not below the mid-seam.
  - O. Each tank shall be marked in the uppermost surface above or near the outlet and include a permit or identification number, weight of tank, type of tank, and date of manufacture.
  - P. Installation shall be in accordance with the manufacturer's recommendations, or as shown

on the Contract Plans, whichever are more stringent—no variations.

## PART 2 - PRODUCTS

### 2.01 RISERS

Risers shall be required for access to internal vaults and access into the septic tanks for septage pumping and inspection. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend 6" above original grade to allow for settlement and to ensure positive drainage away from the access. Risers shall be a minimum of 30" in nominal diameter when the depth of bury is 36" or greater or duplex pumping assemblies are used. All other risers shall be a minimum of 30" in nominal diameter and shall vary in height depending on the depth of bury on the various tanks. Adhesive required adhering the PVC or fiberglass risers to either fiberglass or ABS tank adapters shall be a two-component methacrylate structural adhesive or approved equal. To ensure product compatibility, a single manufacturer shall supply risers, lids, and attachment components.

### 2.02 INLET AND RECIRCULATING SPLITTER/BALL VALVE RISERS

Inlet risers shall be Orenco Systems<sup>®</sup>, Inc. Model Perma-Loc, Ultra-Rib, KOR FLO or COR- approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed-to- be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (54 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of a 1/2 an inch. Risers shall extend to 6 inches above the ground surface to allow for settlement and shall have a minimum nominal diameter of 24 inches.

- Inlet & Outlet flanges grommets: insert holes for FRP style splitter valve flanges or grommets for old style splitter valves shall be drilled/installed by the manufacturer of the valve.

### 2.03 OUTLET RISERS

Outlet risers shall be Orenco Systems<sup>®</sup>, Inc. Model Perma-Loc, Ultra-Rib, KOR FLO or COR-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed-to-be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (54 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2 an inch. Risers shall have a minimum nominal diameter of 30 inches for duplex pumping applications or 30 inches when used in a triplex pumping application and shall be factory-equipped with the following:

- Electrical and Discharge Grommets: when applicable, Orenco Systems<sup>®</sup>, Inc. EPDM grommets shall be installed by the manufacturer for discharge piping, vent piping, and/or the electrical conduit to assure a watertight seal. The manufacturer of

the access risers shall install the grommets at the factory.

#### 2.04 RISER-TO-TANK ATTACHMENT

All attachment components shall be constructed of waterproof, non-corrosive materials, such as PVC, ABS, fiberglass, or stainless steel. Adhesives and sealants shall be waterproof, corrosion resistant and approved for the intended application. The riser-to-tank connection shall be watertight and structurally sound. The riser-to-tank connection shall be capable of withstanding a vertical uplift of 5000 pounds to prevent riser separation due to tank settlement, frost heave, or accidental vehicle traffic over the tank. Risers shall be attached to tanks with one of the following attachment systems, or approved equal:

1. Orenco Systems<sup>®</sup>, Inc. Model RRFTA30, or approved equal tank adapter bolted to tank lid using RRFTA30BDKIT bolt down kit, and a two-component methacrylate structural adhesive.
2. Orenco Systems<sup>®</sup>, Inc. Model PRTA30, or approved equal tank adapter cast into tank lid or bolted to tank using PRTA30RBDKIT bolt down kit, and a two-component methacrylate structural adhesive.

#### 2.05 LIDS

One lid shall be furnished with each access riser. Lids shall be Orenco Systems<sup>®</sup>, Inc. DuraFiber Model FLD30G, Polylok Heavy duty 30" cover, or **COR**-approved equal, as appropriate, fiberglass with green non-skid finish, and provided with stainless steel bolts, and wrench. **MANUFACTURER** shall provide evidence that lids have been used successfully in continuous field service for a minimum of five years to demonstrate long-term integrity and suitability for the application. Lids shall be waterproof, corrosion resistant and UV resistant. Lids shall be flat, with no noticeable upward dome; a crown or dome of no more than 1/8" is allowable. Lids shall not allow water to Pond on them. Lids shall have a green non-skid finish. Self-lubricating plastics, such as polyethylene, shall not be considered non-skid without addition of a non-skid coating. Lids shall form a watertight seal with the top of riser. Lids shall be capable of withstanding a truck wheel load (81 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 3/4 of an inch. Lids shall be provided with tamper-resistant stainless steel fasteners and a tool for fastener removal. Tamper-resistant fasteners include recessed drives, such as hex, Torx, and square. Fasteners that can be removed with common screwdrivers, such as slotted and Phillips, or fasteners that can be removed with standard tools, such as pliers or crescent wrenches, are not considered tamper-resistant. To prevent a tripping hazard, fasteners shall not extend above the surface of the lid. Optional components may include the following:

1. Rigid closed-cell foam insulation of 2-inch or 4-inch thickness shall be attached to the underside of the lid. Any fasteners shall be made of corrosion resistant stainless steel. The insulation shall have an R-value of no less than 10 per 2-inch increment.

#### 2.06 RISER INSTALLATION

Riser installation shall be accomplished according to the **MANUFACTUR'S instructions**. For cold weather areas, risers shall be backfilled with 3/8" pea gravel or other similar granular material to prevent frost heave.

## 2.07 PUMP VAULT

### PVU Series

Orenco Systems<sup>®</sup>, Inc. Model PVU Series, Universal Biotube<sup>®</sup> Pump Vault or COR-approved equal, installed in conformance with the COR's plans. The filter shall have a minimum effective screen area of no less than 19.7 square feet. The Biotube pump vault shall consist of a 12-inch diameter polyethylene vault with eight (8) 2-inch diameter holes evenly spaced around the perimeter, located appropriately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level). Housed inside the polyethylene vault shall be the Biotube assembly consisting of 1/8-inch mesh polypropylene tubes. Attached to the vault is a flow inducer to accept two high-head effluent pumps.

## 2.08 DISCHARGE HOSE AND VALVE ASSEMBLY

Orenco Systems<sup>®</sup>, Inc. Model HV200BSQ or COR-approved equal. Discharge assembly shall be 2-inch diameter and include 150 psi PVC ball valve, 200 psi PVC true union check valve, PVC flex hose with working pressure rating of 60 psi, and Schedule 40 PVC pipe with cam coupler adapter for quick disconnect. Optional components may include the following:

1. Drainback: In cold weather climates a drain-back style discharge assembly shall be used which includes a 1/8" drain back orifice above the check valve. This valve style may be used with a cold weather kit.
2. Cold weather kit: For cold weather climates and deep bury tanks, Orenco Systems<sup>®</sup>, Inc. Model Cold Weather Kit or COR-approved equal.
3. High-pressure flex hose: Orenco Systems<sup>®</sup>, Inc. Model HVX200PR series or COR-approved equal. Shall be constructed of a special elastomer compound with a working Pressure of 250psi for systems requiring a higher horsepower pump.

## 2.09 FLOAT SWITCH ASSEMBLY

### A. Recirculation-Blend Tank

Float switch shall be mercury free Orenco Systems<sup>®</sup>, Inc. Model MF3P with three normally open mechanical switch floats mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high level, timer override on/off, and low-level alarms shall be preset as shown in the COR's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice box. The floats shall be UL or CSA listed.

## 2.10 TREATMENT PUMPS

### A. Flow EQ Tank

All pumps shall comply with general requirements set forth in section I (above). Orenco

Systems<sup>®</sup>, Inc., Model PF200512 series or COR-approved equal.

B. Recirculation Tank 1

Pump shall comply with general requirements set forth in section I (above). Orenco Systems<sup>®</sup>, Inc., Model PF500712 series or COR-approved equal.

C. Recirculation Tank 2

Pump shall comply with general requirements set forth in section I (above). Orenco Systems<sup>®</sup>, Inc., Model PF7515 series or COR-approved equal.

D. Field Dose Tank

Pump shall comply with general requirements set forth in section I (above). Orenco Systems<sup>®</sup>, Inc., Model PF200512 series or COR-approved equal.

2.11 ELECTRICAL SPLICE BOX

External Splice Box

Orenco Systems<sup>®</sup>, Inc. Model SBEX series external splice box or **COR**-approved equal, UL approved for wet locations, equipped with up to four (4) electrical cord grips and two 3/4-inch outlet fittings. Also included shall be UL listed waterproof butt splice connectors. The use of a UL-approved conduit seal kit accessible above ground shall be required to prevent the passage of gases, vapors, or flames through the conduit to the control panel. An additional UL classified sealant shall be added to the splice box coupling to prevent condensation accumulation in the splice box. The following UL approved sealants shall be used:

- a. UL classified moisture-cure polyurethane quick drying foam or **COR**-approved equal with an R-5 rating for each inch of foam.
- b. UL classified silicone sealant or **COR**-approved equal consisting of a neutral cure silicone, non-acetic, non-corrosive silicone able to withstand temperatures to 450° F.

Alternate: Internal Splice Box

Orenco Systems<sup>®</sup>, Inc., Model SB series internal splice box or **COR**-approved equal, UL approved for wet locations, equipped with up to six (6) electrical cord grip and a 1-inch or 1.25-inch outlet fitting. Also included shall be UL listed waterproof wire nuts. The use of a UL-approved conduit seal kit accessible above ground shall be required to prevent the passage of gases, vapors, or flames through the conduit to the control panel. An additional UL classified sealant shall be added to the splice box coupling to prevent condensation accumulation in the splice box. The following UL approved sealants shall be used:

- a. UL classified moisture-cure polyurethane quick drying foam or **COR**-approved equal with an R-5 rating for each inch of foam.

- b. UL classified silicone sealant or COR-approved equal consisting of a neutral cure silicone, non-acetic, non-corrosive silicone able to withstand temperatures to 450° F.

## 2.12 RECIRCULATING SPLITTER/BALL VALVE

Standard: MM4-FRP

Orenco Systems<sup>®</sup>, Inc. Model MM4-FRP 4 inch diameter ball valve assembly to provide guaranteed return of treated effluent returning from filter. The ball valve is designed to redirect 100% of flow to recirculation/dilution tank during periods of low flow or 100% to final discharge during periods of high flow. Must be manufactured of corrosion resistant PVC, Fiberglass, polyethylene and ABS components and allow for easy removal using a sliding quick- disconnect. The item is patented and the COR knows of no equivalent.

## 2.13 CONTROLS AND ALARMS

- A. Controls and alarms shall be listed per UL 508. Panels shall be repairable in the field without the use of soldering irons or substantial disassembly.
- B. A dedicated Ethernet cable shall be installed. Panel is required to allow real-time connectivity with the telemetry control panel and alarm communication. Phone dialers shall not be considered as an equivalent.
- C. Panel shall be Orenco Systems, Inc. TCOM™ control panel or COR-approved equal, meeting the following:
  - 1. Data Collection and Utilization: Logs data for system conditions and events such as pump run time, pump cycles, and alarm conditions.
  - 2. Downloadable Logs: Download logs into a \*.dif or ASCII format for simple conversion to common spreadsheet or word processor programs.
  - 3. Multi-Level Password Security: Only qualified personnel can remotely access site.
  - 4. Program Logic Rules: Simple “If then” declarations. Rules can be written based on several operands, including the following:
    - 5. Input/output status
    - 6. Point status
    - 7. Date: mm/dd/yy format
    - 8. Time of day: 24 hour clock
    - 9. Timers
    - 10. Historical data (allows for control optimization or detection of trends)
    - 11. Schedule functions to control digital “Points” based on date or day of week/time.
    - 12. Automatic daylight savings time adjustment.
    - 13. Automatic call-out to pagers during alarm conditions when panel detects trends that could lead to system failure.

- D. In addition, the unit shall have the capability of real-time direct connection to the panel via laptop serial port, to allow the operator real-time access to detailed logged data and the ability to change point values.

1. Standard Components

- a. Motor-Start Contactor: 120V 16 FLA, 1 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 240 VAC, 16 FLA, 3 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).
- b. HOA 3- Way Toggle Switch: Single-pole switch, Hands (manual) Off, Auto ON. 20 amps, 1 hp.
- c. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 120 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
- d. Pump Circuit Breaker: 20 amps, OFF/ON switch. Single-pole for 120 VAC or double-pole for 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
- e. Audio Alarm: 95 dB at 24", warble-tone sound.
- f. 120 VAC Ground Fault Interrupter (GFI)
- g. Current Sensor: 120 VAC with adjustable high & low alarm set points.
- h. Visual Alarm: 7/8" diameter red lens, "push-to-silence." NEMA 4, 1-watt bulb, 120 VAC.
- i. Touch Screen Display: interface module with 5.7 color touch screen.
- j. Panel Enclosure: NEMA 4X rated, constructed of UV-resistant fiberglass or NEMA 4, constructed of steel; hinges and latch are stainless steel. Conduit couplings provided.
- k. Remote Telemetry Unit: ATRTU-Net; self-powered 24 VDC at 10 mA max, 8 digital inputs, 8 analog inputs expandable to 16 with expansion board. On-board modem (9600 baud), Ethernet port (10 base T, RJ45jack) and Modbus port (RS485/485 terminals).
- l. Deadfront User interface
- m. Flow Meter – Netafim, Model "WMR" 2-inch water flow meter (36WMR2T1D), with electronic (ER) digital register and pulse output connection. In addition to logging daily flows, flow meter shall log flows on an hourly basis.

2. Optional Components

- a. Pump Run Light: 7/8" green lens. NEMA 4, 1-watt bulb, 120 VAC.
- b. Effluent Alarm: 95db at 24", warble-tone sound.
- c. Flashing Light: Lexan lens, flanged base, red, UL-recognized.
- d. Heater: Anti-condensation heater. Self-adjusting radiates additional wattage as temperature drops.
- e. Intrinsically Safe Control Relays: 120 VAC. Listed per UL 698A, for Class 1 Div. 1, Groups A, B, C, D hazardous locations. Larger enclosure required.
- f. 3- Way (main, auto, off) manual transfer/disconnect switch
- g. Event Counter: 120 VAC, 6-digit, non-resettable.
- h. Elapsed Time Meter: 120 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.

2.15 INSTALLATION

All treatment, pumping system, and electrical components shall be installed in accordance with the **MANUFACTURER'S** recommendations, the COR's plans, and all state and local regulations.

2.16 LOCATION

The pump control panel shall be mounted on an exterior backboard at control structure nearest the tank and pumps. The control panel shall be located within 50 feet and in sight of the pump motor or shall be provided with a lockable disconnect switch. The panel, when possible, should be mounted in the shade and protected from the weather. The panel should be located at a convenient height (usually about five feet above the ground) and where it will be accessible for maintenance.

2.17 AX100 ADVANTEX<sup>®</sup> TREATMENT SYSTEM

Oreco Systems<sup>®</sup>, Inc. AX20 AdvanTex<sup>®</sup> Treatment System shall be installed in conformance with the Construction Documents and manufacturer's guidelines. The AX20 is a packed bed filter consisting of a proprietary textile media housed in a 8' x 4' x 3.5'. The media has been specifically engineered for wastewater applications. The item is patented and no equivalent exists.

Oreco Systems<sup>®</sup>, Inc. AX100 AdvanTex<sup>®</sup> Treatment System shall be installed in conformance with the Construction Documents and manufacturer's guidelines. The AX100 is a packed bed filter consisting of a proprietary textile media housed in a 16' x 8' x 3.5'. The media has been specifically engineered for wastewater applications. The item is patented and no equivalent exists.

2.18 ADVANTEX<sup>®</sup> VENTILATION SYSTEM

A. Oreco Systems<sup>®</sup>, Inc. passive vent system

PART 3 - EXECUTION

3.01 PRECONSTRUCTION CONFERENCE

Before any work at the site is started, a conference attended by the **GOVERNMENT, CONTRACTOR, COR, MANUFACTURE, OPERATOR** and others as appropriate will be held to establish a working understanding among the parties as to the work involved for installing each component of the treatment system. At this conference, the **GOVERNMENT, CONTRACTOR, COR, and MANUFACTURE** shall designate, in writing, a specific individual to act as **INSPECTOR** for the installation of the treatment system. Any cost or fees associated with the services of the **INSPECTOR** or the **COR** during construction will be the responsibility of the **GOVERNMENT**.

### 3.02 INSTALLATION AND FIELD TESTING TRAINING

The **MANUFACTURER** shall provide the services of a trained representative to instruct the installing **CONTRACTOR'S** crew and **INSPECTOR** regarding the proper installation and field testing of each component per the **MANUFACTURE'S** recommendations and requirements. The **MANUFACTURER** shall have a trained representative provide installation and field testing training services for a minimum of one (1) visit of a minimum of one (1) eight-hour day at the beginning of construction.

### 3.03 QUALITY CONTROL

- A. To ensure quality control, the **INSPECTOR** shall inspect and certify that an initial installation of the AdvanTex<sup>®</sup> system is in compliance with the **MANUFACTURE'S** recommendations and requirements.
- B. Upon completion of the inspection, the **INSPECTOR**, in coordination with the **COR**, shall perform or direct the **CONTRACTOR** to perform any required adjustments to the equipment and place into operation under the supervision of the **COR**. All equipment and materials required to perform the testing shall be the responsibility of the **CONTRACTOR**. A letter of completion shall be signed by the **INSPECTOR** and copies faxed, emailed, or mailed to the **COR** and **MANUFACTURE** within one (1) week of the AdvanTex<sup>®</sup> system being installed and prior to System Commissioning.
- C. The **MANUFACTURER** shall provide the services of a trained representative for a minimum of one (1) visit of a minimum of one (1) eight-hour day for the purpose of quality control during construction.

### 3.04 SYSTEM COMMISSIONING

- A. The **MANUFACTURER shall** provide the services of a trained representative for training the **GOVERNMENT'S** service provider, and inspecting the AdvanTex<sup>®</sup> installation. The inspection will include items covered from the installation training. Upon system commissioning, the **MANUFACTURER'S** trained representative shall provide the **COR** a written report of findings. The **COR** should then perform or direct the **CONTRACTOR** to perform any required adjustments to the equipment and place into operation. All equipment and materials required to perform additional testing shall be the responsibility of the **CONTRACTOR**. The **MANUFACTURER** shall submit to the **COR** and **GOVERNMENT**, a detailed start-up checklist, according to the manufacturer's inspection and startup procedures.
- B. The **MANUFACTURER** shall provide the services of a trained representative for a minimum of one (1) visit of a minimum of one (1) eight-hour day for the purpose of system commissioning.

## PART 4 - OPERATION AND MAINTENANCE

### 4.01 OPERATION AND MAINTENANCE MANUALS

The **MANUFACTURER shall** provide five (5) operation and maintenance manuals, four (4) to be sent to the **GOVERNMENT**, and one (1) sent to the **COR**.

4.02 SPARE PARTS

The **MANUFACTURER shall** provide a spare pump, six (6) spare floats, check valve, control components, and nozzles, and various other necessary components deemed necessary.

4.03 OPERATION AND MAINTENANCE TOOLS

A. AX LATERAL BRUSH CLEANING KIT

**MANUFACTURER shall** provide a minimum of one (1) AX Lateral Brush Cleaning Kit. This kit shall include 90-inch lateral cleaning brush used to clean 1-1/4" diameter laterals and shall be Orenco Systems<sup>®</sup>, Inc., OM-AX-LAT BRUSH CLEANING KIT or **COR-** approved equal.

B. AX SHEET CLEANING WAND

**MANUFACTURER shall** provide a minimum of one AX sheet-cleaning wand. Wand shall be Orenco Systems<sup>®</sup>, Inc. model OM-AX-CLEANING WAND or **COR-**approved equal. Cleaning wand shall have the ability to connect to a standard garden hose, and fit in between AX sheets to spray off debris.

C. FIELD TEST KIT

**MANUFACTURER shall** provide a field test kit to monitor the following parameters:

- a. pH
- b. Alkalinity
- c. Ammonia (NH<sub>3</sub>-N)
- d. Nitrate/Nitrite (NO<sub>3</sub>-N / NO<sub>2</sub>-N)
- e. Dissolved Oxygen (DO)
- f. Chlorides
- g. Turbidity
- h. Temperature

The field test kit shall include:

- a. pH test strips (0-14 pH)
- b. Alkalinity test strips (0-240 ppm)
- c. Ammonia (NH<sub>3</sub>-N) test strips (0-6 ppm)
- d. Nitrate/Nitrite (NO<sub>3</sub>-N / NO<sub>2</sub>-N) test strips (0-50 ppm)
- e. Dissolved Oxygen (DO) kit (1-12 ppm)
- f. Chloride titrators (30-600 ppm & 300-6000 ppm)
- g. Turbidity kit (0-200 NTUs)
- h. Thermometer (0-240° F)

D. BIOTUBE<sup>®</sup> CARTRIDGE CLEANING CRADLE

**MANUFACTURER shall** include a minimum of one (1) Biotube<sup>®</sup> cleaning

cradle. Cradle shall be Orenco Systems<sup>®</sup>, Inc. Model OM-BIOTUBE CRADLE or **COR**- approved equal for housing the Biotube Effluent Filter cartridges for cleaning and maintenance.

E. BIOTUBE<sup>®</sup> CARTRIDGE CLEANING BRUSH

**MANUFACTURER** shall include a minimum of one (1) Biotube<sup>®</sup> brush. Brush shall be Orenco Systems<sup>®</sup>, Inc. Model OM-BIOTUBE BRUSH or **COR**-approved equal for cleaning the Biotube Effluent Filter cartridges.

F. SCUM MEASURING DEVICE

**MANUFACTURER shall** provide a minimum of one (1) scum measuring utility gauge. The gauge shall consist of a minimum 3/8" diameter stainless steel rod with an incremental scale for measuring scum levels. The rod shall be bent at a 90-degree angle at the base to aid in identifying the scum "by feeling." The gauge shall be Orenco Systems<sup>®</sup>, Inc. Model SMUG or **COR**-approved equal.

G. SLUDGE MEASURING DEVICE

**MANUFACTURER** shall provide a minimum of one (1) SLUDGE JUDGE<sup>®</sup> ULTRA or **COR**-approved equal. Unit shall be constructed of polycarbonate treated with an ultraviolet stabilizer, durable in cold temperatures, and can withstand heat up to 280° F. The measuring device shall be 3/4" diameter and marked with tape to designate 1 ft. increments.

END OF SECTION 465300