

PROJECT MANUAL

TOWN OF FULTON

Fulton, Alabama

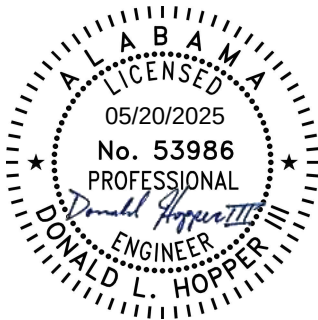
for

Waste Water Treatment Facility Improvements for the Town of Fulton, AL

DRA Project No: AL-55118
(DRA Funds)

May 2025

CONSTRUCTION DOCUMENTS



Prepared By

GMC

Goodwyn Mills Cawood, LLC.
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Montgomery, AL 36117
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www.gmcnetwork.com
GMC PROJECT NUMBER: CMGM230141

OWNERSHIP OF DOCUMENTS AND DISCLAIMER

The Project Manual, Technical Specifications, Drawings, and all other documents relating to this project have been prepared for this individual and particular project, and for the exclusive use of the original Owner, developer or other party so indicated.

Actual project conditions and as-built conditions may vary significantly. Changes made during bidding, negotiations, construction, due to additions or deletions of portions of this project, and/or for other reasons, may not be indicated in these documents.

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ARCHITECTURE ■ ENGINEERING ■ ENVIRONMENTAL ■ GEOTECHNICAL ■ INTERIOR DESIGN
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**WASTE WATER TREATMENT FACILITY IMPROVEMENTS
IN THE TOWN OF FULTON, ALABAMA
FOR THE
TOWN OF FULTON, ALABAMA**

**DRA PROJECT NO: AL-55118
GMC PROJECT NO: CMGM230141**

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MEMO

To: All Plan Holders

From: Craig Sanford, PE

Subject: Waste Water Treatment Facility Improvements
in the Town of Fulton, AL
for the Town of Fulton, AL
DRA Project No: AL-55118
GMC Project No: CMGM230141

Date: MAY 2025

Please be advised that all questions or comments for the above subject project will be accepted in writing from plan holders who have obtained bid documents from GMC. All questions or comments must be received in this office by 12:00 P.M., Thursday, July 17th , 2025.

You can EMAIL your questions or comments to jeremy.lewis@gmcnetwork.com. Appropriate responses will be issued only to those items considered necessary by the Engineer via an addendum.

ADVERTISEMENT FOR BIDS

Sealed bids, subject to the conditions contained herein, will be received by the Town of Fulton until 10:00 A.M., local time, Thursday, July 24, 2025, and then publicly opened and read at Fulton Town Hall located at 1910 Highway 178, Fulton, AL 36446 for furnishing all labor and materials and performing all work for construction of: WASTE WATER TREATMENT FACILITY IMPROVEMENTS.

The project consists of Eastside WWTP Improvements, including an additional Orenco WWT module, Trickling Filter Tank and Media Cleaning, Piping and Valve Replacement as well as instrumentation and controls improvements and related appurtenances.

The CONTRACT DOCUMENTS AND PLANS may be examined at the Fulton Town Hall or at the office of Goodwyn Mills Cawood, LLC.

Copies of the CONTRACT DOCUMENTS AND PLANS may be obtained at the office of Goodwyn Mills Cawood, LLC, by contacting Celina Beck. Email: celina.beck@gmcnetwork.com; upon payment of a one-time administrative fee of \$20.00 for digital access/file sharing access and/or payment of \$100.00 for each printed set. Said cost represents the cost of printing, reproduction, handling, and distribution, **therefore no refund will be granted**. No partial sets, individual pages or drawing sheets will be provided. No documents will be issued within 48 hours prior to bid opening.

All bidders must comply with the President's Executive Order Number 11246 which prohibits discrimination in employment regarding race, color, religion, sex, sexual orientation, gender identity, or national origin. All bidders must comply with title VI of the Civil Rights Act of 1964, the Anti-Kickback Act and the Contract Workhours Act. The attention of bidders is particularly called to the requirements as to conditions of employment to be observed and minimum wage rates to be paid under the Contract, Section 3, Segregated Facilities, Section 109 and E.O. 11246.

The Owner reserves the right to waive any informalities, or to reject any or all bids, and to award the contract to the lowest, most responsive and responsible bidder. All bidders must comply with requirements of the Contractor's Licensing Law of the State of Alabama and be certified for the type of work on which the proposal is submitted. Each bidder must deposit with his bid, security in the amount of, form of and subject to the conditions provided in the Information for Bidders.

Registration in SAM (System for Award Management) www.sam.gov is required to participate in ADECA projects and other Federal funding programs.

All Contractors preparing Bids for the referenced project shall submit a list of similar projects "successfully completed" in the last 5 years, having the same scope of work with construction cost similar to or greater than this project. All nonresident contractors preparing bids shall submit with the bid documents evidence of a current Alabama General Contractor's License, evidence (with original seal of the State of Alabama) of proper registration with the Alabama Secretary of State as a foreign corporation, and a Certificate of Good Standing as a Foreign Corporation from the State of Alabama Department of Revenue. Bids submitted by a nonresident contractor without these documents included will be rejected.

Guarantee will be required with each bid for at least 5% of the amount of the bid filed in the form of a certified check, Bid Bond, or irrevocable Letter of Credit acceptable to the owner payable to the **Town of Fulton**. Bid Bonds shall include certification that the bonding company is listed in Circular 570 of the U.S. Treasury Department. The name, address, telephone number, and contact person for the bonding company shall also be included.

No bidder may withdraw his bid within 60 days after the opening thereof. Bids may be held by the Owner for a period not to exceed sixty (60) days from the date of opening of bids for the purpose of reviewing the bids and investigating the qualifications of the bidders prior to awarding the contract. This project is being funded in part by DRA Project No. AL-55118.

The successful bidder will be required to submit 100% performance and payment bonds or an irrevocable "Letter of Credit" which is acceptable to the Owner. All bonds and letters of credit shall be for 100% of the contract price. Attention of Bidders is called to the license required by Title 34, Chapter 8, of the code of Alabama, 1975, and amendments thereto, relating to the licensing of General Contractors. No bid will be accepted from anyone, except a qualified Contractor, licensed by the State Licensing Board for General Contractors, unless otherwise required by the State Licensing Board.

All bids shall be submitted in a sealed envelope bearing on the outside the name of the Bidder, Bidder's license number, license expiration date, category, address and name of the project. Envelopes containing bids must be addressed as follows, and delivered to the ***Honorable Mike Norris, Mayor, 1910 Highway 178, Fulton, AL 36446: BID FOR WWTF IMPROVEMENTS IN THE TOWN OF FULTON, ALABAMA – DRA PROJECT NO. AL-55118***".

Bidders will be fully responsible for the delivery of their bids in a timely manner. Reliance upon U.S. Mail or other carriers is at the bidder's risk. Late bids will not be considered.

The Town of Fulton is an equal opportunity employer and encourages the participation of women and minority owned businesses (OMBES) and Section 3 qualified contractors in all project contract procurements.

Mike Norris, Mayor

3.

INFORMATION FOR BIDDERS

1. Receipt and Opening of Bids

The Town of Fulton (herein called the "Owner"), invites bids on the form attached hereto, all blanks of which must be appropriately filled in. Bids will be received by the Town of Fulton until 10:00 a.m., Thursday, July 24th, 2025, and then publicly opened and read aloud. The envelopes containing the bids must be sealed, addressed to Honorable Mike Norris, Mayor, Town of Fulton, 1910 Highway 178, Fulton, AL 36446 and designated as bid for WWTF IMPROVEMENTS IN THE TOWN OF FULTON, AL – DRA Project No. AL-55118.

The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within 60 days after the actual date of the opening thereof.

2. Preparation of Bid: Each bid must be submitted on the prescribed form and accompanied by Certification of Bidder Regarding Equal Employment Opportunity, (Page 00160); and Certification of Bidder Regarding Section 3 and Segregated Facilities, (Page 00165). All blank spaces for bid prices must be filled in, and the foregoing Certifications must be fully completed and executed when submitted.

Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, his/her address, contractor's license number, and the name of the project for which the bid is submitted. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed as specified in the bid form.

3. Subcontracts: The bidder is specifically advised that any person, for, or other party to whom it is proposed to award a subcontract under this contract:

- a. Must be acceptable to the Owner.
- b. Must submit Certification by Proposed Subcontractor Regarding Equal Employment Opportunity, (Page 00175); and Certification of Proposed Subcontractor Regarding Section 3 and Segregated Facilities, (Page 00180). Approval of the proposed subcontract award cannot be given by the Owner unless and until the proposed subcontractor has submitted the Certifications and/or other evidence showing that it has fully complied with any reporting requirements to which it is or was subject.

Although the bidder is not required to attach such Certifications by proposed subcontractors to his/her bid, the bidder is here advised of this requirement so that appropriate action can be taken to prevent subsequent delay in subcontract awards.

4. Telegraphic Modification: Any bidder may modify his/her bid by telegraphic communication at any time prior to the scheduled closing time for receipt of bids,

provided such telegraphic communication is received by the Owner prior to the closing time, and provided further, the Owner is satisfied that a written confirmation of the telegraphic modification over the signature of the bidder was mailed prior to the closing time. The telegraphic communication should not reveal the bid price but should provide the addition or subtraction or other modification so that the final prices or terms will not be known by the Owner until the sealed bid is opened. If written confirmation is not received within two days from the closing time, no consideration will be given to the telegraphic modification.

5. Method of Bidding: The Owner invites the following bid(s): Lump Sum
6. Qualifications of Bidder: The Owner may make such investigations as she/he deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional bids will not be accepted.
7. Bid Security: Each bid must be accompanied by cash, certified check of the bidder, or a bid bond prepared on the Bid Bond Form attached hereto, duly executed by the bidder as principal and having as surety thereon a surety company approved by the Owner, in the amount of 5% of the bid. Such cash, checks or bid bonds will be returned promptly after the Owner and the accepted bidder have executed the contract, or if no award has been made within 60 days after the date of the opening of bids, upon demand of the bidder at any time thereafter, so long as she/he has not been notified of the acceptance of his/her bid.
8. Liquidated Damages for Failure to Enter into Contract: The successful bidder, upon his/her failure or refusal to execute and deliver the contract and bonds required within fifteen (15) days after she/he has received notice of the acceptance of his/her bid, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposit with his/her bid.
9. Time of Completion and Liquidated Damages: Bidder must agree to commence work on or before a date to be specified in the written "Notice to Proceed" of the Owner and to fully complete the project within **120** consecutive calendar days thereafter. Bidder must agree also to pay as liquidated damages, the sum of **\$1000.00** for each consecutive calendar day thereafter as hereinafter provided in the General Conditions.
10. Conditions of Work: Each bidder must inform him/herself fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of his/her obligation to furnish all material and labor necessary to carry out the provisions of his/her contract. Insofar as possible, the contractor, in carrying out the work, must employ such methods or means as will not cause any interruption of or interference with the work of any other contractor.
11. Addenda and Interpretations: No interpretation of the meaning of the plans, specification or other pre-bid documents will be made to any bidder orally.

Every request for such interpretation should be emailed to Jeremy.lewis@gmcnetwork.com and to be given consideration must be received at least five (5) days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instruction will be in the form of written addenda to the specifications which, if issued, will be emailed to all prospective bidders (at the respective email addresses furnished for such purposes), not later than three (3) days prior to the date fixed for the opening of bids.

Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his/her bid as submitted. All addenda so issued shall become part of the contract documents.

12. Security for Faithful Performance: Simultaneously with his/her delivery of the executed contract, the contractor shall furnish a surety bond or bonds as security for faithful performance of this contract and for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract, as specified in the General Conditions included herein. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the Owner.
13. Power of Attorney: Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.
14. Notice of Special Conditions: Attention is particularly called to those parts of the contract documents and specifications which deal with the following:
 - a. Inspection and testing of materials.
 - b. Insurance requirements.
 - c. Wage rates.
 - d. Stated allowances.
15. Laws and Regulations: The bidder's attention is directed to the fact that all applicable State laws, municipal ordinances and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though herein written out in full.
16. Method of Award - Lowest Qualified Bidder: If at the time this contract is to be awarded, the lowest bid submitted by a responsible bidder does not exceed the amount of funds then estimated by the Owner as available to finance the contract, the contract will be awarded on the lowest bid. If such bid exceeds such amount, the Owner may reject all bids.
17. Obligation of Bidder: At the time of the opening of bids each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and contract documents (including all addenda). The failure or omission of any bidder to examine any form, instrument or document shall in no way relieve any bidder from any obligation in respect of his/her bid.
18. Safety Standards and Accident Prevention: With respect to all work performed under this contract, the contractor shall:
 - a. Comply with the safety standards provision of applicable laws, building and

construction codes and the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, the requirements of the Occupational Safety and Health Act of 1970 (Public Law 91-596), and the requirements of Title 29 of the Code of Federal Regulations, Section 1518 as published in the "Federal Register", Volume 36, No. 75, Saturday, April 17, 1971.

- b. Exercise every precaution at all times for the prevention of accidents and the protection of persons (including employees) and property.
- c. Maintain at his/her office or other well-known place at the job site, all articles necessary for giving first aid to the injured, and shall make standing arrangements for the immediate removal to a hospital or a doctor's care of persons (including employees), who may be injured on the job site before the employer has made a standing arrangement for removal of injured persons to a hospital or a doctor's care.

19. State of Alabama Licensing Requirements: In order for his/her bid to be received and considered, the bidder must comply with the applicable State law regarding contractor licensing requirements. Selected excerpts from the State law are presented below:

34-8-6. PROHIBITED ACTS; PENALTIES

Any person, firm or corporation not being duly authorized who shall engage in the business of general contracting in this State, except as provided for in this chapter, and any person, firm or corporation presenting or attempting to file as its own the license certificate of another, or who shall give false or forged evidence of any kind to the board, or to any member thereof, in obtaining a certificate of license, or who falsely shall impersonate another, or who shall use an expired or revoked certificate of license, and any person including an owner, architect or engineer who received or considers a bid from any one not properly licensed under this chapter, shall be deemed guilty of a misdemeanor and shall for each offense of which he is convicted be punished by a fine of not less than \$500.00 or imprisonment of six months, or both fine and imprisonment, in the discretion of the court.

The submission of the contractor's current license number before considering the bid shall be sufficient evidence to relieve the owner, architect, engineer or awarding authority of any liability under this chapter.

34-8-8. COPY OF CHAPTER TO BE INCLUDED IN PLANS OF ARCHITECTS AND ENGINEERS

All architects and engineers preparing plans and specifications for work to be contracted in the State of Alabama shall include in their invitations to bidders and their specifications a copy of this chapter or such portions thereof as are deemed necessary to convey to the invited bidder, whether he is a resident or nonresident of this state and whether a license has been issued to him or not, the information that it will be necessary for him to show evidence of license before his bid is considered. (Acts 1935, No. 297, p. 721; Code 1940 T. 46, Section 79; Acts 1959, No. 571, P. 1429).

NAME OF COMPANY: _____

ADDRESS OF COMPANY: _____

TELEPHONE NUMBER OF COMPANY: _____

COMPANY CONTACT PERSON: _____

CONTRACTOR'S CURRENT LICENSE NUMBER: _____

ISSUING AGENCY: STATE OF _____ EXPIRATION DATE: _____

BID LIMIT: _____ CLASSIFICATION: _____

20. Buy America Preference: The Grantee must comply with the requirements of the Build America, Buy America (BABA) Act, 41 USC 8301 note, and all applicable rules and notices, as may be amended, if applicable to the Grantee's infrastructure project. Pursuant to HUD's Notice, "Public Interest Phased Implementation Waiver for FY 2022 and 2023 of Build America, Buy America Provisions as Applied to Recipients of HUD Federal Financial Assistance" (88 FR 17001), any funds obligated by HUD on or after the applicable listed effective dates, are subject to BABA requirements, unless excepted by a waiver.

**WASTE WATER TREATMENT FACILITY IMPROVMENTS
IN THE TOWN OF FULTON, ALABAMA
FOR THE TOWN OF FULTON, ALABAMA
DRA PROJECT NO: AL-55118
GMC PROJECT NO: CMGM230141**

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____,
_____, as Principal, and
_____ as Surety, are hereby held and firmly bound unto
_____ Town of Fulton as Owner in the penal sum of Five Percent of Bid Amount ---5%--- for the
payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors,
administrators, successors and assigns. Signed, this _____ day of _____, _____.

The condition of the above obligation is such that whereas the Principal has submitted to
_____ a certain Bid, attached hereto and hereby made a part hereof to
enter into a contract in writing, for the WWTF IMPROVEMENTS IN THE TOWN OF FULTON, AL.
NOW, THEREFORE,

- a. If said Bid shall be rejected, or in the alternate.
- b. If said Bid shall be accepted and the principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid.

then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Principal (L.S.)

Surety

By: _____

SEAL

BID FOR LUMP SUM CONTRACTS

Place: Town of Fulton

Date: _____

DRA Project No: AL-55118

GMC Project No: CMGM230141

Proposal of _____ (hereinafter called "Bidder") * a corporation, organized and existing under the laws of the State of _____, * a partnership, or an individual doing business as _____.

To the TOWN OF FULTON (hereinafter called "Owner")

Gentlemen:

The Bidder, in compliance with your invitation for bids for the construction of WWTF IMPROVEMENTS IN THE TOWN OF FULTON, AL having examined the plans and specifications with related documents and the site of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of materials and labor, hereby proposes to furnish all labor, materials, and supplies; and to construct the project in accordance with the Contract Documents, within the time set forth therein, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this proposal is a part.

Bidder hereby agrees to commence work under this contract on or before a date to be specified in written "Notice to Proceed" of the Owner and to fully complete the project within 120 consecutive calendar days thereafter as stipulated in the specifications. Bidder further agrees to pay as liquidated damages, the sum of \$1000.00 for each consecutive calendar day thereafter as hereinafter provided in Paragraph 19 of the General Conditions.

Bidder acknowledges receipt of the following addendum:

BASE PROPOSAL: Bidder agrees to perform all of the work described in the specifications and shown on the plans for the sum of _____ (\$ _____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

The above lump sum prices shall include all labor, materials, bailing, shoring, removal, overhead, profit, insurance, etc., to cover the finished work of the several kinds called for. Changes shall be processed in accordance with paragraph 17(a) of the General Conditions.

Bidder understands that the Owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

The bidder agrees that this bid shall be good and may not be withdrawn for a period of **60** calendar days after the scheduled closing time for receiving bids.

Upon receipt of written notice of the acceptance of this bid, Bidder will execute the formal contract attached within ten (10) days and deliver a Surety Bond or Bonds as required by Paragraph 29 of the General Conditions.

The bid security attached in the sum of _____
_____ (\$ _____) is to become the property of
the Owner in the event the contract and bond are not executed within the time above set forth, as
liquidated damages for the delay and additional expense to the Owner caused thereby.

Respectfully submitted:

By: _____
(Signature)

(Title)

(Business Address)

(SEAL - if bid is by a corporation)

BID PROPOSAL

PROJECT: CANFOR EXPANSION WASTEWATER PLANT IMPROVEMENTS
FOR THE TOWN OF FULTON
GMC PROJECT NO. CMGM-230141

BIDDER: _____

<u>ITEM</u>	<u>QTY.</u>	<u>UNIT</u>	<u>DESCRIPTION</u>	<u>UNIT PRICE</u>	<u>TOTAL PRICE</u>
1	1	LS	Mobilization	_____	_____
2	1	LS	Installation and Integration of New Treatment Unit	_____	_____
3	1	LS	Removal of Existing Influent Pipe	_____	_____
4	1	LS	Flow Meters Replacement	_____	_____
5	1	LS	Bypass Pumping	_____	_____
6	1	LS	Chain Link Fences & Gates	_____	_____
7	1	LS	Electrical and Instrumentation	_____	_____
8	1	LS	Site Work	_____	_____
9	1	LS	Existing System Replacement and Repairs	_____	_____
10	1	LS	Yard Piping, Fittings, Valves and Appurtenances	_____	_____
11	1	LS	Erosion Control Measures	_____	_____
12	1	LS	Cleanup, Seeding, Grassing, Mulching, Landscape, & Site Restoration	_____	_____
13	1	LS	Allowance - Construction Material Testing	_____	25,000.00
14	1	LS	Allowance - Engineering Startup	_____	5,000.00
15	1	LS	Allowance - Stormwater/Erosion Control Inspection	_____	10,000.00
16	1	LS	Allowance - Owner's Contingency	_____	50,000.00
TOTAL BID				\$	_____

The above price shall include all labor, materials, bailing, shoring, removal, overhead, profit, insurance, etc. to cover the finished work of the several kinds called for.

Bidder understands that the Owner reserves the right to reject any or all bids and to waive informalities in the bidding.

The bidder agrees that this bid shall be good and may not be withdrawn for a period of 60 calendar days after the scheduled closing time for receiving bids.

Upon receipt of written notice of the acceptance of this bid, bidder will execute the formal contract attached within fifteen (15) days and deliver a Surety Bond or Bonds as required by Paragraph 29 of the General Conditions.

The bid security attached in the sum of _____ (\$ _____) is to become the property of the Owner in the event the contract and bond are not executed within the time set forth, as liquidated damages for the delay and additional expense to the Owner caused thereby.

Respectfully submitted:

By: _____

Title: _____

Company: _____

(Business Address & Zip Code)

(Seal - if bid is by a corporation)

**ACCOUNTING OF SALES TAX
Attachment to Proposal Form**

To: _____ TOWN OF FULTON _____ Date: _____
(Awarding Authority)

NAME OF PROJECT

Waste Water Treatment Facility Improvements

SALES TAX ACCOUNTING

Pursuant to Act 2018-234, the Contractor accounts for the sales tax NOT included in the bid proposal form as follows:

ESTIMATED SALES TAX AMOUNT

BID: \$ _____

Failure to provide an accounting of sales tax shall render the bid non-responsive. Other than determining responsiveness, sales tax accounting shall not affect the bid pricing nor be considered in the determination of the lowest responsible and responsive bidder.

Legal Name of Bidder

Mailing Address

***By (Legal Signature)**

***Name (type or print)**

***Title**

Telephone Number

(Seal)

IMMIGRATION STATUS VERIFICATION

1.1 GENERAL:

- A. Bidders are hereby reminded that they are required to comply with requirements of Alabama Immigration Law, Act 2011-535 (also referred to as the "Beason-Hammon Alabama Taxpayer and Citizen Protection Act", or H.B. 658), as amended by Act No. 2012-491, including in part and effective January 1, 2012, **enrollment in the E-Verify Program of the United States Department of Homeland Security:**
1. Contractor's signed "E-Verify Memorandum of Understanding" will be required to be attached to any Contract awarded.
 2. General Contractors and Subcontractors shall be enrolled in, participate in and maintain compliance for the duration of this contract, and as otherwise required by statute.
- B. The following statement shall and will be included in the Contract for Construction:
- "By signing this contract, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the state of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom."***
- C. Additional information and Guidance is available at the following websites:
1. E-Verify portal maintained by State of Alabama: <http://immigration.alabama.gov>
 2. Alabama Office of the Attorney General Website:
<http://www.ago.alabama.gov/Page-Immigration>
 3. Alabama Building Commission:
<http://www.bc.state.al.us/PDFs/Bulletins/GuidanceonAct2012-491-DatedMay-29-2012.pdf>
 4. US Department of Homeland Security, E-Verify:
www.dhs.gov/E-Verify

END OF SECTION

Company ID Number:

**THE E-VERIFY
MEMORANDUM OF UNDERSTANDING
FOR EMPLOYERS**

**ARTICLE I
PURPOSE AND AUTHORITY**

The parties to this agreement are the Department of Homeland Security (DHS) and the _____ (Employer). The purpose of this agreement is to set forth terms and conditions which the Employer will follow while participating in E-Verify.

E-Verify is a program that electronically confirms an employee's eligibility to work in the United States after completion of Form I-9, Employment Eligibility Verification (Form I-9). This Memorandum of Understanding (MOU) explains certain features of the E-Verify program and describes specific responsibilities of the Employer, the Social Security Administration (SSA), and DHS.

Authority for the E-Verify program is found in Title IV, Subtitle A, of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996 (IIRIRA), Pub. L. 104-208, 110 Stat. 3009, as amended (8 U.S.C. § 1324a note). The Federal Acquisition Regulation (FAR) Subpart 22.18, "Employment Eligibility Verification" and Executive Order 12989, as amended, provide authority for Federal contractors and subcontractors (Federal contractor) to use E-Verify to verify the employment eligibility of certain employees working on Federal contracts.

**ARTICLE II
RESPONSIBILITIES**

A. RESPONSIBILITIES OF THE EMPLOYER

1. The Employer agrees to display the following notices supplied by DHS in a prominent place that is clearly visible to prospective employees and all employees who are to be verified through the system:
 - a. Notice of E-Verify Participation
 - b. Notice of Right to Work
2. The Employer agrees to provide to the SSA and DHS the names, titles, addresses, and telephone numbers of the Employer representatives to be contacted about E-Verify. The Employer also agrees to keep such information current by providing updated information to SSA and DHS whenever the representatives' contact information changes.
3. The Employer agrees to grant E-Verify access only to current employees who need E-Verify access. Employers must promptly terminate an employee's E-Verify access if the employer is separated from the company or no longer needs access to E-Verify.

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4. The Employer agrees to become familiar with and comply with the most recent version of the E-Verify User Manual.
 5. The Employer agrees that any Employer Representative who will create E-Verify cases will complete the E-Verify Tutorial before that individual creates any cases.
 - a. The Employer agrees that all Employer representatives will take the refresher tutorials when prompted by E-Verify in order to continue using E-Verify. Failure to complete a refresher tutorial will prevent the Employer Representative from continued use of E-Verify.
 6. The Employer agrees to comply with current Form I-9 procedures, with two exceptions:
 - a. If an employee presents a "List B" identity document, the Employer agrees to only accept "List B" documents that contain a photo. (List B documents identified in 8 C.F.R. § 274a.2(b)(1)(B)) can be presented during the Form I-9 process to establish identity.) If an employee objects to the photo requirement for religious reasons, the Employer should contact E-Verify at 888-464-4218.
 - b. If an employee presents a DHS Form I-551 (Permanent Resident Card), Form I-766 (Employment Authorization Document), or U.S. Passport or Passport Card to complete Form I-9, the Employer agrees to make a photocopy of the document and to retain the photocopy with the employee's Form I-9. The Employer will use the photocopy to verify the photo and to assist DHS with its review of photo mismatches that employees contest. DHS may in the future designate other documents that activate the photo screening tool.
- Note: Subject only to the exceptions noted previously in this paragraph, employees still retain the right to present any List A, or List B and List C, document(s) to complete the Form I-9.
7. The Employer agrees to record the case verification number on the employee's Form I-9 or to print the screen containing the case verification number and attach it to the employee's Form I-9.
 8. The Employer agrees that, although it participates in E-Verify, the Employer has a responsibility to complete, retain, and make available for inspection Forms I-9 that relate to its employees, or from other requirements of applicable regulations or laws, including the obligation to comply with the antidiscrimination requirements of section 274B of the INA with respect to Form I-9 procedures.
 - a. The following modified requirements are the only exceptions to an Employer's obligation to not employ unauthorized workers and comply with the anti-discrimination provision of the INA: (1) List B identity documents must have photos, as described in paragraph 6 above; (2) When an Employer confirms the identity and employment eligibility of newly hired employee using E-Verify procedures, the Employer establishes a rebuttable presumption that it has not violated section 274A(a)(1)(A) of the Immigration and Nationality Act (INA) with respect to the hiring of that employee; (3) If the Employer receives a final nonconfirmation for an employee, but continues to employ that person, the Employer must notify DHS and the Employer is subject to a civil money penalty between \$550 and \$1,100 for each failure to notify DHS of continued employment following a final nonconfirmation; (4) If the Employer continues to employ an employee after receiving a final nonconfirmation, then the Employer is subject to a rebuttable presumption that it has knowingly

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employed an unauthorized alien in violation of section 274A(a)(1)(A); and (5) no E-Verify participant is civilly or criminally liable under any law for any action taken in good faith based on information provided through the E-Verify.

b. DHS reserves the right to conduct Form I-9 compliance inspections, as well as any other enforcement or compliance activity authorized by law, including site visits, to ensure proper use of E-Verify.

9. The Employer is strictly prohibited from creating an E-Verify case before the employee has been hired, meaning that a firm offer of employment was extended and accepted and Form I-9 was completed. The Employer agrees to create an E-Verify case for new employees within three Employer business days after each employee has been hired (after both Sections 1 and 2 of Form I-9 have been completed), and to complete as many steps of the E-Verify process as are necessary according to the E-Verify User Manual. If E-Verify is temporarily unavailable, the three-day time period will be extended until it is again operational in order to accommodate the Employer's attempting, in good faith, to make inquiries during the period of unavailability.

10. The Employer agrees not to use E-Verify for pre-employment screening of job applicants, in support of any unlawful employment practice, or for any other use that this MOU or the E-Verify User Manual does not authorize.

11. The Employer must use E-Verify for all new employees. The Employer will not verify selectively and will not verify employees hired before the effective date of this MOU. Employers who are Federal contractors may qualify for exceptions to this requirement as described in Article II.B of this MOU.

12. The Employer agrees to follow appropriate procedures (see Article III below) regarding tentative nonconfirmations. The Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify case. The Employer agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer agrees to provide written referral instructions to employees and instruct affected employees to bring the English copy of the letter to the SSA. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending. Further, when employees contest a tentative nonconfirmation based upon a photo mismatch, the Employer must take additional steps (see Article III.B. below) to contact DHS with information necessary to resolve the challenge.

13. The Employer agrees not to take any adverse action against an employee based upon the employee's perceived employment eligibility status while SSA or DHS is processing the verification request unless the Employer obtains knowledge (as defined in 8 C.F.R. § 274a.1(l)) that the employee is not work authorized. The Employer understands that an initial inability of the SSA or DHS automated verification system to verify work authorization, a tentative nonconfirmation, a case in continuance (indicating the need for additional time for the government to resolve a case), or the finding of a photo mismatch, does not establish, and should not be interpreted as, evidence that the employee is not work authorized. In any of such cases, the employee must be provided a full and fair opportunity to contest the finding, and if he or she does so, the employee may not be terminated or suffer any adverse employment consequences based upon the employee's perceived employment eligibility status

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(including denying, reducing, or extending work hours, delaying or preventing training, requiring an employee to work in poorer conditions, withholding pay, refusing to assign the employee to a Federal contract or other assignment, or otherwise assuming that he or she is unauthorized to work) until and unless secondary verification by SSA or DHS has been completed and a final nonconfirmation has been issued. If the employee does not choose to contest a tentative nonconfirmation or a photo mismatch or if a secondary verification is completed and a final nonconfirmation is issued, then the Employer can find the employee is not work authorized and terminate the employee's employment. Employers or employees with questions about a final nonconfirmation may call E-Verify at 1-888-464-4218 (customer service) or 1-888-897-7781 (worker hotline).

14. The Employer agrees to comply with Title VII of the Civil Rights Act of 1964 and section 274B of the INA as applicable by not discriminating unlawfully against any individual in hiring, firing, employment eligibility verification, or recruitment or referral practices because of his or her national origin or citizenship status, or by committing discriminatory documentary practices. The Employer understands that such illegal practices can include selective verification or use of E-Verify except as provided in part D below, or discharging or refusing to hire employees because they appear or sound "foreign" or have received tentative nonconfirmations. The Employer further understands that any violation of the immigration-related unfair employment practices provisions in section 274B of the INA could subject the Employer to civil penalties, back pay awards, and other sanctions, and violations of Title VII could subject the Employer to back pay awards, compensatory and punitive damages. Violations of either section 274B of the INA or Title VII may also lead to the termination of its participation in E-Verify. If the Employer has any questions relating to the anti-discrimination provision, it should contact OSC at 1-800-255-8155 or 1-800-237-2515 (TDD).

15. The Employer agrees that it will use the information it receives from E-Verify only to confirm the employment eligibility of employees as authorized by this MOU. The Employer agrees that it will safeguard this information, and means of access to it (such as PINS and passwords), to ensure that it is not used for any other purpose and as necessary to protect its confidentiality, including ensuring that it is not disseminated to any person other than employees of the Employer who are authorized to perform the Employer's responsibilities under this MOU, except for such dissemination as may be authorized in advance by SSA or DHS for legitimate purposes.

16. The Employer agrees to notify DHS immediately in the event of a breach of personal information. Breaches are defined as loss of control or unauthorized access to E-Verify personal data. All suspected or confirmed breaches should be reported by calling 1-888-464-4218 or via email at E-Verify@dhs.gov. Please use "Privacy Incident – Password" in the subject line of your email when sending a breach report to E-Verify.

17. The Employer acknowledges that the information it receives from SSA is governed by the Privacy Act (5 U.S.C. § 552a(i)(1) and (3)) and the Social Security Act (42 U.S.C. 1306(a)). Any person who obtains this information under false pretenses or uses it for any purpose other than as provided for in this MOU may be subject to criminal penalties.

18. The Employer agrees to cooperate with DHS and SSA in their compliance monitoring and evaluation of E-Verify, which includes permitting DHS, SSA, their contractors and other agents, upon

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reasonable notice, to review Forms I-9 and other employment records and to interview it and its employees regarding the Employer's use of E-Verify, and to respond in a prompt and accurate manner to DHS requests for information relating to their participation in E-Verify.

19. The Employer shall not make any false or unauthorized claims or references about its participation in E-Verify on its website, in advertising materials, or other media. The Employer shall not describe its services as federally-approved, federally-certified, or federally-recognized, or use language with a similar intent on its website or other materials provided to the public. Entering into this MOU does not mean that E-Verify endorses or authorizes your E-Verify services and any claim to that effect is false.

20. The Employer shall not state in its website or other public documents that any language used therein has been provided or approved by DHS, USCIS or the Verification Division, without first obtaining the prior written consent of DHS.

21. The Employer agrees that E-Verify trademarks and logos may be used only under license by DHS/USCIS (see [M-795 \(Web\)](#)) and, other than pursuant to the specific terms of such license, may not be used in any manner that might imply that the Employer's services, products, websites, or publications are sponsored by, endorsed by, licensed by, or affiliated with DHS, USCIS, or E-Verify.

22. The Employer understands that if it uses E-Verify procedures for any purpose other than as authorized by this MOU, the Employer may be subject to appropriate legal action and termination of its participation in E-Verify according to this MOU.

B. RESPONSIBILITIES OF FEDERAL CONTRACTORS

1. If the Employer is a Federal contractor with the FAR E-Verify clause subject to the employment verification terms in Subpart 22.18 of the FAR, it will become familiar with and comply with the most current version of the E-Verify User Manual for Federal Contractors as well as the E-Verify Supplemental Guide for Federal Contractors.

2. In addition to the responsibilities of every employer outlined in this MOU, the Employer understands that if it is a Federal contractor subject to the employment verification terms in Subpart 22.18 of the FAR it must verify the employment eligibility of any "employee assigned to the contract" (as defined in FAR 22.1801). Once an employee has been verified through E-Verify by the Employer, the Employer may not create a second case for the employee through E-Verify.

a. An Employer that is not enrolled in E-Verify as a Federal contractor at the time of a contract award must enroll as a Federal contractor in the E-Verify program within 30 calendar days of contract award and, within 90 days of enrollment, begin to verify employment eligibility of new hires using E-Verify. The Employer must verify those employees who are working in the United States, whether or not they are assigned to the contract. Once the Employer begins verifying new hires, such verification of new hires must be initiated within three business days after the hire date. Once enrolled in E-Verify as a Federal contractor, the Employer must begin verification of employees assigned to the contract within 90 calendar days after the date of enrollment or within 30 days of an employee's assignment to the contract, whichever date is later.

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b. Employers enrolled in E-Verify as a Federal contractor for 90 days or more at the time of a contract award must use E-Verify to begin verification of employment eligibility for new hires of the Employer who are working in the United States, whether or not assigned to the contract, within three business days after the date of hire. If the Employer is enrolled in E-Verify as a Federal contractor for 90 calendar days or less at the time of contract award, the Employer must, within 90 days of enrollment, begin to use E-Verify to initiate verification of new hires of the contractor who are working in the United States, whether or not assigned to the contract. Such verification of new hires must be initiated within three business days after the date of hire. An Employer enrolled as a Federal contractor in E-Verify must begin verification of each employee assigned to the contract within 90 calendar days after date of contract award or within 30 days after assignment to the contract, whichever is later.

c. Federal contractors that are institutions of higher education (as defined at 20 U.S.C. 1001(a)), state or local governments, governments of Federally recognized Indian tribes, or sureties performing under a takeover agreement entered into with a Federal agency under a performance bond may choose to only verify new and existing employees assigned to the Federal contract. Such Federal contractors may, however, elect to verify all new hires, and/or all existing employees hired after November 6, 1986. Employers in this category must begin verification of employees assigned to the contract within 90 calendar days after the date of enrollment or within 30 days of an employee's assignment to the contract, whichever date is later.

d. Upon enrollment, Employers who are Federal contractors may elect to verify employment eligibility of all existing employees working in the United States who were hired after November 6, 1986, instead of verifying only those employees assigned to a covered Federal contract. After enrollment, Employers must elect to verify existing staff following DHS procedures and begin E-Verify verification of all existing employees within 180 days after the election.

e. The Employer may use a previously completed Form I-9 as the basis for creating an E-Verify case for an employee assigned to a contract as long as:

- i. That Form I-9 is complete (including the SSN) and complies with Article II.A.6,
- ii. The employee's work authorization has not expired, and
- iii. The Employer has reviewed the Form I-9 information either in person or in communications with the employee to ensure that the employee's Section 1, Form I-9 attestation has not changed (including, but not limited to, a lawful permanent resident alien having become a naturalized U.S. citizen).

f. The Employer shall complete a new Form I-9 consistent with Article II.A.6 or update the previous Form I-9 to provide the necessary information if:

- i. The Employer cannot determine that Form I-9 complies with Article II.A.6,
- ii. The employee's basis for work authorization as attested in Section 1 has expired or changed, or
- iii. The Form I-9 contains no SSN or is otherwise incomplete.

Note: If Section 1 of Form I-9 is otherwise valid and up-to-date and the form otherwise complies with

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Article II.C.5, but reflects documentation (such as a U.S. passport or Form I-551) that expired after completing Form I-9, the Employer shall not require the production of additional documentation, or use the photo screening tool described in Article II.A.5, subject to any additional or superseding instructions that may be provided on this subject in the E-Verify User Manual.

g. The Employer agrees not to require a second verification using E-Verify of any assigned employee who has previously been verified as a newly hired employee under this MOU or to authorize verification of any existing employee by any Employer that is not a Federal contractor based on this Article.

3. The Employer understands that if it is a Federal contractor, its compliance with this MOU is a performance requirement under the terms of the Federal contract or subcontract, and the Employer consents to the release of information relating to compliance with its verification responsibilities under this MOU to contracting officers or other officials authorized to review the Employer's compliance with Federal contracting requirements.

C. RESPONSIBILITIES OF SSA

1. SSA agrees to allow DHS to compare data provided by the Employer against SSA's database. SSA sends DHS confirmation that the data sent either matches or does not match the information in SSA's database.

2. SSA agrees to safeguard the information the Employer provides through E-Verify procedures. SSA also agrees to limit access to such information, as is appropriate by law, to individuals responsible for the verification of Social Security numbers or responsible for evaluation of E-Verify or such other persons or entities who may be authorized by SSA as governed by the Privacy Act (5 U.S.C. § 552a), the Social Security Act (42 U.S.C. 1306(a)), and SSA regulations (20 CFR Part 401).

3. SSA agrees to provide case results from its database within three Federal Government work days of the initial inquiry. E-Verify provides the information to the Employer.

4. SSA agrees to update SSA records as necessary if the employee who contests the SSA tentative nonconfirmation visits an SSA field office and provides the required evidence. If the employee visits an SSA field office within the eight Federal Government work days from the date of referral to SSA, SSA agrees to update SSA records, if appropriate, within the eight-day period unless SSA determines that more than eight days may be necessary. In such cases, SSA will provide additional instructions to the employee. If the employee does not visit SSA in the time allowed, E-Verify may provide a final nonconfirmation to the employer.

Note: If an Employer experiences technical problems, or has a policy question, the employer should contact E-Verify at 1-888-464-4218.

D. RESPONSIBILITIES OF DHS

1. DHS agrees to provide the Employer with selected data from DHS databases to enable the Employer to conduct, to the extent authorized by this MOU:

a. Automated verification checks on alien employees by electronic means, and

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- b. Photo verification checks (when available) on employees.
2. DHS agrees to assist the Employer with operational problems associated with the Employer's participation in E-Verify. DHS agrees to provide the Employer names, titles, addresses, and telephone numbers of DHS representatives to be contacted during the E-Verify process.
3. DHS agrees to provide to the Employer with access to E-Verify training materials as well as an E-Verify User Manual that contain instructions on E-Verify policies, procedures, and requirements for both SSA and DHS, including restrictions on the use of E-Verify.
4. DHS agrees to train Employers on all important changes made to E-Verify through the use of mandatory refresher tutorials and updates to the E-Verify User Manual. Even without changes to E-Verify, DHS reserves the right to require employers to take mandatory refresher tutorials.
5. DHS agrees to provide to the Employer a notice, which indicates the Employer's participation in E-Verify. DHS also agrees to provide to the Employer anti-discrimination notices issued by the Office of Special Counsel for Immigration-Related Unfair Employment Practices (OSC), Civil Rights Division, U.S. Department of Justice.
6. DHS agrees to issue each of the Employer's E-Verify users a unique user identification number and password that permits them to log in to E-Verify.
7. DHS agrees to safeguard the information the Employer provides, and to limit access to such information to individuals responsible for the verification process, for evaluation of E-Verify, or to such other persons or entities as may be authorized by applicable law. Information will be used only to verify the accuracy of Social Security numbers and employment eligibility, to enforce the INA and Federal criminal laws, and to administer Federal contracting requirements.
8. DHS agrees to provide a means of automated verification that provides (in conjunction with SSA verification procedures) confirmation or tentative nonconfirmation of employees' employment eligibility within three Federal Government work days of the initial inquiry.
9. DHS agrees to provide a means of secondary verification (including updating DHS records) for employees who contest DHS tentative nonconfirmations and photo mismatch tentative nonconfirmations. This provides final confirmation or nonconfirmation of the employees' employment eligibility within 10 Federal Government work days of the date of referral to DHS, unless DHS determines that more than 10 days may be necessary. In such cases, DHS will provide additional verification instructions.

ARTICLE III

REFERRAL OF INDIVIDUALS TO SSA AND DHS

A. REFERRAL TO SSA

1. If the Employer receives a tentative nonconfirmation issued by SSA, the Employer must print the notice as directed by E-Verify. The Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify

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case. The Employer also agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer agrees to provide written referral instructions to employees and instruct affected employees to bring the English copy of the letter to the SSA. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending.

2. The Employer agrees to obtain the employee's response about whether he or she will contest the tentative nonconfirmation as soon as possible after the Employer receives the tentative nonconfirmation. Only the employee may determine whether he or she will contest the tentative nonconfirmation.

3. After a tentative nonconfirmation, the Employer will refer employees to SSA field offices only as directed by E-Verify. The Employer must record the case verification number, review the employee information submitted to E-Verify to identify any errors, and find out whether the employee contests the tentative nonconfirmation. The Employer will transmit the Social Security number, or any other corrected employee information that SSA requests, to SSA for verification again if this review indicates a need to do so.

4. The Employer will instruct the employee to visit an SSA office within eight Federal Government work days. SSA will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it determines that more than 10 days is necessary.

5. While waiting for case results, the Employer agrees to check the E-Verify system regularly for case updates.

6. The Employer agrees not to ask the employee to obtain a printout from the Social Security Administration number database (the Numident) or other written verification of the SSN from the SSA.

B. REFERRAL TO DHS

1. If the Employer receives a tentative nonconfirmation issued by DHS, the Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify case. The Employer also agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending.

2. The Employer agrees to obtain the employee's response about whether he or she will contest the tentative nonconfirmation as soon as possible after the Employer receives the tentative nonconfirmation. Only the employee may determine whether he or she will contest the tentative nonconfirmation.

3. The Employer agrees to refer individuals to DHS only when the employee chooses to contest a tentative nonconfirmation.

4. If the employee contests a tentative nonconfirmation issued by DHS, the Employer will instruct the

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employee to contact DHS through its toll-free hotline (as found on the referral letter) within eight Federal Government work days.

5. If the Employer finds a photo mismatch, the Employer must provide the photo mismatch tentative nonconfirmation notice and follow the instructions outlined in paragraph 1 of this section for tentative nonconfirmations, generally.

6. The Employer agrees that if an employee contests a tentative nonconfirmation based upon a photo mismatch, the Employer will send a copy of the employee's Form I-551, Form I-766, U.S. Passport, or passport card to DHS for review by:

- a. Scanning and uploading the document, or
- b. Sending a photocopy of the document by express mail (furnished and paid for by the employer).

7. The Employer understands that if it cannot determine whether there is a photo match/mismatch, the Employer must forward the employee's documentation to DHS as described in the preceding paragraph. The Employer agrees to resolve the case as specified by the DHS representative who will determine the photo match or mismatch.

8. DHS will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it determines that more than 10 days is necessary.

9. While waiting for case results, the Employer agrees to check the E-Verify system regularly for case updates.

ARTICLE IV SERVICE PROVISIONS

A. NO SERVICE FEES

1. SSA and DHS will not charge the Employer for verification services performed under this MOU. The Employer is responsible for providing equipment needed to make inquiries. To access E-Verify, an Employer will need a personal computer with Internet access.

ARTICLE V MODIFICATION AND TERMINATION

A. MODIFICATION

1. This MOU is effective upon the signature of all parties and shall continue in effect for as long as the SSA and DHS operates the E-Verify program unless modified in writing by the mutual consent of all parties.

2. Any and all E-Verify system enhancements by DHS or SSA, including but not limited to E-Verify checking against additional data sources and instituting new verification policies or procedures, will be covered under this MOU and will not cause the need for a supplemental MOU that outlines these changes.

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B. TERMINATION

1. The Employer may terminate this MOU and its participation in E-Verify at any time upon 30 days prior written notice to the other parties.
2. Notwithstanding Article V, part A of this MOU, DHS may terminate this MOU, and thereby the Employer's participation in E-Verify, with or without notice at any time if deemed necessary because of the requirements of law or policy, or upon a determination by SSA or DHS that there has been a breach of system integrity or security by the Employer, or a failure on the part of the Employer to comply with established E-Verify procedures and/or legal requirements. The Employer understands that if it is a Federal contractor, termination of this MOU by any party for any reason may negatively affect the performance of its contractual responsibilities. Similarly, the Employer understands that if it is in a state where E-Verify is mandatory, termination of this by any party MOU may negatively affect the Employer's business.
3. An Employer that is a Federal contractor may terminate this MOU when the Federal contract that requires its participation in E-Verify is terminated or completed. In such cases, the Federal contractor must provide written notice to DHS. If an Employer that is a Federal contractor fails to provide such notice, then that Employer will remain an E-Verify participant, will remain bound by the terms of this MOU that apply to non-Federal contractor participants, and will be required to use the E-Verify procedures to verify the employment eligibility of all newly hired employees.
4. The Employer agrees that E-Verify is not liable for any losses, financial or otherwise, if the Employer is terminated from E-Verify.

ARTICLE VI

PARTIES

- A. Some or all SSA and DHS responsibilities under this MOU may be performed by contractor(s), and SSA and DHS may adjust verification responsibilities between each other as necessary. By separate agreement with DHS, SSA has agreed to perform its responsibilities as described in this MOU.
- B. Nothing in this MOU is intended, or should be construed, to create any right or benefit, substantive or procedural, enforceable at law by any third party against the United States, its agencies, officers, or employees, or against the Employer, its agents, officers, or employees.
- C. The Employer may not assign, directly or indirectly, whether by operation of law, change of control or merger, all or any part of its rights or obligations under this MOU without the prior written consent of DHS, which consent shall not be unreasonably withheld or delayed. Any attempt to sublicense, assign, or transfer any of the rights, duties, or obligations herein is void.
- D. Each party shall be solely responsible for defending any claim or action against it arising out of or related to E-Verify or this MOU, whether civil or criminal, and for any liability wherefrom, including (but not limited to) any dispute between the Employer and any other person or entity regarding the applicability of Section 403(d) of IIRIRA to any action taken or allegedly taken by the Employer.
- E. The Employer understands that its participation in E-Verify is not confidential information and may be disclosed as authorized or required by law and DHS or SSA policy, including but not limited to,

Company ID Number:

Congressional oversight, E-Verify publicity and media inquiries, determinations of compliance with Federal contractual requirements, and responses to inquiries under the Freedom of Information Act (FOIA).

F. The individuals whose signatures appear below represent that they are authorized to enter into this MOU on behalf of the Employer and DHS respectively. The Employer understands that any inaccurate statement, representation, data or other information provided to DHS may subject the Employer, its subcontractors, its employees, or its representatives to: (1) prosecution for false statements pursuant to 18 U.S.C. 1001 and/or; (2) immediate termination of its MOU and/or; (3) possible debarment or suspension.

G. The foregoing constitutes the full agreement on this subject between DHS and the Employer.

To be accepted as an E-Verify participant, you should only sign the Employer's Section of the signature page. If you have any questions, contact E-Verify at 1-888-464-4218.

Company ID Number:

Approved by:

Employer	
Name (Please Type or Print)	Title
Signature	Date
Department of Homeland Security – Verification Division	
Name (Please Type or Print)	Title
Signature	Date

Company ID Number:

Information Required for the E-Verify Program	
Information relating to your Company:	
Company Name	
Company Facility Address	
Company Alternate Address	
County or Parish	
Employer Identification Number	
North American Industry Classification Systems Code	
Parent Company	
Number of Employees	
Number of Sites Verified for	

Are you verifying for more than 1 site? If yes, please provide the number of sites verified for in each State:

[illegible][illegible]

Information relating to the Program Administrator(s) for your Company on policy questions or operational problems:

[illegible]

[illegible]

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State of Alabama)

County of Clarke)

CERTIFICATE OF COMPLIANCE WITH THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN PROTECTION ACT (ACT 2011-535, as amended by Act 2012-491)

DATE: _____

RE Contract/Grant/Incentive (describe by number or subject): WWTP Improvements - AL-55118 by and between _____ (Contractor/Grantee) and Delta Regional Authority (DRA) (State Agency or Department or other Public Entity)

The undersigned hereby certifies to the State of Alabama as follows:

1. The undersigned holds the position of _____ with the Contractor/Grantee named above, and is authorized to provide representations set out in this Certificate as the official and binding act of that entity, and has knowledge of the provisions of THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN PROTECTION ACT (ACT 2011-535 of the Alabama Legislature, as amended by Act 2012-491) which is described herein as "the Act".
2. Using the following definitions from Section 3 of the Act, select and initial either (a) or (b), below, to describe the Contractor/Grantee's business structure.

BUSINESS ENTITY. Any person or group of persons employing one or more persons performing or engaging in any activity, enterprise, profession, or occupation for gain, benefit, advantage, or livelihood, whether for profit or not for profit. "Business entity" shall include, but not be limited to the following:

- a. Self-employed individuals, business entities filing articles of incorporation, partnerships, limited partnerships, limited liability companies, foreign corporations, foreign limited partnerships, foreign limited liability companies authorized to transact business in this state, business trusts, and any business entity that registers with the Secretary of State.
- b. Any business entity that possesses a business license, permit, certificate, approval, registration, charter, or similar form of authorization issued by the state, any business entity that is exempt by law from obtaining such a business license, and any business entity that is operating unlawfully without a business license.

EMPLOYER. Any person, firm, corporation, partnership, joint stock association, agent, manager, representative, foreman, or other person having control or custody of any employment, place of employment, or of any employee, including any person or entity employing any person for hire within the State of Alabama, including a public employer. This term shall not include the occupant of a household contracting with another person to perform casual domestic labor within the household.

____ (a) The Contractor/Grantee is a business entity or employer as those terms are defined in Section 3 of the Act.

____ (b) The Contractor/Grantee is not is a business entity or employer as those terms are defined in Section 3 of the Act.

3. As of the date of this Certificate, Contractor/Grantee does not knowingly employ an unauthorized alien within the State of Alabama and hereafter it will not knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama;
4. Contractor/Grantee is enrolled in E-Verify unless it is not eligible to enroll because of the rules of that program or other factors beyond its control.

Certified this _____ day of _____ 20____.

Name of Contractor/Grantee/Recipient

By: _____

Its _____

The above Certification was signed in my presence by the person whose name appears above, on

this _____ day of _____ 20____.

WITNESS: _____

Print Name of Witness

CERTIFICATION FOR CONTRACTS, GRANTS, LOANS, AND COOPERATIVE AGREEMENTS

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

DRA Grant No: AL-55118

Name & Title of Signer (Print or Type)

Signature

Date

7.

CERTIFICATION OF BIDDER REGARDING EQUAL EMPLOYMENT OPPORTUNITY

CERTIFICATION OF BIDDER
REGARDING EQUAL EMPLOYMENT OPPORTUNITY

Instructions

This certification is required pursuant to Executive Order 11246 (30 F.R. 12319-25). The implementing rules and regulations provide that any bidder or prospective contractor, or any of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause, and if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the bidder has not filed a compliance report due under applicable instructions, such bidder shall be required to submit a compliance report within seven (7) calendar days after bid opening. No contract shall be awarded unless such report is submitted.

Certification of Bidder

Name and Address of Bidder (include zip code)

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause.

Yes _____ No _____

2. Compliance reports were required to be filed in connection with such contract or subcontract.

Yes _____ No _____

3. Bidder has filed all compliance reports due under applicable instructions, including Monthly Employment Utilization Report (257).

Yes _____ No _____ None Required _____

4. Have you ever been or are you being considered for sanction due to violation of Executive Order 11246, as amended?

Yes _____ No _____

Name and Title of Signer (please type)

Signature

Date

RESTRICTIONS ON THE AWARD OF CERTAIN CONTRACTS
AND SUBCONTRACTS TO FOREIGN COUNTRIES
Section 109 Public Law 100-202

Solicitation Provisions

Grantees soliciting bids or requesting proposals for contracts for the construction, alteration, or repair of any public building or public work project subject to the prohibitions described in this Notice shall include in their solicitations the following provisions:

Restrictions on Public Buildings and Public Works Projects Certification

(a) Definitions. The definitions pertaining to this provision are those that are set forth in the clause entitled, "Restrictions on Public Works Projects." (Set out under "Contract Clauses" below.)

(b) Certification. Except as provided in paragraph (c) of this provision, by submission of its bid or proposal, the offeror certifies that it --

(1) Is not a Contractor for a foreign country included on the list of countries that discriminate against U. S. firms published by the Office of the United States Trade Representative (USTR) (see paragraph (h) of this provision);

(2) Has not or will not enter into any subcontract with a subcontractor of a foreign country included on the list of countries that discriminate against U. S. firms published by the USTR; and

(3) Will not provide any product of a country included on the list of foreign countries that discriminate against U. S. firms published by the USTR.

(c) Inability to certify. An offeror unable to certify in accordance with paragraph (b) of this provision shall submit with its offer a written explanation fully describing the reasons for its inability to make the certification.

(d) Applicability of 18 U.S.C. 1001. The certification in paragraph (b) of this provision concerns a matter within the jurisdiction of an agency of the United States, and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, U.S.C. 1001.

(e) Notice. The offeror shall provide immediate written notice to the Contracting Officer if, at any time before the contract award, the offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(f) Restrictions on contract award. Unless a waiver to these restrictions is granted by the Secretary of Housing and Urban Development, no contract will be awarded to the offeror (1) who is owned or controlled by a citizen or national of a foreign country included on the list of foreign countries that discriminate against U. S. firms published by the USTR, (2) whose subcontractors are owned or controlled by citizens or nationals of a foreign country on the USTR list or, (3) who incorporate any product of a foreign country on the USTR list in the public works project.

(g) Recordkeeping. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (b) of this provision. The knowledge and information of an offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(h) USTR list. The USTR published an initial list in the Federal Register on December 30, 1987 (53 FR 49244), which identified one country - Japan. The USTR can add countries to the list, and remove countries from it, in accordance with section 109(c) of Pub. L. 100-202. [End of Solicitation Clause].

Contract Clauses

Grantees or subgrantee recipients entering into contracts for construction, alteration, or repair of any public building or public work project subject to the prohibitions described in this Notice shall include the following provisions in all such contracts:

Restrictions on Public Buildings and Public Works Projects

(a) Definitions. "Component" as used in this clause, means those articles, materials, and supplies incorporated directly into the product. "Contractor or subcontractor of a foreign country," as used in this clause, means any Contractor or subcontractor that is a citizen or national of a foreign country or is controlled directly or indirectly by citizens or nationals of a foreign country. A contractor or subcontractor shall be considered to be a citizen or national of a foreign country or controlled directly or indirectly by citizens or nationals of a foreign country --

(1) If 50 percent or more of the stock of the Contractor or subcontractor is owned by a citizen or national of the foreign country;

(2) If the title to 50 percent or more of the stock of the Contractor or subcontractor is held subject to trust or fiduciary obligation in favor of citizens or nationals of the foreign country;

(3) If 50 percent or more of the voting power in the Contractor or subcontractor is vested in or exercisable on behalf of a citizen or national of the foreign country;

(4) In the case of a partnership, if any general partner is a citizen of the foreign country;

(5) In the case of a corporation, if its president or other chief executive officer or the chairman of its board of directors is a citizen of the foreign country or the majority of any number of its directors necessary to constitute a quorum are citizens of the foreign country or the corporation is organized under the laws of the foreign country or any subdivision, territory, or possession thereof; or

(6) In the case of a contractor or subcontractor who is a joint venture, if any participant firm is a citizen or national of a foreign country or meets any of the criteria in subparagraphs (a)(1) through (5) of this clause.

"Product", as used in this clause, means construction materials--i.e., articles, materials and supplies brought to the construction site for incorporation into the public works project, including permanently affixed equipment, instruments, utilities, electronic or other devices, but not including vehicles or construction equipment. In determining the origin of a product (insert name of grantee), will consider a product as produced in a foreign country if it has been assembled or manufactured in the foreign country, or if the cost of the components mined, produced, or manufactured in the foreign country exceed 50 percent of the cost of all its components.

(b) Restrictions. The Contractor shall not (1) knowingly enter into any subcontract under this contract with a subcontractor of a foreign country included on the list of countries that discriminate against U. S. firms published by the United States Trade Representative (see paragraph (c) of this clause), or (2) supply any product under this contract of a country included on the list of foreign countries that discriminate against U. S. firms published by the USTR.

(c) USTR list. The USTR published an initial list in the Federal Register on December 30, 1987 (53 FR 49244), which identified one country--Japan. The USTR can add other countries to the list or remove countries from it, in accordance with section 109(c) of Pub. L. 100-202.

(d) Certification. The Contractor may rely upon the certification of a prospective subcontractor that it is not a subcontractor of a foreign country included on the list of countries that discriminate against U. S. firms published by the USTR and that products supplied by such subcontractor for use on the Federal public works project under this contract are not products of a foreign country included on the list of foreign countries that discriminate against U. S. firms

published by the USTR, unless such Contractor has knowledge that the certification is erroneous.

(e) Subcontracts. The Contractor shall incorporate this clause, modified only for the purpose of properly identifying the parties, in all subcontracts. This paragraph (e) shall also be incorporated in all subcontracts.

Pro20a
procur/1
USTR

**CERTIFICATION OF BIDDER REGARDING
SECTION 3 AND SEGREGATED FACILITIES**

Name of Prime Contractor

WASTE WATER TREATMENT FACILITY IMPROVEMENTS, FULTON, AL

Project Name

DRA Project No: AL- 55118

Project Number

The undersigned hereby certifies that:

- a. Section 3 provisions are included in the Contract.
- b. A written Section 3 plan was prepared and submitted as part of the bid proceedings (if bid equals or exceeds \$10,000).
- c. No segregated facilities will be maintained.

Name and Title of Signer (print or type)

Signature

Date

9.

CONTRACTOR SECTION 3 PLAN FORMAT

(if bids equal or exceeds \$10,000)

_____ agrees to implement the following specific
(Name of Contractor)
affirmative action steps directed at increasing the utilization of lower income residents and businesses within the City/County of Fulton / Clarke.

- A. To ascertain from the locality's DRA program official the exact boundaries of the Section 3 covered project area and where advantageous, seek the assistance of local officials in preparing and implementing the affirmative action plan.
- B. To attempt to recruit from within the city/county the necessary number of lower income residents through: Local advertising media, signs placed at the proposed site for the project, and community organizations and public or private institutions operating within or serving the project area such as Service Employment and Redevelopment (SER), Opportunities Industrialization Center (OIC), Urban League, Concentrated Employment Program, Hometown Plan, or the U. S. Employment Service.
- C. To maintain a list of all lower income residents who have applied either on their own or on referral from any source, and to employ such persons, if otherwise eligible and if a vacancy exists.
- *D. To insert this Section 3 plan in all bid documents, and to require all bidders on subcontracts to submit a Section 3 affirmative action plan including utilization goals and the specific steps planned to accomplish these goals.
- *E. To insure that subcontracts which are typically let on a negotiated rather than a bid basis in areas other than Section 3 covered project areas, are also let on a negotiated basis, whenever feasible, when let in a Section 3 covered project area.
- F. To formally contact unions, subcontractors and trade associations to secure their cooperation for this program.
- G. To insure that all appropriate project area business concerns are notified of pending subcontractual opportunities.
- H. To maintain records, including copies of correspondence, memoranda, etc., which document that all of the above affirmative action steps have been taken.
- I. To appoint or recruit an executive official of the company or agency as Equal Opportunity Officer to coordinate the implementation of this Section 3 plan.
- J. To list on Table A, information related to subcontracts to be awarded.
- K. To list on Table B, all projected workforce needs for all phases of this project by occupation, trade, skill level and number of positions.
- * *Loan, grant contracts & subsidies for less than \$10,000 will be exempt.*

As officers and representatives of _____,
Name of Contractor

We the undersigned have read and fully agree to this Affirmative Action Plan, and become a party to the full implementation of this program.

Signature

Title

Date

Signature

Title

Date

CONTRACTOR SECTION 3 PLAN FORMAT continued

PROPOSED SUBCONTRACTS BREAKDOWN TABLE A

FOR THE PERIOD COVERING _____, 20____ THROUGH _____, 20____

(Duration of the DRA-Assisted Project)

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5
TYPE OF CONTRACT (BUSINESS OF PROFESSION)	TOTAL NUMBER OF CONTRACTS	TOTAL APPROXIMATE DOLLAR AMOUNT	ESTIMATED NUMBER OF CONTRACTS TO PROJECT AREA BUSINESSES*	ESTIMATED DOLLAR AMOUNT TO PROJECT AREA BUSINESSES*

*The Project Area is coextensive with the City/County of Fulton/Clarke's boundaries.

Company

Waste Water Treatment Facility Improvements, Fulton, AL
Project Name

DRA Project No: AL- 55118
Project Number

EEO Officer – Signature

Date

CONTRACTOR SECTION 3 PLAN FORMAT continued

ESTIMATED PROJECT WORKFORCE BREAKDOWN

TABLE B

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5
JOB CATEGORY	TOTAL ESTIMATE POSITIONS	NO. POSITIONS CURRENTLY OCCUPIED BY PERMANENT EMPLOYEES	NO. POSITIONS NOT CURRENTLY OCCUPIED	NO. POSITIONS TO BE FILLED WITH L.I.P.A.R.*
OFFICERS/SUPERVISORS				
PROFESSIONALS				
HOUSING SALES/RENTAL/ MANAGEMENT				
OFFICE CLERICAL				
SERVICE WORKERS				
OTHERS				
TRADE:				
JOURNEYMEN				
HELPERS				
APPRENTICES				
MAXIMUM NO. TRAINEES				
OTHERS				
TRADE:				
JOURNEYMEN				
HELPERS				
APPRENTICES				
MAXIMUM NO. TRAINEES				
OTHERS				
TRADE:				
JOURNEYMEN				
HELPERS				
APPRENTICES				
MAXIMUM NO. TRAINEES				
OTHERS				
TOTAL				

*Lower Income Project Area residents.
Individuals residing within the City/County of
Fulton / Clarke
whose family income does not exceed 90%
of the median income in the SMSA

Company

**CERTIFICATION BY PROPOSED SUBCONTRACTOR
REGARDING EQUAL EMPLOYMENT OPPORTUNITY**

CERTIFICATION BY PROPOSED SUBCONTRACTOR
REGARDING EQUAL EMPLOYMENT OPPORTUNITY

Name of Prime Contractor

CDBG Project No.: AL- 55118
GMC Project No.: CMGM230141

Instructions

This certification is required pursuant to Executive Order 11246 (30 F.R. 12319-25). The implementing rules and regulations provide that any bidder or prospective contractor, or any of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause, and if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the subcontractor has not filed a compliance report due under applicable instructions, such subcontractor shall be required to submit a compliance report before the Owner approves the subcontract or permits work to begin under the subcontract.

Subcontractor's Certification

Name and Address of Subcontractor (include zip code)

1. Subcontractor has participated in a previous contract or subcontract subject to the Equal Opportunity Clause.

Yes _____ No _____

2. Compliance reports were required to be filed in connection with such contract or subcontract.

Yes _____ No _____

3. Subcontractor has filed all compliance reports due under applicable instructions, including Monthly Employment Utilization Report (257).

Yes _____ No _____ None Required _____

4. Have you ever been or are you being considered for sanction due to violation of Executive Order 11246, as amended?

Yes _____ No _____

Name and Title of Signer (please type)

Signature

Date

**CERTIFICATION OF PROPOSED SUBCONTRACTOR REGARDING
SECTION 3 AND SEGREGATED FACILITIES**

Name of Subcontractor

WASTE WATER TREATMENT FACILITY IMPROVEMENTS IN THE TOWN OF FULTON, AL
Project Name

DRA Project No: AL- 55118/ GMC Project No: CMGM230141
Project Number

The undersigned hereby certifies that:

- a. Section 3 provisions are included in the Contract.
- b. A Written Section 3 plan was prepared and submitted as part of the bid proceedings (if bid equals or exceeds \$10,000).
- c. No segregated facilities will be maintained as required by Title VI of the Civil Rights Act of 1964.

Name and Title of Signer (print or type)

Signature

Date

CONTRACT FORM

THIS AGREEMENT, made this ____ day of _____, _____, by and between the **TOWN OF FULTON**, herein called "Owner", acting herein through Mike Norris, Mayor, and _____ of _____, County of _____, and State of _____, herein called "Contractor".

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned, to be made and performed by the OWNER, the CONTRACTOR hereby agrees with the OWNER to commence and complete the construction described as follows:

**WASTE WATER TREATMENT FACILITY IMPROVEMENTS IN THE TOWN OF FULTON, AL
FOR THE TOWN OF FULTON, AL
DRA PROJECT NO: AL- 55118
GMC PROJECT NO: CMGM203141**

hereinafter called the project for the bid sum of _____ and 00/100 Dollars (\$ _____) and all extra work in connection therewith, under the terms as stated in the General Conditions and Special Conditions; and at his (its or their) own proper cost and expense to furnish all the materials, supplies, machinery, equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to complete the said project in accordance with the conditions and prices stated in the Proposal, the General Conditions, Supplemental General Conditions and Special Conditions of the Contract, the plans, which include all maps, plats, blue prints, and other drawings and printed or written explanatory matter thereof, the specifications and contract documents therefore as prepared by GOODWYN MILLS CAWOOD, LLC., herein entitled the Architect/Engineer, and as enumerated in Paragraph 1 of the Supplemental General Conditions, all of which are made a part hereof and collectively evidence and constitute the contract.

The Contractor hereby agrees to commence work under this contract on or before a date to be specified in a written "Notice to Proceed" of the Owner and to fully complete the project within 120 consecutive calendar days thereafter. The Contractor further agrees to pay, as liquidated damages, the sum of \$1000.00 for each consecutive calendar day thereafter as hereinafter provided in Paragraph 19 of the General Conditions.

Should the source of funds for the payment be a grant, award, or direct reimbursement from the state, federal government, or other source which will not become available until after the execution of the contract, this shall be disclosed in the bid document and contract and the provisions of this chapter regarding prompt payment shall not apply until the awarding authority is in receipt of the funds as provided in the contract. Upon such receipt, the contracting agency shall process payment within 10 days and the requirement shall be enforceable as provided herein.

The Owner does hereby certify that this contract was let in accordance with the provisions of Title 39, Code of Alabama, 1975, as amended, and all other applicable provisions of law.

By signing this contract, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the state of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.

In the advent that ground-disturbing work uncovers significant archaeological materials, such as stone arrowheads, ceramics, or early building foundations, or if work uncovers human burials or human remains, ground disturbing activities will immediately be stopped within a 300 foot radius and the materials protected. The State Historic Preservation Officer and the Choctaw Nation of Oklahoma Historic Preservation Department will be contacted as soon as possible, and given an opportunity to provide input before construction resumes. If an archaeological or cultural materials are discovered during the project undertaking, neither the construction team nor the HUD applicant will disclose this information to the general public or the media in any manner. Discoveries of archaeological material will be kept private and confidential.

IN WITNESS WHEREOF, the parties to these presents have executed this contract in one (1) counterpart, of which shall be deemed an original, in the year and day first above mentioned.

(Seal)

TOWN OF FULTON

ATTEST:

(Owner)

By _____
Mike Norris

(City/Town Clerk/ Secretary)

Mayor
(Title)

(Witness)

(Seal)

(Contractor)

By: _____

(Secretary)

(Title)

(Witness)

(Address, City, State, Zip Code)

NOTE: Secretary of the Owner should attest. If Contractor is a corporation, Secretary should attest.

Contractor's Federal Tax Identification Number: _____

SPECIAL CONDITIONS TO CONTRACT

Pay Requests are handled as follows:

1. Per approved House Bill 24, Act #2014-404 Code of Alabama, effective on July 1, 2014 amends 39-2-2 and 39-2-12, grant funds will be utilized for this project and prompt payment shall not apply until local government is in receipt of the funds as provided in the contract.
2. Payment request is submitted to Engineer. Engineer approves and sends to Grant Consultant to approve and prepare State drawdown request on behalf of the local government.
3. Drawdown is submitted to local government for signature and mailing to ADECA. Processing time by the State is typically a minimum of 3 weeks.
4. Local government then has 10 days to cut a check to the contractor once State funds are received.

Contractor

By: _____
Title

Date: _____

PERFORMANCE BOND

Bond No. _____

KNOW ALL PERSONS BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a _____, hereinafter called Principal, and
(Corporation, Partnership or Individual)

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto _____

Town of Fulton

(Name of Owner)

1910 Highway 178, Fulton, AL 36446

(Address of Owner)

hereinafter called OWNER, in the total aggregate penal sum of _____
Dollars (\$ _____)

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the principal entered into a certain contract with the OWNER, dated the _____ day of _____, 20____, a copy of which is hereto attached and made a part hereof for the construction of:

Waste Water Treatment Facility Improvements in the Town of Fulton, AL

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, or GOVERNMENT, with or without notice to the SURETY and during the one year guaranty period and if the PRINCIPAL shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER and GOVERNMENT from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER and GOVERNMENT all outlay and expense which the OWNER and GOVERNMENT may incur in making good any default, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the liability of the PRINCIPAL and SURETY hereunder to the GOVERNMENT shall be subject to the same limitations and defenses as may be available to them against a claim hereunder by the OWNER, provided, however, that the GOVERNMENT may, at its option, perform any obligations of the OWNER required by the contract.

PROVIDED, FURTHER, that the said SURETY, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to WORK to be performed thereunder or the SPECIFICATIONS accompanying same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that is expressly agreed that the BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the CONTRACT as so amended. The term "Amendment", wherever used in this BOND, and whether referring to this BOND, the Contract or the Loan Documents shall include any alteration, addition, extension, or modification of any character whatsoever.

PROVIDED, FURTHER, that no final settlement between the OWNER or GOVERNMENT and the PRINCIPAL shall abridge the right of the other beneficiary hereunder, whose claim may be unsatisfied. The OWNER and GOVERNMENT are the only beneficiaries hereunder.

IN WITNESS WHEREOF, this instrument is executed in _____ 1 _____ counterpart, of which shall be deemed an original, this the _____ day of _____, _____.

ATTEST:

(Principal) Secretary

Principal

(SEAL)

By: _____

(Witness as to Principal)

(Address)

(Address)

(Address)

Surety

ATTEST:

(Surety) Secretary

(SEAL)

By _____
Witness to Surety

Attorney-in-Fact

(Address)

(Address)

NOTE: Date of BOND must not be prior to date of Contract.

If CONTRACTOR is partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the Project is located.

PAYMENT BOND

Bond No. _____

KNOW ALL PERSONS BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a _____, hereinafter called PRINCIPAL and
(Corporation, Partnership or Individual)

(Name of Surety)

hereinafter called SURETY, are held and firmly bound unto

Town of Fulton
(Name of Owner)

1910 Highway 178, Fulton, AL 36446
(Address of Owner)

hereinafter called Owner, in the penal sum of _____ Dollars (\$_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the PRINCIPAL entered into a certain contract with the OWNER, dated the _____ day of _____, 20____, a copy of which is hereto attached and made a part hereof for the construction of:

Waste Water Treatment Facility Improvements in the Town of Fulton, AL

NOW, THEREFORE, if the PRINCIPAL shall promptly make payment to all persons, firms, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extensions or modifications thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and for all labor cost incurred in such WORK including that by a SUBCONTRACTOR, and to any mechanic or materialman lienholder whether it acquires its lien by operation of State or Federal law; then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, that beneficiaries or claimants hereunder shall be limited to the SUBCONTRACTORS, and persons, firms, and corporations having a direct contract with the PRINCIPAL or its SUBCONTRACTORS.

PROVIDED, FURTHER, that the said SURETY for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of this contract or to the WORK or to the SPECIFICATIONS.

PROVIDE, FURTHER, that no suit or action shall be commenced hereunder by any claimant: (a) Unless claimant, other than one having a direct contract with the PRINCIPAL (or with the GOVERNMENT in the event the GOVERNMENT is performing the obligations of the OWNER), shall have given written notice to any two of the following: The PRINCIPAL, the OWNER, or the SURETY above named within ninety (90) days

after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the PRINCIPAL, OWNER, or SURETY, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer. (b) After the expiration of one (1) year following the date of which PRINCIPAL ceased work on said CONTRACT, is being understood, however, that if any limitation embodied in the BOND is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

PROVIDED, FURTHER, that it is expressly agreed that this BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this BOND and whether referring to this BOND, the contract or the loan Documents shall include any alteration, addition, extension or modification of any character whatsoever.

PROVIDED, FURTHER, that no final settlement between the OWNER or GOVERNMENT and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

WITNESS WHEREOF, this instrument is executed in 1 counterpart, of which shall be deemed an original, this the _____ day of _____, _____.

ATTEST:

_____	_____
(Principal) Secretary	Principal

(SEAL)

By: _____

Witness as to Principal

(Address)

ATTEST:

Witness as to Surety

Address

By: _____

Attorney - in-Fact

Address

NOTE: Date of BOND must not be prior to date of Contract.
 If CONTRACTOR is partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) as be authorized to transact business in the State where the Project is located.

BONDING AND INSURANCE REQUIREMENTS

The Common Rule

A state or local unit of government receiving a grant from the Federal government which requires contracting for construction or facility improvement shall follow its own requirements relating to bid guarantees, performance bonds and payment bonds, except for contracts or subcontracts exceeding \$100,000. For contracts or subcontracts exceeding \$100,000, the Federal agency must make a determination that the Government's interest is adequately protected. If such a determination has not been made, the minimum requirements shall be as follows:

- a. A bid guarantee from each bidder equivalent to five percent of the bid price. The "bid guarantee" shall consist of a firm commitment such as a bid bond, certified check, or cash accompanying a bid as assurance that the bidder will, upon acceptance of his/her bid, execute such contractual documents as may be required within the time specified.
- b. A performance bond on the part of the contractor for 100 percent of the contract price. A "performance bond" is one executed in connection with a contract to secure fulfillment of all the contractor's obligations under such contract.
- c. A payment bond on the part of the contract for 100 percent of the contract price. A "payment bond" is one executed in connection with a contract to assure payment as required by law of all persons supplying labor and material in the execution of the work provided for in the contract.

BONDING AND INSURANCE REQUIREMENTS

References 41-16-50 through 41-16-63 of the Code of Alabama of 1975 as amended through the 1981 Regular Session. OMB Circular A-102 Attachment B.

As a minimum a local unit of government or any subdivision thereof receiving a grant from the state/federal government will be required to cause to be furnished the following:

Bid Bonds

All bidders must furnish a bid bond on any contract exceeding \$10,000 and may be required on amounts less than \$10,000 at the discretion of the locality; provided that bonding is available for such services, equipment or materials. The amount of such bond shall be specified in the advertisement for bids except that on contracts exceeding \$100,000 the bid bond shall not be less than five percent of the bid price. See additional requirement for PUBLIC WORKS CONTRACTS.

The bid bond shall consist of a "guarantee" such as a bond, certified check, or cash accompanying a bid as assurance that the bidder will, upon acceptance of his/her bid, execute such contractual documents as may be required within the time specified.

Performance Bonds

All bidders may be required to furnish a performance bond on any contract. The amount of such bond shall be specified in the advertisement for bids except that on contracts exceeding \$100,000 such bond shall be not less than 100 percent of the contract price. See additional requirement for PUBLIC WORKS CONTRACTS.

A performance bond is one executed in connection with a contract to secure fulfillment of all of the contractor's obligations under such contract.

Payment Bond or Surety Bond

All bidders may be required to furnish a surety or payment bond on any contract. The amount of such bond shall be specified in the advertisement for bids except that on contracts exceeding \$100,000 such bond shall not be less than 100 percent of the contract price. See additional requirements for PUBLIC WORKS CONTRACTS.

A payment bond or surety bond is one executed in connection with a contract to assure payment as required by law of all persons supplying labor and material in the execution of the work provided for in the contract.

Reference 39-1-1 in its entirety, Code of Alabama of 1982 as amended through the 1981 Regular Session.

Public Works Contracts - For Contracts of \$5,000 and Above

While the foregoing information is applicable on all contracts in the minimums and maximums as specified, there are special requirements for contracts on public works setting certain constraints within those minimums and maximums.

Performance Bonds and Surety or Payment Bonds

Any person, firm or corporation entering into a contract with any county or municipal corporation or subdivision thereof for repair, construction or prosecution of any public buildings or public work, highways, or bridges shall be required, before commencing such work, to execute a performance bond for not less than 100 percent of the contract price, and in addition thereto.

The contractor shall immediately after completion of the contract give notice of said completion by an advertisement in some newspaper of general circulation published within the city or county or town wherein the work has been done for a period of three (3) successive weeks.

In no instance shall a final settlement be made upon the contract until the expiration of 30 days after completion of same.

Proof of publication shall be made by the contractor to the contracting authority by affidavit of the publisher and a printed copy of the notice published. If there is no newspaper published in the county where the work is done, the notice may be given by posting at the courthouse for 30 days, and proof of same shall be made by the probate judge or sheriff and the contractor.

Bid Bonds

All bidders shall furnish a bid bond in an amount not less than five (5) percent of the bid price.

NOTICE OF AWARD

To: Contractor
Address
City, State, Zip

Date: _____
Project: WWTF Improvements in the Town of
Fulton, for the Town of Fulton, AL
DRA Project No: AL- 55118
GMC Project No: CMGM230141

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for Bids dated _____, 20__, and Information for Bidders.

You are hereby notified that your BID has been accepted for items in the amount of \$_____.

You are required by the Information for Bidders to execute the Agreement and furnish the required CONTRACTOR'S Performance BOND, Payment BOND and certificates of insurance within fifteen (15) calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said BONDS within fifteen (15) days from the date of this Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER'S acceptance of your BID as abandoned and as a forfeiture of your BID BOND. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

TOWN OF FULTON

Owner

By: _____

Mike Norris

Title _____

Mayor

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by _____
this the _____ day of _____, 20__.

Contractor

By: _____

Title _____

NOTICE TO PROCEED

To: Contractor
Address
City, State, Zip

Date: _____
Project: WWTF Improvements in the Town of
Fulton for the Town of Fulton, AL
DRA Project No: AL- 55118
GMC Project No: CMGM230141

You are hereby notified to commence WORK in accordance with the Agreement dated _____, 20____, on or before _____, 20____, and you are to complete the WORK within 120 consecutive calendar days thereafter. The date of completion of all WORK is therefore _____, 20____.

TOWN OF FULTON

Owner

By: _____

Mike Norris

Title _____

Mayor

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by _____
_____, this the ____ day of _____, 20__.

Contractor

By: _____

Title _____

CHANGE ORDER

Order No. _____

Date: _____

Agreement Date: _____

NAME OF PROJECT: Waste Water Treatment Facility Improvements (CMGM230141)

OWNER: The Town of Fulton, Alabama

CONTRACTOR: _____

The following changes are hereby made to the CONTRACT DOCUMENTS.

Justification:

Change to CONTRACT PRICE:

Original CONTRACT PRICE \$ _____

Current CONTRACT PRICE adjusted by previous CHANGE ORDER \$ _____

The CONTRACT PRICE due to this CHANGE ORDER will be (increased) (decreased) by:

\$ _____

The new CONTRACT PRICE including this CHANGE ORDER will be \$ _____

Change to CONTRACT TIME:

The CONTRACT TIME will be (increased) (decreased) by _____ calendar days.

The date of completion of all work will be _____ (Date).

Approvals Required:

To be effective this Order must be approved by the Federal agency if it changes the scope or objective of the PROJECT, or as may otherwise be required by the SUPPLEMENTAL GENERAL CONDITIONS.

Requested by: _____

Ordered by: _____

Accepted by: _____

Federal Agency Approval (where applicable) _____

FINAL INSPECTION CERTIFICATION

I CERTIFY that GMC has inspected the _____ WWTF Improvements (CMGM230141) _____
Project Name and Number
and it has been completed in accordance with the Drawings and Specifications or other
descriptive material. Appropriate State approval has been given
_____. The Builder's Warranty date is _____.
Date of Approval

Signature of Contractor Date

Signature of Project Engineer Date

The undersigned gives approval of acceptance of the work constructed under the
conditions of the contract and Builder's Warranty.

Signature of Mayor Date

NOTE: This form is to be executed prior to running the Notice of Completion
advertisement or holding the Close-out Public Hearing.

This form must be submitted with the final draw for engineering/architectural and/or the
drawdown for final payment for construction.

In addition to the Final Inspection Certification, the final 2516 form and the final 60002
(Section 3) form must be submitted. For projects not requiring the Final Inspection
Certification, the 2516 and 60002 will still be required.

ADECA will not process drawdown requests for final payment for the primary activity
without the 2516 and 60002 forms.

AS-BUILT CERTIFICATION FORM

I CERTIFY that construction of _____
(Sub-Recipient's Name, Project Name & DRA Project Number)

has been completed in accordance with the original and revised plans and specifications and are consistent with the scope of the approved project and that a copy of the As-Built drawings have been delivered to the OWNER.

(Project Engineer's/Architect's Signature)

(Date)

The undersigned certifies that the OWNER has received a copy of the As-Built drawings for the above mentioned project.

(Mayor's/Chairman's Signature)

(Date)

GENERAL CONDITIONS
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GENERAL CONDITIONS

1. Contract and Contract Documents

The project to be constructed and pursuant to this Contract will be financed with assistance from the Alabama Community Development Block Grant Program and is subject to all applicable laws.

The plans, specifications, and addenda, hereinafter enumerated in Paragraph 1 of the Supplemental General Conditions, shall form part of this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were in fully set forth. The table of contents, titles, headings, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or cast light on the interpretation of the provisions to which they refer.

2. Definitions

The following terms as used in this contract are respectively defined as follows:

- a. "Contractor": A person, firm or corporation with whom the contract is made by the Owner.
- b. "Subcontractor": A person, firm or corporation supplying labor and materials or only labor for work at the site of the project for, and under separate contract or agreement with, the Contractor.
- c. "Work on (at) the project": Work to be performed at the location of the project, including the transportation of materials and supplies to or from the location of the project by employees of the Contractor and any Subcontractor.

3. Additional Instructions and Detail Drawings

The Contractor will be furnished additional instructions and detail drawings as necessary to carry out the work included in the contract. The additional drawings and instructions thus supplied to the Contractor will coordinate with the Contract Documents and will be so prepared that they can be reasonably interpreted as part thereof. The Contractor shall carry out the work in accordance with the additional detail drawings and instructions. The Contractor and the Architect/Engineer will prepare jointly (a) a schedule, fixing the dates at which special detail drawings will be required, such drawings, if any, to be furnished by the Architect/Engineer in accordance with said schedule, and (b) a schedule fixing the respective dates for the submission of shop drawings, the beginning of manufacture, testing and installation of materials, supplied and equipment, and the completion of the various parts of the work; each such schedule to be subject to change from time to time in accordance with the progress of the work.

4. Shop or Setting Drawings

The Contractor shall submit promptly to the Architect/Engineer two copies of each shop or setting drawing prepared in accordance with the schedule predetermined as aforesaid. After examination of such drawings by the Architect/Engineer and the return thereof, the Contractor shall make such corrections to the drawings as have been indicated and shall furnish the Architect/Engineer with two corrected copies. If requested by the Architect/Engineer the Contractor must furnish additional copies. Regardless of corrections made in or approval given to such drawings by the Architect/Engineer, the Contractor will nevertheless be responsible for the accuracy of such drawings and for their conformity to the plans and specifications, unless he notifies the Architect/Engineer in writing of any deviations at the time he furnishes such drawings.

5. Materials, Services and Facilities

- a. It is understood that except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature and all other services and facilities of every nature whatsoever necessary to execute, complete and deliver the work within the specified time.
- b. Any work necessary to be performed after regular working hours, on Sunday or Legal Holidays, shall be performed without additional expense to the Owner.

6. Contractor's Title to Materials

No materials or supplies for the work shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies used by him in the work, free from all liens, claims and encumbrances.

7. Inspection and Testing of Materials

- a. All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Owner. The Owner will pay for all laboratory inspection service direct, and not as a part of the Contract.
- b. Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

8. "Or Equal" Clause

Whenever a material, article or piece of equipment is identified on the plans or in the specifications by reference to manufacturers' or vendors' names, trade names, catalogue numbers, etc., it is intended merely to establish a standard; and, any materials, article or equipment of other manufacturers and vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article or equipment so proposed, is, in the opinion of the Architect/Engineer, of equal substance and function. It shall not be purchased or installed by the Contractor without the Architect/Engineer's written approval.

9. Patents

- a. The Contractor shall hold and save the Owner and its officers, agents, servants and employees harmless from liability of any nature or kind, including cost and expenses for, or on account, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of the Contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract Documents.
- b. License or Royalty Fees: License and/or royalty fees for the use of a process which is authorized by the Owner of the project must be reasonable, and paid to the holder of the patent, or his authorized licensee, direct by the Owner and not by or through the Contractor.
- c. If the Contractor uses any design, device or materials covered by letters, patent or copyright, he shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, that, without exception, the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his Sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted

design, device or materials or any trademark or copyright in connection with work agreed to be performed under this Contract, and shall indemnify the Owner for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

10. Surveys, Permits and Regulations

Unless otherwise expressly provided for in the specifications, the Owner will furnish to the Contractor all surveys necessary for the execution of the work.

The Contractor shall procure and pay all permits, licenses and approvals necessary for the execution of his contract.

The Contractor shall comply with all laws, ordinances, rules, orders and regulations relating to performance of the work, the protection of adjacent property and the maintenance of passageways, guard fences or other protective facilities.

11. Contractor's Obligations

The Contractor shall and will, in good workmanlike manner, do and perform all work and furnish all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary or proper to perform and complete all the work required by this Contract, within the time herein specified, in accordance with the provisions of this Contract and said specifications and in accordance with the plans and drawings covered by this Contract any and all supplemental plans and drawings, and in accordance with directions of the Architect/Engineer as given from time to time during the progress of the work. He shall furnish, erect, maintain and remove such construction plant and such temporary works as may be required.

The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements and limitations of the Contract and specifications, and shall do, carry on the complete and entire work to the satisfaction of the Architect/Engineer and the Owner.

12. Weather Conditions

In the event of temporary suspension of work, or during inclement weather, or whenever the Architect/Engineer shall direct, the Contractor will, and will cause his Subcontractors to protect carefully his and their work and materials against damage or injury from the weather. If, in the opinion of the Architect/Engineer, any work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any of his Subcontractors so to protect his work, such materials shall be removed and replaced at the expense of the Contractor.

13. Protection of Work and Property - Emergency

The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this Contract. He shall at all times safely guard and protect his own work, and that of adjacent property from damage. The Contractor shall replace or make good any such damage, loss or injury unless such be caused directly by errors contained in the Contract or by the Owner, or his duly authorized representatives.

In the case of an emergency which threatens loss or injury of property, and/or safety of life, the Contractor will be allowed to act, without previous instructions from the Architect/Engineer, in a diligent manner. He shall notify the Architect/Engineer immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted to the Architect/Engineer for approval.

Where the Contractor has not taken action but has notified the Architect/Engineer of an emergency threatening injury to persons or damage to the work or any adjoining property, he shall act as instructed or authorized by the Architect/Engineer.

The amount of reimbursement claimed by the Contractor on account of any emergency action shall be determined in the manner provided in Paragraph 17 of the General Conditions.

14. Inspection

The authorized representatives and agents of the ADECA and the Department of Housing and Urban Development shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials and other relevant data and records.

15. Reports, Records and Data

The Contractor shall submit to the Owner such schedule of quantities and costs, progress schedules, estimates, records and other data as the Owner may request concerning work performed or to be performed under this Contract. All records must be maintained not less than five (5) years from the conclusion of this project.

16. Superintendence by Contractor

At the site of the work, the Contractor shall employ a construction superintendent or foreman who shall have full authority to act for the Contractor. It is understood that such representative shall be acceptable to the Architect/Engineer and shall be one who can be continued in that capacity for the particular job involved unless he ceases to be on the Contractor's payroll.

17. Changes in Work

No changes in the work covered by the approved Contract Documents shall be made without having prior written approval of the Owner. Charges or credits for the work covered by the approved change shall be determined by one or more, or a combination of the following methods:

- a. Unit bid prices previously approved.
- b. An agreed lump sum.
- c. The actual cost of:
 1. Labor, including foremen.
 2. Materials entering permanently into the work.
 3. The ownership or rental cost of construction plant and equipment during the time of use on the extra work.
 4. Power and consumable supplies for the operation of power equipment.
 5. Insurance.
 6. Social security and old age and unemployment contributions.

To the cost under (c) there shall be added a fixed fee to be agreed upon but not to exceed fifteen percent (15%) of the actual cost of work. The fee shall be compensation to cover the cost of supervision, overhead, bond, profit and any other general expenses.

18. Extras

Without invalidating the Contract, the Owner may order extra work or make changes by altering, adding to or deducting from the work, the contract sum being adjusted accordingly, and the consent of the Surety being first obtained where necessary or desirable. All the work of the kind bid upon shall be paid for at the price stipulated in the proposal, and no claims for any extra work or materials shall be allowed unless the work is ordered in writing by the Owner or its Architect/Engineer, acting officially for the Owner, and the price is stated in such order.

19. Time for Completion and Liquidated Damages

It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion as specified in the contract of the work to be done hereunder are ESSENTIAL CONDITIONS of this Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on a date to be specified in the "Notice to Proceed."

The Contractor agrees that said work shall be prosecuted regularly, diligently and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

If the said Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this Contract, to pay to the Owner the amount specified in the Contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the work.

The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodical estimates.

It is further agreed that time is of the essence of each and every portion of this Contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract. Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner; provided, further, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due:

- a. To any preference, priority or allocation order duly issued by the Government.
- b. To unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and severe weather.
- c. To any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (a) and (b) of this article.

Provided, further, that the Contractor shall, within ten (10) days from the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final settlement of the Contract, notify the Owner, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of its decision in the matter.

20. Correction of Work

All work, all materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be at all times and places subject to the inspection of the Architect/Engineer who shall be the final judge of the quality and suitability of the work, materials, processes of manufacture and methods of construction for the purposes for which they are used. Should they fail to meet his approval they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the

Contractor at his own expense. Rejected materials shall immediately be removed from the site. If, in the opinion of the Architect/Engineer, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the Contract Documents, the compensation to be paid to the Contractor hereunder shall be reduced by such amount as in the judgement of the Architect/Engineer shall be equitable.

21. Subsurface Conditions Found Different

Should the Contractor encounter subsurface and/or latent conditions at the site materially differing from those shown on the plans or indicated in the specifications, he shall immediately give notice to the Architect/Engineer of such conditions before they are disturbed. The Architect/Engineer will thereupon promptly investigate the conditions, and if he finds that they materially differ from those shown on the plans or indicated in the specifications, he will at once make such changes in the plans and/or specifications as he may find necessary, any increase or decrease of cost resulting from such changes to be adjusted in the manner provided in Paragraph 17 of the General Conditions.

22. Claims for Extra Cost

No claim for extra work or cost shall be allowed unless the same was done in pursuance of a written order of the Architect/Engineer approved by the Owner, as aforesaid, and the claim presented with the first estimate after the changed or extra work is done. When work is performed under the terms of subparagraph 17(c) of the General Conditions, the Contractor shall furnish satisfactory bills, payrolls and vouchers covering all items of cost and when requested by the Owner, give the Owner access to accounts relating thereto.

23. Right of Owner to Terminate Contract

In the event that any of the provisions of this Contract are violated by the Contractor, or by any of his Subcontractors, the Owner may serve written notice upon the Contractor and Surety of its intention to terminate the Contract, such notices to contain the reasons for such intention to terminate the Contract, and unless within ten (10) days after the serving of such notice upon the Contractor, such violation or delay shall cease and satisfactory arrangement of correction be made, the Contract shall, upon the expiration of said ten (10) days, cease and terminate. In the event of any such termination, the Owner shall immediately serve notice thereof upon the Surety and the Contractor and the Surety shall have the right to take over the work and prosecute the same to completion by contract or by force account for the account and at the expense of the Contractor and the Contractor and his Surety shall be liable to the Owner for any excess cost occasioned by the Owner thereby, and in such event the Owner may take possession of and utilize in completing the work, such materials, appliances and plant as may be on the site of the work and necessary therefore.

24. Construction Schedule and Periodic Estimates

Immediately after execution and delivery of the Contract, and before the first partial payment is made, the Contractor shall deliver to the Owner an estimated construction progress schedule in form satisfactory to the Owner, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents and the anticipated amount of each monthly payment that will become due the Contractor in accordance with the progress schedule. The Contractor shall also furnish on forms to be supplied by the Owner (a) a detailed estimate giving a complete breakdown of the contract price and (b) periodic itemized estimates of work done for the purpose of making partial payments thereon. The costs employed in making up any of these schedules will be used only for determining the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the contract price.

25. Payment to Contractor

- a. Not later than the 15th day of each calendar month the Owner shall make a progress payment to the Contractor on the basis of a duly certified and approved estimate of the work performed during the preceding calendar month under this Contract, but to insure the proper performance of this Contract, the Owner shall retain a maximum of five percent (5%) retainage until 50% completion of all work covered

by this Contract; provided, that the Contractor shall submit his estimate not later than the 30th day of the month; provided, further, that on completion and acceptance of each separate building, public work, or other division of the Contract, payment may be made in full, less authorized deductions as per State Bid law.

- b. In preparing estimates the material delivered on the site and preparatory work done may be taken into consideration.
- c. All material and work covered by partial payments made shall thereupon become the sole property of the Owner, but this provision shall not be constructed as relieving the Contractor from the sole responsibility for the care and protection of materials and work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of the Owner to require the fulfillment of all of the terms of the Contract.
- d. Owner's Rights to Withhold Certain Amounts and Make Application Thereof: The Contractor agrees that he will indemnify and save the Owner harmless from all claims growing out of the lawful demands of subcontractors, laborers, workmen, mechanics, materialmen and furnishers of machinery and parts thereof, equipment, power tools and all supplies, including commissary, incurred in the furtherance of the performance of this Contract. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature hereinabove designated have been paid, discharged or waived. If the Contractor fails so to do, then the Owner may, after having served written notice on the said Contractor, either pay unpaid bills, of which the Owner has written notice, direct, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of this Contract, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor or his Surety. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of the Contractor, and any payment so made by the Owner shall be considered as a payment under the Contract by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.

26. Acceptance of Final Payment Constitutes Release

The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor for all things done or furnished in connection with this work and for every act and neglect of the Owner and others relating to or arising out of this work. No payment, however, final or otherwise, shall operate to release the Contractor or his Sureties from any obligations under this Contract or the performance and payment bond.

27. Payments by Contractor

The Contractor shall pay (a) for all transportation and utility services not later than the 10th day of the calendar month following that in which services are rendered, (b) for all materials, tools and other expendable equipment to the extent of ninety percent (90%) of the cost thereof, not later than the 10th day of the calendar month following that in which such materials, tools and equipment are delivered at the site of the project, and the balance of the cost thereof, not later than the 10th day following the completion of that part of the work in or on which such materials, tools and equipment are incorporated or used, and (c) to each of his Subcontractors, not later than the 10th day following each payment to the Contractor, the respective amount allowed the Contractor on account of the work performed by his Subcontractors to the extent of each Subcontractor's interest therein.

28. Insurance

The Contractor shall not commence work under this Contract until he has obtained all the insurance required under this paragraph and such insurance has been approved by the Owner, nor shall the Contractor allow any

Subcontractor to commence work on this subcontract until the insurance required of the Subcontractor has been so obtained and approved.

- a. Compensation Insurance: The Contractor shall procure and shall maintain during the life of this Contract Workmen's Compensation Insurance as required by applicable State or territorial law for all of his employees to be engaged in work at the site of the project under this Contract and, in case of any such work sublet, the Contractor shall require the Subcontractor similarly to provide Workmen's Compensation Insurance for all of the latter's employees to be engaged in such work unless such employees are covered by the protection afforded by the Contractor's Workmen's Compensation Insurance. In case any class of employees engaged in hazardous work on the project under this Contract is not protected under the Workmen's Compensation Statute, the Contractor shall provide and shall cause each Subcontractor to provide adequate employer's liability insurance for the protection of such of his employees as are not otherwise protected.
- b. Contractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance: The Contractor shall procure and shall maintain during the life of this Contract Contractor's Public Liability Insurance, Contractor's Property Damage Insurance and Vehicle Liability Insurance in the amounts specified in the Supplemental General Conditions.
- c. Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance: The Contractor shall either (1) require each of his Subcontractors to procure and to maintain during the life of his subcontract, Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance of the type and in the amounts specified in the Supplemental General Conditions specified in subparagraph (b) hereof, or (2) insure the activities of his policy, specified in subparagraph (b) hereof.
- d. Scope of Insurance and Special Hazards: The insurance required under subparagraphs (b) and (c) hereof shall provide adequate protection for the Contractor and his Subcontractors, respectively, against damage claims which may arise from operations under this Contract, whether such operations be by the insured or by anyone directly or indirectly employed by him and, also against any of the special hazards which may be encountered in the performance of this Contract as enumerated in the Supplemental General Conditions.
- e. Builder's Risk Insurance (Fire and Extended Coverage): Until the project is completed and accepted by the Owner, the Owner or Contractor (at the Owner's option as indicated in the Supplemental General Conditions) is required to maintain Builder's Risk Insurance (fire and extended coverage) on a 100 percent (100%) completed value basis on the insurable portion of the project for the benefit of the Owner, the Contractor, and Subcontractors as their interests may appear. The Contractor shall not include any costs for Builder's Risk Insurance (fire and extended coverage) premiums during construction unless the Contractor is required to provide such insurance; however, this provision shall not release the Contractor from his obligation to complete, according to plans and specifications, the project covered by the Contract, and the Contractor and his Surety shall be obligated to full performance of the Contractor's undertaking.
- f. Proof of Carriage of Insurance: The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates and date of expiration of policies. Such certificates shall also contain substantially the following statement: "The insurance covered by this certificate will not be canceled or materially altered, except after ten (10) days written notice has been received by the Owner."

29. Contract Security

The Contractor shall furnish a performance bond in an amount at least equal to 100 percent (100%) of the contract prices as security for the faithful performance of this Contract and also a payment bond in an amount not less than 100 percent (100%) of the contract price or in a penal sum not less than that prescribed by State, territorial or local law, as security for the payment of all persons performing labor on the project

under this Contract and furnishing materials in connection with this Contract. The performance bond and the payment bond may be in one or in separate instruments in accordance with local law.

30. Additional or Substitute Bond

If at any time the Owner for justifiable cause shall be or become dissatisfied with any Surety or Sureties, then upon the performance or payment bonds, the Contractor shall within five (5) days after notice from the Owner so to do, substitute an acceptable bond (or bonds) in such form and sum and signed by such other Surety or Sureties as may be satisfactory to the Owner. The premiums on such bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new Surety or Sureties shall have furnished such an acceptable bond to the Owner.

31. Assignments

The Contractor shall not assign the whole or any part of this Contract or any monies due or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or any part of the monies due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations of services rendered or materials supplied for the performance of the work called for in this Contract.

32. Mutual Responsibility of Contractors

If, through acts of neglect on the part of the Contractor, any other Contractor or any Subcontractor shall suffer loss or damage on the work, the Contractor agrees to settle with such other Contractor or Subcontractor by agreement or arbitration if such other Contractor or Subcontractor will so settle. If such other Contractor or Subcontractor shall assert any claim against the Owner on account of any damage alleged to have been sustained, the Owner shall notify the Contractor, who shall indemnify and save harmless the Owner against any such claim.

33. Separate Contracts

The Contractor shall coordinate his operations with those of other Contractors. Cooperation will be required in the arrangement for the storage of materials and in the detailed execution of the work. The Contractor, including his Subcontractors, shall keep informed of the progress and the detail work of other Contractors and shall notify the Architect/Engineer immediately of lack of progress or defective workmanship on the part of other Contractors. Failure of a Contractor to keep informed of the work progressing on the site and failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance by him of the status of the work as being satisfactory for proper coordination with his own work.

34. Subcontracting

- a. The Contractor may utilize the services of specialty Subcontractors on those parts of the work which, under normal contracting practices are performed by specialty Subcontractors.
- b. The Contractor shall not award any work to any Subcontractor without prior written approval of the Owner, which approval will not be given until the Contractor submits to the Owner a written statement concerning the proposed award to the Subcontractor, which statement shall contain such information as the Owner may require.
- c. The Contractor shall be as fully responsible to the Owner for the acts and omissions of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.
- d. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind Subcontractors to the Contractor by the terms of the General Conditions and other Contract

Documents insofar as applicable to the work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.

- e. Nothing contained in this Contract shall create any contractual relation between any Subcontractor and the Owner.

35. Architect/Engineer's Authority

The Architect/Engineer shall give all orders and directions contemplated under this Contract and specifications, relative to the execution of the work. The Architect/Engineer shall determine the amount, quality, acceptability and fitness of the several kinds of work and materials which are to be paid for under this Contract and shall decide all questions which may arise in relation to said work and the construction thereof. The Architect/Engineer's estimates and decisions shall be final and conclusive, except as herein otherwise expressly provided. In case any question shall arise between the parties hereto relative to said Contract and specifications, the determination or decision of the Architect/Engineer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this Contract affected in any manner or to any extent by such question.

The Architect/Engineer shall decide the meaning and intent of any portion of the specifications and of any plans or drawings where the same may be found obscure or be in dispute. Any differences or conflicts in regard to their work which may arise between the Contractor under this Contract and other Contractors performing work for the Owner shall be adjusted and determined by the Architect/Engineer.

36. Stated Allowances

The Contractor shall include in his proposal the cash allowances stated in the Supplemental General Conditions. The Contractor shall purchase the "Allowed Materials" as directed by the Owner on the basis of the lowest and best bid of at least three (3) competitive bids. If the actual price for purchasing the "Allowed Materials" is more or less than the "Cash Allowance," the contract price shall be adjusted accordingly. The adjustment in contract price shall be made on the basis of the purchase price without additional charges for overhead, profit, insurance or any other incidental expenses. The cost of installation of the "Allowed Materials" shall be included in the applicable sections of the Contract Specifications covering this work.

37. Use of Premises and Removal of Debris

The Contractor expressly undertakes at his own expense:

- a. To take every precaution against injuries to persons or damage to property.
- b. To store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the work as will not unduly interfere with the progress of his work or the work of any other Contractors.
- c. To place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work.
- d. To clean up frequently all refuse, rubbish, scrap materials and debris caused by his operations, to the end that all times the site of the work shall present a neat, orderly and workmanlike appearance.
- e. Before final payment to remove all surplus material, false-work, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations, and to put the site in a neat, orderly condition.
- f. To effect all cutting, fitting or patching of his work required to make the same to conform to the plans and specifications and, except with the consent of the Architect/Engineer, not to cut or otherwise alter the work of any other Contractor.

38. Quantities of Estimate

Wherever the estimated quantities of work to be done and materials to be furnished under this Contract are shown in any of the documents including the proposal, they are given for use in comparing bids and the right is especially reserved except as herein otherwise specifically limited, to increase or diminish them as may be deemed reasonably necessary or desirable by the Owner to complete the work contemplated by this Contract, and such increase or diminution shall in no way vitiate this Contract, nor shall any such increase or diminution give cause for claims or liability for damages.

39. Lands and Rights-of-Way

Prior to the start of construction, the Owner shall obtain all lands and rights-of-way necessary for the carrying out and completion of work to be performed under this Contract.

40. General Guaranty

Neither the final certificate of payment nor any provision in the Contract Documents, nor partial or entire occupancy of the premises by the Owner, shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from the date of final acceptance of the work unless a longer period is specified. The Owner will give notice of observed defects with reasonable promptness.

41. Conflicting Conditions

Any provisions in any of the Contract Documents which may be in conflict or inconsistent with any of the paragraphs in these General Conditions shall be void to the extent of such conflict or inconsistency.

42. Notice and Service Thereof

Any notice to any Contractor from the Owner relative to any part of this Contract shall be in writing and considered delivered and the service thereof completed, when said notice is posted, by certified or registered mail, to the said Contractor at his last given address, or delivered in person to the said Contractor or his authorized representative on the work.

43. Provisions Required by Law Deemed Inserted

Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party the Contract shall forthwith be physically amended to make such insertion or correction.

44. Protection of Lives and Health

"The Contractor shall exercise proper precaution at all times for the protection of persons and property and shall be responsible for all damages to persons or property, either on or off the site, which occur as a result of his prosecution of the work. The safety provisions of applicable laws and building and construction codes, in addition to specific safety and health regulations described by Chapter XIII, Bureau of Labor Standards, Department of Labor, Part 1518, Safety and Health Regulations for Construction, as outlined in the Federal Register, Volume 36, No. 75, Saturday, April 17, 1971. Title 29 - LABOR, shall be observed and the Contractor shall take or cause to be taken, such additional safety and health measures as the Contracting Authority may determine to be reasonably necessary."

45. Subcontracts

"The Contractor will insert in any subcontracts the Federal Labor Standards Provisions contained herein and such other clauses as the Department of Housing and Urban Development may, by instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts which they may enter into, together with a clause requiring this insertion in any further subcontracts that may in turn be made."

46. Interest of Member of or Delegate to Congress

No member of or delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this Contract or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this Contract if made with a corporation for its general benefit.

47. Other Prohibited Interests

No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this Contract or in any part hereof. No officer, employee, architect, attorney, engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part thereof, any material supply contract, subcontract, insurance contract or any other contract pertaining to the project.

48. Use and Occupancy Prior to Acceptance by Owner

The Contractor agrees to the use and occupancy of a portion or unit of the project before formal acceptance by the Owner, provided the Owner:

- a. Secures written consent of the Contractor except in the event, in the opinion of the Architect/Engineer, the Contractor is chargeable with unwarranted delay in final cleanup of punch list items or other Contract requirements.
- b. Secures endorsement from the insurance-carrier and consent of the surety permitting occupancy of the building or use of the project during the remaining period of construction.

OR

- c. When the project consists of more than one building, and one of the buildings is occupied, secures permanent fire and extended coverage insurance, including a permit to complete construction. Consent of the surety must also be obtained.

49. Photographs of the Project

If required by the Owner, the Contractor shall furnish photographs of the project, in the quantities and as described in the Supplemental General Conditions.

50. Suspension of Work

Should the Owner be prevented or enjoined from proceeding with work either before or after the start of construction by reason of any litigation or other reason beyond the control of the Owner, the Contractor shall not be entitled to make or assert claim for damage by reason of said delay; but time for completion of the work will be extended to such reasonable time as the Owner may determine will compensate for time lost by such delay with such determination to be set forth in writing.

51. Contractor's Records

The Contractor shall retain all books, documents, papers and records which are directly pertinent to this contract for five years after expiration of this contract unless permission to destroy them is granted by the Owner. Furthermore, the Owner, the Alabama Department of Economic and Community Affairs, the Alabama Attorney General, the Comptroller General of the United States, or any of their duly authorized representatives, shall have access to any records of the Contractor directly pertinent to the contract, for the purpose of making audit, examination, excerpts and/or transcriptions.

52. Domestic Steel Requirements

As per Alabama Public Works Law, Code 39-3-4, any contractor for a public works project, financed by the State of Alabama or any political subdivision thereof, within this state shall use steel produced within the United States when specifications in the construction contract require the use of steel and do not limit its supply to a sole source under subsection (f) of section 39-2-2. If the procurement of the above-mentioned steel products becomes impractical as a result of a national emergency, national strike, or other cause, the awarding authority shall waive the above restriction.

In the event the contractor violates the domestic steel requirements of subsection (a) and domestic steel is not used, there shall be a downward adjustment in the contract price equal to any realized savings or benefits to the contractor.

53. Domestic Products Requirements

As per Alabama Public Works Law, Code 39-3-1, Contracts for public works project financed entirely by state or subdivisions thereof to provide for use of domestic products if available, etc.

- (a) The awarding authority contracting for a public works project to be financed entirely by the State of Alabama or any political subdivision of the state, shall stipulate or cause to be stipulated in the contract a provision whereby the person, firm, or corporation undertaking the project agrees to use in the execution of the contract materials, supplies, and products manufactured, mined, proceeded, or otherwise produced in the United States or its territories, if the same are available at reasonable and competitive prices and are not contrary to any sole source specification implemented under subsection (f) of Section 39-2-2.
- (b) In the event the contractor breaches the agreement to use domestic products, and domestic products are not used, there shall be a downward adjustment in the contract price equal to any realized savings or benefits to the contractor.

SUPPLEMENTAL GENERAL CONDITIONS

1. BONDS AND INSURANCE

1.1 The following are your instructions with respect to the requirements for Bonds and insurance to be included in the Construction Documents for the above Project.

1.2 Bonds - Bid security is to be provided by each CONTRACTOR in the amount of five percent of his maximum Bid price and will be in the form of:

- a) Bid Bond; the prescribed type of Bid Bond is attached.
- b) Bank cashier's check.
- c) Construction Performance Bond and Construction Payment Bond each in an amount equal to the Contract Price.

1.3 Workers Compensation - The limits of liability for the workers compensation insurance required as specified in the General Conditions shall provide coverages for not less than the following amounts or greater where required by law or regulations and the coverages shall be as follows:

- a) State: Statutory
- b) Applicable Federal Statutory
- c) Employer's Liability \$500/500/500

1.4 Contractor's Liability Insurance - Additional insureds shall be the Owner, the Engineer and their Consultants.

1.5 All insurance certificates shall provide for "Waiver of Subrogation" against the Owner, Engineer and their Consultants, by the Contractor, Subcontractors and their insurers.

1.6 All insurance certificates shall provide Excess Liability and Umbrella Form:
General Aggregate: \$0
Each Occurrence: \$0

1.7 Commercial General Liability of the General Conditions (including Premises-Operations; Independent Contractor's Protection; Products Liability and Completed Operations; Broad Form Property Damage) and Blanket Contractual Liability:

- a) Bodily Injury and Property Damage Liability:

\$2,000,000	Each Occurrence
\$1,000,000	Personal Advertising Injury
\$2,000,000	General Aggregate
\$2,000,000	Products and Completed Operations Aggregate

- b) Property Damage liability insurance will provide Explosion, Collapse and Underground coverages.

1.8 Comprehensive Automobile Liability as specified in the General Conditions:

- a) Bodily Injury and Property Damage:

\$1,000,000

Each Occurrence

- 1.9 Additional liability coverage for Owner and Engineer will be provided:

- a) By endorsement as additional insureds on CONTRACTOR'S General Liability Policy.
b) The CONTRACTOR'S general liability carrier shall not issue a separate Protective Liability Policy covering Owner and Engineer.

- 1.10 The insurance covered by this certificate will not be cancelled or materially altered, except after ten (10) days written notice has been received by the Owner (certificate holder) (General Conditions-Section 28 f.)

2. **PROTECTION OF OWNER**

- 2.1 The Contractor hereby agrees to hold harmless, indemnify and defend the Owner, the Owner's agent, the Consulting Engineers, and the owner's employees while acting within the scope of their duties from and against any and all liability, claims, damages, and cost of defense arising out of the Contractor's performance of the work described herein but not including the sole negligence of the Owner, his agents or employees. The Contractor will require any and all subcontractors to conform with the provisions of this clause prior to commencing any work and agrees to name as additional insured the Owner and the Consulting Engineer.
- 2.2 The Contractor and his insurer, by the contractor's execution of the Contract, shall waive all rights of subrogation against the Owner, Architect, and their Consultants, on all insurance provided by the Contractor and by every Subcontractor.
- 2.3 The Contractor and his insurer agree all policies furnished by Contractor shall contain no exclusion pertaining to faulty workmanship, job related accident, safety or construction sequences.

3. **MAINTENANCE OF TRAFFIC**

- 3.1 Traffic is to be maintained on all roads and streets which must be crossed by construction related to this contract. If the open cut method is used for construction, two separate cuts must be made and one lane left open to traffic at all times. All pipelines crossing roads and streets shall be installed in accordance with the State Department of Transportation Policy and Procedures.

4. **SHOP DRAWINGS APPROVAL**

- 4.1 All submittals, shop drawings and other similar documents submitted to the Engineer for approval shall first be reviewed and approved by the Contractor. Each document submitted to the Engineer shall contain the following wording: "The Contractor hereby represents that all field measurements, field construction criteria, materials, dimensions, catalog numbers and other similar data have been determined and verified and that each shop drawing and sample has been checked and coordinated with the requirements of the work and of the contract documents".

5. **SUBSTITUTES AND "OR-EQUALS"**

- 5.1 Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described as follows:

5.1.1 **OR EQUAL ITEMS**

- A. If in the Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
- 1) In the exercise of reasonable judgment Engineer determines that (i) it is at least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole.
 - 2) Contractor certifies that (i) there is no increase in cost to the Owner; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.
- B. Where "or equal" or "approved equal" occurs in the specifications, the Contractor will be allowed under the procedure outlined below to submit for approval prior to the bid opening detailed information concerning alternative products. The information shall contain:
- 1) A copy of the contract specifications that name the materials, products and manufacturers as specified.
 - 2) The manufacturers specifications for the materials, products and performance of the proposed alternative.
 - 3) Submittals concerning all proposed substitutions shall be submitted in writing to the Engineer 14 days or more prior to the date of the bid opening. All submittals shall be made in good faith and shall be certified as verifiably equal or superior to the specified item.
 - 4) All submittals shall include all data that would be present in construction drawings and specifications, including complete names and descriptions, dimensions, performance verification, and latest catalog numbers.
 - 5) If a new material is proposed for substitution, data shall be provided on laboratory tests and standards that have been observed in the design of the product.

- 6) If a new fabricator is proposed, information concerning his capabilities and experience shall be included in the submittal.
- 7) The Engineer will review the "or equal" submittal package as quickly as possible and will issue a written opinion to the Contractor and to all other bidders within two days of the bid opening.

5.1.2. **SUBSTITUTE ITEMS**

- A. In the Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, it will be considered a proposed substitute item.
- B. Contractor shall submit sufficient information as provided below to allow Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor.
 - 1) Contractor shall first make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use.
 - 2) The application shall certify that the substitute item will perform adequately and achieve the results called for by the general design, be similar in substance to that specified.
 - 3) The application will state the extent, if any, if the use of proposed substitute item will affect Contractor's Substantial Completion on time, whether or not use of the substituted item will require a change in any of the Contract Documents to adapt the design of the proposed substitute item and whether or not use of the substitute item is subject to payment of any license fee or royalty.
 - 4) All variations of the substitute item will be identified in the application and available engineering, sales, maintenance, repair, and replacement services will be indicated.
 - 5) The application will also contain an itemized estimate of all costs or credits that will result from use of substitute item, including costs of redesign and claims of other contractors affected by resulting changed
 - 6) Engineer may require Contractor to furnish additional data about the proposed substitute item.
 - 7) Any proposal for alternate equipment shall be accompanied by full engineering calculations demonstrating the combined hydraulic and electrical performance of the proposed equipment. Additional data required for evaluation will include, but not be limited to, pump curves, complete control data, including proposed schematic circuitry, and a list of at least 5 successful installations of equal or larger size to that specified. A complete operational history of and supervisor contact for each reference, telephone numbers of personnel contacts and dates of equipment installation and acceptance shall be provided prior to approval of alternate equipment. The Contractor shall be responsible for accumulation of all data required for equipment evaluation.
 - 8) In the event the Contractor obtains Engineer's approval of equipment other than that which was originally laid out, the Contractor shall make at his own expense, any changes in structures, buildings, piping, wiring, or other appurtenances necessary to accommodate the alternate equipment, and shall furnish proposed blueprint drawings, 24" x 36" size minimum, to show clearly and illustrate any and all changes in the

station to the Engineer. As-built drawings, 24" x 36" minimum, will be required to show the completed structure with alternate equipment installed. All drawings shall be accurately dimensioned and scaled.

- 9) It will be assumed that the cost to the Contractor of the equipment proposed for substitution is less than that of the equipment specified in the contract. Prior to approval of any substitute equipment, the Contractor shall provide firm documentation of the pricing for both the specified and alternate equipment. The Contract Price shall then be reduced by an amount exactly equal to the difference in cost between the specified and the alternate equipment.

5.1.3 **SUBSTITUTE CONSTRUCTION METHODS OR PROCEDURES**

- A. If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer to determine that the substitute proposed is equivalent to that called for by the Contract Documents. The procedure for review by Engineer will be similar to that listed in the above section.

5.1.4 **ENGINEER'S EVALUATION**

- A. Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal. Engineer will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized until Engineer's review is completed.

5.1.5 **SPECIAL GUARANTEE**

- A. Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

5.1.6 **ENGINEER'S COST REIMBURSEMENT**

- A. Engineer will record time required by Engineer and Engineer's Consultants in evaluating substitute proposed or submitted by Contractor and in making changes in the Contract Documents (or in the provisions of any other direct contact with Owner for work on the Project). Whether or not Engineer approves a substitute item so proposed or submitted by Contractor, Contractor shall reimburse Owner for the charges of Engineer and Engineer's Consultants for evaluating each such proposed substitute.

5.1.7 **CONTRACTOR'S EXPENSE**

- A. Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6. **COPIES OF DOCUMENTS**

- 6.1 The Contractor will be furnished with three complete sets of plans and specifications. Any additional sets required can be purchased for the payment fee as stipulated in the Advertisement for Bids.

7. **SUBCONTRACTORS, SUPPLIERS AND OTHERS**

- 7.1 The Contractor will be required to submit a list of Subcontractors, Suppliers and other persons and organizations (including those who are to furnish the principal items of material and equipment) to the Owner in advance of the Effective Date of the Agreement.

8. **CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES**

- 8.1 Immediately after execution and delivery of the contract, and before the first partial payment is made, the Contractor shall deliver to the Owner an estimated construction progress schedule in form satisfactory to the Owner, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents and the anticipated amount of each monthly payment that will become due the Contractor in accordance with the progress schedule. The Contractor shall also furnish on forms to be supplied by the Owner (a) a detailed estimate giving a complete breakdown of the contract price and (b) periodic itemized estimates of work done for the purpose of making partial payments thereon. The costs employed in making up any of these schedules will be used only for determining the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the contract price.
- 8.2 The Contractor shall schedule the work to be completed within the time for completion as provided in the contract. Work shall be scheduled during regular work times during week days, except for special or emergency situations that may arise. Engineer shall be notified in writing at least two days in advance of any overtime or weekend work schedules, except in the case of emergencies. Contractor shall be responsible for any extra inspection and testing costs resulting from work performed under special work hour conditions.

9. **DOCUMENTATION**

- 9.1 The Contractor shall supply a digital copy, along with one (1) hard copy of detailed submittal drawings, Operation and Maintenance instruction manuals, and parts lists for all equipment provided as a part of this contract. Standard submittals will consist of the following as an absolute minimum:

1. Outline Drawings
2. Electrical Data and As-Built Schematics
3. Equipment Performance Data
4. Control Panel Schematics and Dimensional Data
5. Installation Data for all Equipment
6. Factory Certifications Required

Operation and Maintenance manuals and parts lists shall be provided to the Owner after the equipment has been started and placed into automatic operation by the supplier. Three sets of manuals shall be provided to the Owner. All manuals shall be new and unused and shall pertain to the type and model of equipment provided. General manuals that do not give specific details concerning the equipment actually provided shall not be acceptable.

10. **RECORD DOCUMENTS**

- 10.1 Contractor shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders and written interpretations and clarifications in good order and annotated to show all changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples and Shop Drawings shall be delivered to Engineer for Owner.

11. **SALVAGE MATERIAL**

- 11.1 All metals and devices removed from the project that can be returned for scrap shall be the property of the Owner. Owner shall have first right of refusal on all items that are to be demolished, removed or scrapped from the project. Contractor shall provide a list of such items in written form to the Owner. Prior to the Contractor salvaging any material for his own gain, the Contractor shall obtain written approval from the Owner.

12. **NOTICE OF COMPLETION**

- 12.1 The Contractor shall immediately after the completion of the contract give notice of said completion by an advertisement in some newspaper of general circulation published within the city or county wherein the work has been done for a period of three successive weeks. The notice shall comply with Title 39, Chapter 1, Section 1, Subsection (f), Code of Alabama.
- 12.2 The notice shall notify all creditors to file any claims for unpaid bills in writing with the Owner prior to a date specified in the notice. The Contractor shall submit a draft of the completion notice to the engineer for approval prior to publication.

13. **HB 24, Act #2014-404 CODE OF ALABAMA**

Approved House Bill 24, Act #2014-404, effective on July 1, 2014 amends §39-2-2 and §39-2-12 relating to public works contracts. The new legislation, among other things:

- (1) Requires pre-bid meetings to be held at least seven days prior to the bid opening.
- (2) Provides that the awarding authority shall designate a person to review the progress of completed work and to review documents submitted by the contractor.
- (3) Reduces the time for payment of completed work on public works contracts by an awarding authority. Generally, partial payment shall be made as work progresses at the end of each calendar month, but in no case later than 35 days after acceptance of work by the awarding authority. If any payment is made after the 35-day period for payment, the awarding authority must pay interest at the rate assessed for underpayment of taxes under §40-1-44(a), *Code of Alabama*.
- (4) Provides for the review and approval of the progress of completed work and provides procedures for the dispute of any submitted invoice.
- (5) Provides that the awarding authority may not offer a contract for bidding unless confirmation of any applicable grant has been received and any required matching funds have been secured by or are available to the awarding authority.

14. **SAM (System for Award Management)**

- 14.1 Registration in SAM (System for Award Management) www.sam.gov is required to participate in ADECA projects and other Federal funding programs.

15. **TAXES**

- 15.1 Owner is exempt from payment of sales and compensating use taxes of the State of Alabama and of cities and counties thereof on all materials to be incorporated into the Work.
- A. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.
 - B. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

END OF SECTION

SUPPLEMENTAL GENERAL CONDITIONS
Including Equal Opportunity Provisions

1. Enumeration of Plans, Specifications and Addenda
2. Stated Allowances
3. Special Hazards
4. Contractor's and Subcontractor's Public Liability, Vehicle Liability and Property Damage Insurance
5. Photographs of Project
6. Builder's Risk Insurance
7. Special Equal Opportunity Provisions
8. Certification of Compliance with Air and Water Acts
9. Special Conditions Pertaining to Hazards, Safety Standards and Accident Prevention

1. Enumeration of Plans, Specifications and Addenda

Following are the Plans, Specifications and Addenda which form a part of this Contract, as set forth in paragraph 1 of the General Conditions, "Contracts and Contract Documents":

DRAWINGS:

Consisting of a coversheet and sheets (for a total of 24 sheets) each bearing the general title: "Waste Water Treatment Facility Improvements in the Town of Fulton, AL. DRA Project No: AL-55118, GMC Project No.: CMGM230141, May 2025."

SPECIFICATIONS:

See Table of Contents

ADDENDA:

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

2. Stated Allowances

Pursuant to paragraph 36 of the General Conditions, the Contractor shall include the following cash allowances in his proposal: **See Bid Proposal Form**

3. Special Hazards

The Contractor's and his Subcontractor's Public Liability and Property Damage Insurance shall provide adequate protection against the following special hazards: Not applicable

4. Contractor's and Subcontractor's Public Liability, Vehicle Liability and Property Damage Insurance

As required under paragraph 28 of the General Conditions, the Contractor's Public Liability Insurance and Vehicle Liability Insurance shall be in the amount not less than \$1,000,000 for injuries, including accidental death, to any one person, and subject to the same limit for each person, in an amount not less than \$1,000,000 on account of one accident, the Contractor's Property Damage Insurance (refer to Supplemental General Conditions – Section 00700-1, paragraph 2.7).

The Contractor shall either (1) require each of his Subcontractors to procure and to maintain during the life of his subcontract, Subcontractor's Public Liability and Property Damage Insurance of the type and in the same amounts as specified in the preceding paragraph, or (2) insure the activities of his Subcontractors in his own policy.

5. Photographs of Project

As provided in paragraph 30 of the General Conditions, the Contractor will furnish photographs in the number, type and stage as enumerated below: Not applicable

6. Builder's Risk Insurance

As provided in the General Conditions, paragraph 29(e), the Contractor ~~will~~/will not* maintain Builder's Risk Insurance (fire and extended coverage) on a 100 percent completed value basis on the insurable portions of the project for the benefit of the Owner, the Contractor and all Subcontractors, as their interests may appear.

*Strike out one.

7. Special Equal Opportunity Provisions

A. 3-Paragraph Equal Opportunity Clause for Activities and Contracts Not Subject to Executive Order 11246, as Amended (applicable to Federally assisted construction contracts and related subcontracts \$10,000 and under)

During the performance of this Contract, the Contractor agrees as follows:

1. The Contractor shall not discriminate against any employer or applicant for employment because of race, color, religion, sex or national origin. The Contractor shall take affirmative action to ensure the applicants for employment are employed, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.
2. The Contractor shall post in conspicuous places, available to employees and applicants for employment, notices to be provided by contracting officer setting forth the provisions of this nondiscrimination clause. The Contractor shall state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.
3. Contractors shall incorporate foregoing requirements in all subcontracts.

B. Executive Order 11246 (contracts/subcontracts above \$10,000)

1. Section 202 Equal Opportunity Clause

During the performance of this Contract, the Contractors agrees as follows:

- a. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applications for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
- b. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.
- c. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer, advising said labor union or workers' representatives of the Contractor's commitment under Section 202 of the provisions of Executive Order 11246 of Sept. 24, 1965, appear at 30 FR 12319, 12935, 3 CFR, 1964 -1965 Comp., o. 339, unless otherwise noted.

- d. The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations and relevant orders of the Secretary of Labor.
 - e. The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the Department and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and others.
 - f. In the event of the Contractor's non-compliance with the nondiscrimination clauses of this Contract or with any of the said rules, regulations or orders, this Contract may be canceled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.
 - g. The Contractor will include the provisions of the sentence immediately preceding paragraph a. and the provisions of paragraphs a. through g. in every subcontract or purchase order unless exempted by rules, regulations or order of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each Subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Department may direct as a means of enforcing such provisions, including sanctions for non-compliance. Provided, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a Subcontractor or vendor as a result of such direction by the Department, the Contractor may request the United States to enter into such litigation to protect the interest of the United States.
2. Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246) (applicable to contract/subcontracts exceeding \$10,000)
- a. The Offerer's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
 - b. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for
Minority
Participation

26.4%

Goals for
Female
Participation

6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally assisted) performed in the covered area. If the Contractor performs construction work in a geographic area, it shall apply the goals established for such geographic area where the work is actually performed. With regard to this second area, the Contractor also is involved and non-Federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the

Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the Contract, the Executive Order and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

- c. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within ten (10) working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the Subcontractor; employer identification number; estimated dollar amount of the subcontract; and the geographical area in which the contract is to be performed.
 - d. As used in this notice, and in the contract resulting from the solicitation, the "covered area" is (State of Alabama, Clarke County, the Town of Fulton).
3. Standard DRA Assisted Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246)
- a. As used in these specifications:
 - (1) "Covered area" means the geographical area described in the solicitation from the which this Contract resulted.
 - (2) "Director" means Director, Office of Federal Contract Compliance Program, United States Department of Labor, or any person to whom the Director delegates authority.
 - (3) "Employer Identification Number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U. S. Treasury Department Form 941.
 - (4) "Minority" includes:
 - (a) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin).
 - (b) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish culture or origin, regardless of race).
 - (c) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent or the Pacific Islands).
 - (d) American Indian or Alaskan native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
 - (5) Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this Contract resulted.
 - (6) If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U. S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the plan area (including goals and timetables) shall be in accordance with that plan for those trades which have unions participating in the plan. Contractors must be able to demonstrate

their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the plan goals and timetables.

- (7) The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this Contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction Contractors performing contracts in geographical area where they do not have a Federal or Federally-assisted construction contract shall apply the minority and female goals established for the geographic area where the contract is being performed. Goals are published periodically in the Federal Register in notice form and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.
- (8) Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under the specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.
- (9) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U. S. Department of Labor.
- (10) The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:
 - (a) Ensure and maintain a working environment free of harassment, intimidation and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
 - (b) Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
 - (c) Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a

union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

- (d) Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
- (e) Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.
- (f) Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
- (g) Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed and disposition of the subject matter.
- (h) Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.
- (I) Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures and tests to be used in the selection process.
- (j) Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation

employment to minority and female youth both on the site and in other areas of Contractor's work force.

- (k) Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.
 - (l) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for through appropriate training, etc., such opportunities.
 - (m) Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effort by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.
 - (n) Ensure that all facilities and company activities are nonsegregated except that separate or single-use toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
 - (o) Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and supplies, including circulation of solicitations to minority and female contractor associations and other business associations.
 - (p) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.
- (11) Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation shall not be a defense for the Contractor's non-compliance.
- (12) A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).
- (13) The contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex or national origin.
- (14) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

- (15) The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.
- (16) The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.
- (17) The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e. g. mechanic, apprentice, trainee, helper or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, Contractors shall not be required to maintain separate records.
- (18) Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application or requirements for the hiring of local or other area residents (e. g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

C. Certification of Nonsegregated Facilities (over \$10,000)

By the submission of this bid, the bidder, offeror, applicant or subcontractor certifies that s/he does not maintain or provide for his/her employees any segregated facility at any of his/her establishment, and that s/he does not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. S/he certifies further that s/he will not maintain or provide for employees any segregated facilities at any of his/her establishments, and s/he will not permit employees to perform their services at any location under his/her control where segregated facilities are maintained. The bidder, offeror, applicant or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause of this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, *transportation and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local customer or otherwise. S/he further agrees that (except where s/he has obtained identical certifications from proposed Subcontractors for specific time periods) s/he will obtain identical certification from proposed Subcontractors prior to the award of subcontractors exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity Clause; that s/he will retain such certifications in his/her files; and that s/he will forward the following notice to such proposed Subcontractors (except where proposed Subcontractors have submitted identical certifications for specific time periods).

*Parking lots, drinking foundations, recreation or entertainment areas.

D. Title VI Clause, Civil Rights Act of 1964

Under Title VI of the Civil Rights Act of 1964, no person shall, on the grounds of race, color or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.

E. Section 109 Clause, Housing and Community Development Act of 1974

No person in the United States shall on the grounds of race, color, national origin or sex be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity funded in whole or in part with funds made available under this title.

F. "Section 3" Compliance in the Provision of Training, Employment and Business Opportunities

1. The work to be performed under this Contract is on a project assisted under a program providing direct Federal financial assistance from the Department of Housing and Urban Development and is subjected to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12, U.S.C. 1701u. Section 3 requires that to the greatest extent feasible, opportunities for training and employment be given lower income residents of the project area and contracts for work in connection with the project be awarded to business concerns which are located in, or owned in substantial part by persons residing in the area of the project.
2. The parties of this Contract will comply with the provisions of said Section 3 and the regulations issued pursuant thereto by the Secretary of Housing and Urban Development set forth in 24 CFR 135, and all applicable rules and orders of the Department issued thereunder prior to the execution of this Contract. The parties to this Contract certify and agree that they are under no contractual or other disability which would prevent them from complying with these requirements.
3. The Contractor will send to each labor organization or representative of workers with which he has a collective bargaining agreement or other contract or understanding, if any, a notice advising the said labor organization or workers' representative of this commitments under this Section 3 clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment or training.
4. The Contractor will include this Section 3 clause in every subcontract for work in connection with the project and will, at the direction of the applicant for or recipient of Federal financial assistance, take appropriate action pursuant to the subcontract upon a finding that the Subcontractor is in violation of regulations issued by the Secretary of Housing and Urban Development, 24 CFR Part 135. The Contractor will not subcontract with any Subcontractor where it has notice or knowledge that the latter has been found in violation of regulations under 24 CFR Part 135 and will not let any subcontract unless the Subcontractors has first provided it with a preliminary statement of ability to comply with the requirements of these regulations.
5. Compliance with the provisions of Section 3, the regulations set forth in 24 CFR Part 135, and all applicable rules and orders of the Department issues hereunder prior to the execution of the Contract, shall be a condition of the Federal financial assistance provided to the project, binding upon the applicant or recipient for such assistance, its successors and assigns. Failure to fulfill these requirements shall subject the applicant or recipient, its contractors and subcontractors, its successors and assigns to those sanctions specified by the grant or loan agreement or contract through which Federal assistance is provided, and to such sanctions as are specified in 24 CFR Part 135.

G. Rehabilitation Act of 1973, Section 504 Handicapped (if \$2,500 or over)

Affirmative Action for Handicapped Workers

1. The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.
2. The Contractor agrees to comply with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.
3. In the event of the Contractor's non-compliance with the requirements of this clause, actions for non-compliance may be taken in accordance with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.
4. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the contracting officer. Such notices shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.
5. The Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Rehabilitation Act of 1973, and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.
6. The Contractor will include the provisions of this clause in every subcontract or purchase order of \$2,500 or more unless exempted by rules, regulations or orders of the Secretary issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each Subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for non-compliance.

H. Section 402 Veterans of the Vietnam Era (if \$10,000 or over)

Affirmative Action for Disable Veterans and Veterans of the Vietnam Era

1. The contractor will not discriminate against any employee or applicant for employment because he or she is a disable veteran or veteran of the Vietnam era in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based on their disability or veteran status in all employment practices such as the following: employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.
2. The Contractor agrees that all suitable employment openings of the Contractor which exist at the time of the execution of this Contract and those which occur during the performance of this Contract, including those not generated by this Contract and including those occurring at an establishment of the Contractor other than the one wherein the Contract is being performed but excluding those of independently operated corporate affiliates, shall be listed at an appropriate local office of the State employment service system wherein the opening occurs. The Contractor further agrees to provide such reports to such local office regarding employment openings and hires as may be required.

State and local government agencies holding Federal contracts of \$10,000 or more shall also list all their suitable openings with the appropriate office of the State employment service, but are not required to provide those reports set forth in paragraphs 4 and 5.

3. Listing of employment openings with the employment service system pursuant to this clause shall be made at least concurrently with the use of any other recruitment source or effort and shall involve the normal obligations which attach to the placing of a bond fide job order, including the acceptance of referrals of veterans and non-veterans. The listing of employment openings does not require the hiring of any particular job applicant or from any particular group of job applicants, and nothing herein is intended to relieve the Contractor from any requirements in Executive Orders or regulations regarding nondiscrimination in employment.
4. The reports required by paragraph 2 of this clause shall include, but not be limited to, periodic reports which shall be filed at least quarterly with the appropriate local office or, where the Contractor has more than one hiring location in a State, with the central office of the State employment service. Such reports shall indicate for each hiring location (1) the number of individuals hired during the reporting period, (2) the number of nondisabled veterans of the Vietnam era hired, (3) the number of disabled veterans of the Vietnam era hired, and (4) the total number of disabled veterans hired. The reports should include covered veterans hired for on-the-job training under 38 U.S.C. 1787. The Contractor shall submit a report within 30 days after the end of each reporting period wherein any performance is made on this Contract identifying data for each hiring location copies of the reports submitted until the expiration of one year after final payment under the Contract, during which time these reports and related documentation shall be made available, upon request, for examination by any authorized representatives of the contracting officer or of the Secretary of Labor. Documentation would include personnel records respecting job openings, recruitment and placement.
5. Whenever the Contractor becomes contractually bound to the listing provisions of this clause, it shall advise the employment service system in each State where it has establishments of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these provisions and has so advised the State system, there is no need to advise the State system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by the contract clause.
6. This clause does not apply to the listing of employment openings which occur and are filled outside of the 50 states, the District of Columbia, Puerto Rico, Guam and the Virgin Islands.
7. The provisions of paragraphs 2, 3, 4 and 5 of this clause do not apply to openings which the Contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement. This exclusion does not apply to a particular opening once an employer decides to consider applicants outside of his own organization or employer-union arrangement for that opening.
8. As used in this clause:
 - a. "All suitable employment openings" includes, but is not limited to, openings which occur in the following job categories: production and nonproduction; plant and office; laborers and mechanics; supervisory and nonsupervisory; technical; and executive, administrative, and professional openings are compensated on a salary bases of less than \$25,000 per year. This term includes full-time employment, temporary employment of more than three days' duration, and part-time employment. It does not include openings which the Contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement nor openings in an educational institution which are restricted to students of that institution. Under the most compelling circumstances an employment opening may not be suitable for listing, including such situations where the needs of the Government

cannot reasonably be otherwise supplied, where listing would be contrary to national security, or where the requirement of listing would otherwise not be for the best interest of the Government.

- b. "Appropriate office of the State employment service system" means the local office of the Federal-State national system of public employment offices with assigned responsibility for serving the area where the employment opening to be filled, including the District of Columbia, Guam, Puerto Rico and the Virgin Islands.
 - c. "Openings which the contractor proposes to fill from within his own organization" means employment openings for which no consideration will be given to persons outside the Contractor's organization (including any affiliates, subsidiaries, and the parent companies) and includes any openings which the Contractor proposed to fill from regularly established "recall" lists.
 - d. "Openings which the Contractor proposes to fill pursuant to a customary and traditional employer-union hiring arrangements" means employment openings which the Contractor proposes to fill from union halls, which is part of the customary and traditional hiring relationship which exists between the Contractor and representatives of his employees.
- 9. The Contractor agrees to comply with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.
 - 10. In the event of the Contractor's non-compliance with the requirements of this clause, actions for non-compliance may be taken in accordance with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.
 - 11. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by through the contracting officer. Such notices shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era for employment, and the rights of applicants and employees.
 - 12. The Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of the Vietnam Era Veterans Readjustment Assistance Act, and is committed to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era.
 - 13. The Contractor will include the provisions of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations or orders of the Secretary issued pursuant to the Act, so that such provisions will be binding upon each Subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for non-compliance.

I. Age Discrimination Act of 1975

During the performance of this Contract, the Contractor agrees as follows: the Contractor agrees not to exclude from participation, deny program benefits, or discriminate on the basis of age.

- 8. Certification of Compliance with Air and Water Acts (applicable to Federally assisted construction contracts and related subcontracts exceeding \$10,000)

Compliance with Air and Water Acts

During the performance of this Contract, the Contractor and all Subcontractors shall comply with the requirements of the Clean Air Act, as amended, 42 USC 1857 et seq., the Federal Water Pollution Control Act, as amended, 33 USC 1251 et seq., and the regulations of the Environmental Protection Agency with respect thereto, at 40 CFR Part 15, as amended. In addition to the foregoing requirements, all nonexempt Contractors and Subcontractors shall furnish to the Owner, the following:

- A. A stipulation by the Contractor or Subcontractors, that any facility to be utilized in the performance of any nonexempt contract or subcontract, is not listed on the List of Violating Facilities issued by the Environmental Protection Agency (EPA) pursuant to 40 CFR 15.20.
- B. Agreement by the Contractor to comply with all the requirements of Section 114 of the Clean Air Act, as amended, (42 USC 1857c-8) and Section 308 of the Federal Water Pollution Control Act, as amended, (33 USC 1318) relating to inspection, monitoring, entry, reports and information, as well as all other requirements specified in said Section 114 and Section 308, and all regulations and guidelines issued thereunder.
- C. A stipulation that as a condition for the Contract, prompt notice will be given of any notification received from the Director, Office of Federal Activities, EPA, indicating that a facility utilized, or to be utilized for the Contract, is under consideration to be listed on the EPA List of Violating Facilities.
- D. Agreement by the Contractor that he will include, or cause to be included, the criteria and requirements in paragraphs A through D of this section in every nonexempt subcontract and requiring that the Contractor will take such actions as the Government may direct as a means of enforcing such provisions.

9. Special Conditions Pertaining to Hazards, Safety Standards and Accident Prevention

- A. Lead-Based Paint Hazards (applicable to contracts for construction or rehabilitation of residential structures)

The construction or rehabilitation of residential structures is subject to the HUD Lead-Based Paint regulations, 24 CFR Part 35. The Contractor and Subcontractors shall comply with the provisions for the elimination of lead-based paint hazards under sub-part B of said regulations. The Owner will be responsible for the inspections and certifications required under Section 35.14(f) thereof.

- B. Use of Explosives (modify as required)

When the use of explosives is necessary for the prosecution of the work, the Contractor shall observe all local, State and Federal laws in purchasing and handling of explosives. The Contractor shall take all necessary precaution to protect completed work, neighboring property, water lines or other underground structures. Where there is danger to structures or property from blasting, the charges shall be reduced and the material shall be covered with suitable timber, steel or rope mats.

The Contractor shall notify all owners of public utility property of intention to use explosives at least eight hours before blasting is done close to such property. Any supervision or direction of use of explosives by the Engineer, does not in any way reduce the responsibility of the Contractor or his Surety for damage that may be caused by such use.

- C. Danger Signals and Safety Devices (modify as required)

The Contractor shall make all necessary precautions to guard against damages to property and injury to persons. He shall put up and maintain in good condition, sufficient red or warning lights at night, suitable barricades and other devices necessary to protect the public. In case the Contractor fails or neglects to take such precautions, the Owner may have such lights and barricades installed and charge the cost of this work to the Contractor. Such action by the Owner does not relieve the Contractor of any liability incurred under these specifications or Contract.

**TECHNICAL SPECIFICATIONS
FOR
WASTE WATER TREATMENT FACILITY IMPROVEMENTS
DRA PROJECT NO: AL-55118

TOWN OF FULTON, ALABAMA
GMC PROJECT NO. CMGM230141**

OWNERSHIP OF DOCUMENTS AND DISCLAIMER

The Project Manual, Technical Specifications, Drawings, and all other documents relating to this project have been prepared for this individual and particular project, and for the exclusive use of the original Owner, developer or other party so indicated.

Actual project conditions and as-built conditions may vary significantly. Changes made during bidding, negotiations, construction, due to additions or deletions of portions of this project, and/or for other reasons, may not be indicated in these documents.

These documents may not be used or relied upon as a certification of information indicated, or used for any other project, by any third parties or other parties, for any purpose whatsoever, without the prior written consent of Goodwyn Mills Cawood, LLC., or prior to receipt of mutually agreed to compensation paid to Goodwyn Mills Cawood, LLC., therefor.

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SECTION 01 10 00 - SUMMARY

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:
 - 1. Project information
 - 2. Work covered by Contract Documents
 - 3. Phased construction
 - 4. Contractor-furnished
 - 5. Access to Site
 - 6. Coordination with Occupants
 - 7. Work Restrictions
 - 8. Specification and Drawing Conventions
 - 9. Miscellaneous Provisions
- B. Related Requirements:
 - 1. Section 01 50 00 - Temporary Facilities and Controls for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: Canfor Expansion Wastewater Plant Improvements
 - 1. Project Location: **800 Church Road, Fulton, AL**
- B. Owner: **Town of Fulton**
 - 1. Owner's Representatives: **Mike Norris, Mayor; Sebastian Shoemaker, Operator**
- C. Engineer: **Goodwyn Mills Cawood; Birmingham, AL**
- D. Engineer's Consultants: The Engineer has retained the following design professionals who have prepared designated portions of the Contract Documents:
 - 1. Electrical Engineer – Goodwyn Mills Cawood; Montgomery, AL
- E. Contractor: TBD.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. General Description: This project generally consists of the rehabilitation of Fulton's existing treatment system and the addition a new treatment unit to be integrated with the existing units onsite. Contractor shall be responsible for coordination with the treatment unit manufacturer/supplier to ensure complete integration and operability of the previously existing and new treatment units.
2. The construction and modifications consist of the following:
 - a. Clearing and grubbing, civil/site work, etc.
 - b. Installation of new package treatment unit
 - c. Repair of gaskets
 - d. Installation of replacement textile media, manifolds, fans, lid clamps in existing treatment units
 - e. Installation of replacement aerator pumps
 - f. Installation of replacement discharge pumps
 - g. Installation of replacement recirculation pump
 - h. Upgrade of existing control panel to achieve full functionality with all existing and proposed treatment units (including necessary reprogramming)

B. Type of Contract:

1. Project will be constructed as a design-bid-build contract.

1.5 WORK BY OWNER

- A. General:** Cooperate fully with Owner so that work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.6 CONTRACTOR-FURNISHED AND INSTALLED PRODUCTS

- A.** Contractor shall furnish all products indicated in the bid documents. The Work includes unloading, handling, storing, and protecting Contractor-furnished products as directed and turning them over to Owner at Project closeout.

1.7 ACCESS TO SITE

- A. General:** Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other Contractors on portions of Project.
- B. Use of Site:** Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways and loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.8 COORDINATION WITH OCCUPANTS

- A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 1. Engineer will prepare a Certificate of Substantial Completion for each specific phase of the project.
 2. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.

1.9 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.
- B. On-Site Work Hours: Working hours shall be generally limited to 7am to 5pm; Contractor shall contact the Engineer/Owner when working hours are extended beyond normal business hours or when weekend construction is expected to occur.
- C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to neighbors with the Owner.
 1. Obtain Engineer's written permission before proceeding with disruptive operations.
- D. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1.10 ADVERSE WEATHER

- A. General
 1. Notice of rain delay days with the documentation of the aforementioned sources herein and on-site records must be submitted by the Contractor to the Inspector/Engineer on the first working day of every month for the previous month or at the monthly construction meeting as determined at the preconstruction meeting.

B. Definition

1. Adverse weather is defined as the occurrence of a condition that prevents construction activity exposed to weather conditions or access to the site for more than four (4) hours in a day.
2. Adverse weather may also include, if appropriate, “dry-out” or “mud” days.
3. Adverse weather includes days that temperature does not rise above the required temperature for a construction activity.

C. Qualifications

1. Adverse weather conditions having a direct effect on construction progress are to be handled as follows:
 - a. Precipitation is to be measured by the Contractor using a precipitation gauge on-site. For each month, the number of days (24 hours) that the site experiences precipitation of 0.10 inches or more shall be totaled, confirmed with the Owner/Inspector, and reported to the Engineer.
 - b. For each month, the total number of days of 0.10 inches or more of precipitation shall be compared to the number of expected days for that month. The number of expected days of 0.10 inches or more of precipitation shall be established as follows:
 - 1) Identify National Oceanic and Atmospheric (NOAA) weather stations as shown at <https://gis.ncdc.noaa.gov/maps/ncei> within a 100-mile radius of the project location.
 - a) If multiple weather stations are found within 100 miles of the project site, the weather station that is the closest to the site shall be used. Compile rain data from the previous 5 years and total the number of days with precipitation of 0.10 inches or more.
 - b) If a weather station is not found within a 100-mile radius of the site, the following schedule shall be used:

Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
11	9	10	8	8	9	12	9	8	6	8	10

- c. Rain delay days will be approved by the Engineer and added to the contract duration only if they exceed the number of expected days for that given month.
2. Adverse weather conditions having an indirect effect due to precipitation are to be handled as follows:
 - a. Precipitation that occurs beyond the standard baseline which results in “dry-out” or “mud” days.
 - 1) The standard baseline is based on the NOAA’s Point Precipitation Frequency (PPF) Estimate for the construction area using the latitude and longitude for a 1-year average recurrence interval and a 60-min time period. This can be found at <http://dipper.nws.noaa.gov/hdsc/pfds/>.

3. Adverse weather conditions due to temperature are as follows:
 - 1) Cold Weather concreting shall be per ACI 306.
 - a) The Contractor shall have a calibrated thermometer onsite which is logged by the inspector and Contractor prior to any concrete pours during cold weather.
4. Adverse weather conditions due to wind speeds are as follows:
 - a. Wind speeds exceeding those permissible to use equipment or to perform certain tasks safely, including but not limited to operating crane(s) or other aerial equipment for construction or erection of a building structure.
 - 1) The Contractor shall have a calibrated wind speed gauge on-site.
5. Adverse weather conditions resulting in compromised project site conditions are as follows:
 - a. Project site conditions such as mud, pooling of water, ice, or standing snow subsequent to the actual precipitation days, prevent the performance of activities such as, but not limited to, mass grading, building pad grading, foundations, piping, excavations, backfill, concrete, masonry, etc. operations.

D. Weather Delay Days

1. Adverse weather delay day may be counted if adverse weather prevents work on the project during an event where:
 - a. Precipitation days for a specific month is greater than the recorded monthly average for a project location indicated above.
 - 1) The number of average rain days shall be subtracted from the number of recorded rain days and the difference shall be the allotted time.
 - b. Precipitation for a given day is greater than the NOAA's PFF estimate indicated above.
 - 1) One (1) day for each day or consecutive days of precipitation that exceeds the standard baseline.
 - c. Precipitation of 3.0 inches over a 24-hour period.
 - 1) The number of allotted days shall be at the discretion of the Engineer/Owner based on site conditions, working conditions, and type of construction.
 - 2) Temperature per ACI 306.

E. Exceptions

1. The Contractor shall take into account that certain construction activities are more affected by adverse weather and seasonal conditions than other activities, and that "dry-out" or "mud" days are not eligible to be counted as an Adverse Weather Delay Day until

the standard baseline is exceeded. Hence, the Contractor should allow for an appropriate number of additional days associated with the Standard Baseline days in which such applicable construction activities are expected to be prevented and suspended.

F. Record Keeping

1. All Adverse Weather events shall be recorded by the on-site management team.
2. On-site records of daily rain and/or temperature readings shall be kept by the Contractor and may be accepted to verify weather and/or temperature variations which prevent earthwork, foundation and slabs, and/or roofing materials installation. The Inspector shall also be required to maintain on-site records of daily rain and/or temperature.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations.

1.12 WARRANTIES

- A. Warranties shall conform to the requirements of the General Conditions.
- B. All equipment supplied by the Contractor under these Specifications shall be warranted by the Contractor and the equipment manufacturers for a period of one (1) year. Warranty period shall commence on the date of Substantial Completion.
- C. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail due to workmanship, design and materials during the warranty period, it shall be replaced by the Contractor and the unit(s) restored to service at no expense to the Owner.
- D. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. The Contractor shall be responsible for obtaining equipment warranties from each of the respective suppliers or manufacturers for all the equipment specified.

1.13 MATERIALS TESTING

- A. The Owner will engage a qualified testing agency to perform materials testing. All materials testing (geotechnical, concrete, etc.) shall be paid for by the Owner.
- B. It shall be the Contractor's responsibility to schedule and coordinate materials testing.

1.14 EROSION CONTROL INSPECTION

- A. The Owner will engage a qualified agency to perform erosion control inspections. All erosion control and stormwater inspections shall be paid for by the Owner.
- B. It shall be the Contractor's responsibility to schedule and coordinate erosion control inspections.

1.15 CONSTRUCTION SEQUENCE

- A. Contactor shall arrange the Work so that at no time shall it cause unnecessary interruption to the operation of existing facilities. Contractor shall prepare and submit to Engineer for approval, a complete detailed working schedule setting forth the sequence of operations the Contractor proposes to follow. Adequate treatment of wastewater shall occur at all times. All shutdowns and bypasses shall be coordinated with the Owner and Operator and Engineer.
- B. The following can be constructed without affecting existing operations and shall be fully functional prior to installation of replacement appurtenances and components
 - 1. Installation of new package treatment unit.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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SECTION 01 15 00 – MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 GENERAL

- A.** For the information and guidance of bidders, the following explanation of the bid form items is made. The omission or reference to any item in this description shall not, however, alter the intent of the bid form or relieve the Contractor of the necessity of furnishing such as a part of the Contract. The quantities set forth in the bid form are approximate and are given to establish a uniform basis for the comparison of bids. The Owner reserves the right to increase or decrease the quantity of any class or portion of the work during the progress of construction in accordance with the terms of the Contract. Unit prices are used as a means of computing the final figures for bid and contract purposes, for periodic payments for work performed, for determining value of additions or deletions and wherever else reasonable.
- B.** The Contractor shall base his proposal on the materials specified herein and on the drawings. Reference to a particular product by manufacturer, trade name, or catalog number establishes the quality standards of materials and equipment required for this installation and is not intended to exclude products equal in quality and similar in design.
- C.** Payment shall be made on the basis of work actually performed toward the completion of each item in the Contract proposal and construction cost breakdown, such work including, but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, cleanup, and all other appurtenances to complete the construction and installation of the work to the configuration and extent as shown on the Drawings and described in the Specifications.
- D.** The Contractor shall assume responsibility for all materials and equipment stored, protection of his product and compliance with all federal, state and local safety regulations.
- E.** The Contractor will be paid only for satisfactorily installed and tested quantities. All material order quantities shall be taken from field measurements after approval from the Engineer. The Owner will not pay for excess leftover materials. All quantities derived or measurements taken from project plan sheets shall be considered estimates only.
- F.** All excavation shall be bid on an “unclassified” basis. All costs for this type of work must be included in the amounts bid in the Proposal. No extra payment will be made for muck excavation or the removal of any wet, unstable, or unsuitable soil. Should any unsuitable soil be encountered, the contractor is responsible for procuring suitable material for pipe trench backfill in those areas and all costs for this work must be included in the amounts bid in the proposal. The contractor is required to inspect the area to his satisfaction prior to turning in a bid proposal.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 BID ITEMS

A. Mobilization

1. Work performed under this item shall consist of preparatory work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; and for other work, operations or costs which are of necessary incurred prior to the beginning of construction. Bond costs, license fees, lump sum insurance premiums, and other such items of expense may be included but any item that will be subsequently paid for as project work or material on hand shall be excluded.
2. Payment shall be at the Lump Sum (LS) contract price as stated in the bid documents. The cost of mobilization for each section of work shall not exceed three percent (3%) of the total amount for the respective section. Should an amount exceeding three percent be submitted in the bid, the amount will be revised to three percent.

B. Installation and Integration of New Treatment Unit

1. Work performed under this item shall include furnishing all labor, materials, and equipment necessary for the provision, installation, and integration of the proposed Ax-Max Unit #8 in accordance with the contract documents.
2. Payment shall be at the Lump Sum (LS) contract price as stated in the bid documents.

C. Removal of Existing Influent Pipe

1. Work performed under this item shall include furnishing all labor, materials, and equipment necessary to remove the existing water pipe at locations shown on the drawings and in accordance with the contract documents, included but not limited to; site preparation, excavation, backfill, dewatering, cleaning, final grading, and other miscellaneous items necessary to complete the work.
2. Payment shall be at the lump sum (LS) contract price as stated in the contract documents.

D. Flow Meters Replacement

1. Work performed under this item shall include furnishing all labor, materials, and equipment necessary to furnish and install the new flow meters in the meter boxes as shown on the drawings and in accordance with the contract documents.
2. Payment shall be at the Lump Sum (LS) contract price as stated in the contract documents.

E. Bypass Pumping

1. Work performed under this item shall include costs to provide by-pass pumping for all portions of the work performed on the project including but not limited to: installation,

plugs, pumps, power, piping, fuel, incidentals, removal, labor, and equipment necessary for the work.

2. Payment shall be at the Lump Sum (LS) contract price as stated in the bid documents.

F. Chain Link Fences & Gates

1. Work performed under this item shall include all materials, equipment and labor required to complete the installation of a high chain link fence and 3 strands of barbed wire and gates, unless indicated elsewhere in the contract documents, at the locations shown on the plans and in accordance with the Contract Documents.
2. Payment shall be at the Lump Sum (LS) contract price as stated in the bid documents.

G. Electrical and Instrumentation

1. Work performed under this item shall include all labor, materials, and equipment necessary to install Electrical and Instrumentation at the project location, including but not limited to; conduit, wiring, floats, level transducers, service connection, risers, inspections, panels, racks, testing, and all other accessories necessary for a complete treatment system.
2. Payment shall be at the Lump Sum (LS) contract price as stated in the bid documents.

H. Site Work

1. Work under this item shall include, but is not limited to, costs for equipment, labor, and material required to complete all grading, excavation, site preparation, backfill, geotextiles, installation of gravel site surfacing, and crusher run as required to complete the work as specified on the plans and in accordance with the contract documents.
2. Payment shall be at the Lump Sum (LS) contract price as stated in the bid documents.

I. Existing System Replacements and Repairs

1. Work under this item shall include all materials, equipment, and labor required to replace appurtenances in existing treatment units as shown on plans. This includes but is not limited to; the removal and replacement of textile media, lid latches, distribution manifolds, spin nozzles, penetration gaskets, fans, pumps, and floats. This shall also include all refurbishing/rehabilitation of control panels to ensure complete system functionality.
2. Payment shall be at the Lump Sum (LS) contract price as stated in the bid documents.

J. Yard Piping, Fittings, Valves and Appurtenances

1. Work performed under this item shall include but is not limited to costs for furnishing and installing all force main piping, suction piping, supports, vents, fittings, valves, boxes, and other appurtenances located within the treatment facility fence as indicated on the project drawings and the bid documents.
2. Payment shall be at the Lump Sum (LS) contract price as stated in the bid documents.

K. Erosion Control Measures

1. Work performed under this item shall consist of installation, maintenance, inspection and removal of all erosion and sedimentation controls shown; as well as any additional measures needed to ensure proper erosion and sedimentation control and regulatory compliance including minor grading.

2. Payment shall be at the Lump Sum (LS) contract price as stated in the bid documents. The Contractor will be responsible for paying any fines from the Alabama Department of Environmental Management or any other regulatory body as a result of inadequate erosion control measures.

L. Cleanup, Grassing, Mulching, Site & Landscape Restoration

1. Work performed under this item shall include furnishing all labor, materials, and equipment necessary to complete all cleanup, seeding, mulching, and site restoration, including but not limited to: cleanup of vegetation and construction debris, final topsoil, fertilizer, seeding, mulching, watering, maintenance, mowing, landscape and site restoration, and final grading in accordance with the drawings and contract documents.
2. All disturbed grassed areas must be re-established to their original or better condition by seeding. Any new seed must match the pre-disturbed grass species and shall be to the satisfaction of the Owner and Engineer.
3. All costs associated with restoring structures and facilities (roadway signs, mailboxes, ornamental shrubbery, landscaping plants, fences, etc.) to pre-construction conditions shall be included in this bid item.
4. Payment shall be at the Lump Sum (LS) contract price as stated in the contract documents.
 - a. The Owner and Engineer shall be the final determination as to whether lawns are acceptable.
 - b. Acceptable seeded areas shall be deemed areas with a vigorous and uniform stand of grass with bare areas less than 5 square feet in size. All areas which fail to provide a uniform stand of turf shall be treated or replanted repeatedly until a uniform stand of grass of at least 70% coverage is attained with no bare areas greater than 5 square feet.

END OF SECTION 01 15 00

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Testing and inspecting allowances.
 - 3. Unit-cost allowances.
 - 4. Quantity allowances.
 - 5. Contingency allowances.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related work specified elsewhere includes:
 - 1. Divisions 2 through 50.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Engineer from the designated supplier.

1.4 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified by Engineer.

- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 ALLOWANCES

A. Lump Sum

- 1. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.
- 2. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.
- 3. At Project closeout, credit unused amounts remaining in these allowances to Owner by Change Order.

B. Testing and Inspection

- 1. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.
- 2. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.
- 3. Costs of services not required by the Contract Documents are not included in the allowance.
- 4. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

C. Unit Cost

- 1. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Engineer under allowance and shall include taxes, freight, and delivery to Project site.
- 2. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Engineer under allowance shall be included as part of the Contract Sum and not part of the allowance.

D. Quantity

1. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Engineer under allowance and shall include taxes, freight, and delivery to Project site.
2. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Engineer under allowance shall be included as part of the Contract Sum and not part of the allowance.
3. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - a. If requested by Engineer, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

E. Contingency

1. Use the contingency allowance only as directed by Engineer for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
2. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.
3. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.
4. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.7 UNUSED MATERIALS

- A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
1. If requested by Engineer, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Engineer, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

1.8 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, required maintenance materials, and similar margins.
1. Include installation costs in purchase amount only where indicated as part of the allowance.
 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.

3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs due to a change in the scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. The following allowances shall be included in Contract Sum in accordance with the allowance type described above. Should the below allowances not be shown on the project proposal, the Contractor shall include them in the total bid cost.

1. Allowance No. 1: Lump Sum Allowance: Include the sum of \$25,000 for Materials Testing
 - a. The allowance set forth herein shall include all materials testing which shall be the responsibility of the Contractor.
 - b. All materials testing (geotechnical, concrete, etc.) shall be paid for by the Contractor and included in the base bid (including the allowance).

- c. The following information regarding Employment of and Payment for Testing Services under the work of Specifications shall take precedence over any conflicting statement otherwise, which may have remained in the Project Manual after editing:
 - 1) Initial testing required by the Contract Documents for Divisions 2, 3, 4 and 5 shall be provided by a testing agency pre-approved by the Owner & Contractor, and employed, and paid by the Contractor, from the Materials Testing Allowance for testing.
 - 2) Any retesting required (due to questionable materials or construction methods, for verification purposes, and etc.) shall be at the Contractor's expense when the results of such retesting indicate any work or materials do not comply with requirements of the Contract Documents.
 - 3) Any retesting under the above provisions shall be performed by the same Owner accepted testing agency.
 - d. The Contractor shall be responsible for contacting and providing directions to the accepted testing agency and for any follow-up communications required, for all testing required by the Contract Documents. Contractor shall copy Engineer on all materials testing correspondence and testing results.
 - e. No unsuitable or unsatisfactory existing soils or building materials (other than work in Contract) shall be removed without either the presence of or concurrence of and prior approval of the Engineer and the accepted testing agency, so as to assure quality of the Work is maintained.
 - f. Contractor shall be required to have geotechnical analysis performed on any fill material to ensure it meets the earthwork/backfill specifications.
 - g. The Contractor may contact Kevin Wales at Goodwyn, Mills, & Cawood (205-879-4462) in Birmingham, Alabama for assistance with materials testing.
2. Allowance No. 2: Lump Sum Allowance: Include the sum of \$5,000 for Engineering Startup
- a. Startup/commissioning is a systematic process of ensuring that all systems perform interactively according to the design intent and the Owner's operational needs. The startup and commissioning process shall verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors. The objective of functional performance testing is to demonstrate that each system is operating according to the Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full operation. The testing process shall identify areas of deficient performance and these areas shall be corrected, improving the operation and functioning of the systems. The allowance set forth herein shall include assistance with engineering startup and commissioning activities to ensure areas of deficient performed are operation and functioning as designed and intended.
3. Allowance No. 3: Lump Sum Allowance: Include the sum of \$10,000 for Stormwater/Erosion Control Inspection.
- a. The allowance set forth herein shall include all stormwater inspection which shall be the responsibility of the Contractor.

- b. All stormwater permitting, inspection, and BMP plan shall be paid for by the Contractor and included in the base bid (including the allowance).
 - c. The Contractor shall be responsible for compliance with all Federal and State regulations and statutes as relate to Stormwater Permitting, erosion control and compliance with a BMP plan. This shall include all permitting, BMP plan, and required inspections.
 - d. All stormwater field materials, appurtenances, and labor shall be included in the price bid, separately from the allowance herein for erosion control permitting and allowance.
4. Allowance No. 4: Lump Sum Allowance: Include the sum of \$50,000 for Unforeseen Conditions / Owner's Contingency
- a. This allowance may be used, as authorized and directed by the Engineer, to pay for costs of additional work resulting from the need to address minor items at any of the facilities in which work is being performed and throughout the plant. Cost amounts shall be determined as specified in the General Conditions for Lump Sum changes or Time and Expense changes. This work is not shown or specified in the drawings and specifications bid by the Contractor and not covered by another line item in the bid. This work may be required in the event the Engineer or Owner established the need for additional work deemed to be necessary for the successful completion of the contract. This cash allowance is to be included in the Lump Sum Base Bid, but is to be paid to the Contractor only if authorized as provided in this paragraph.

END OF SECTION 01 21 00

SECTION 01 25 00 - SUBSTITUTION OF MAJOR EQUIPMENT ITEMS & PRODUCTS

Commented [g1]: Needs to be reviewed with consideration of the procurement practices of the Owner.

PART 1 - GENERAL

Commented [DT2]: Consider condensing this spec and including it in the actual bid form

1.1 RELATED DOCUMENTS

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

1.2 GENERAL REQUIREMENTS

Commented [g3]: This section of specs is only valid if the bids are set up as "Base Bid" or "Basis of Bid" type. It would require careful editing if used in project and must be coordinated with the bid form and consistent with owner's procurement practices. I normally wouldn't want this included in a project spec unless it was specifically tailored.

- A. This section of the specifications defines the LUMP SUM TOTAL BID PRICE contract format using "Basis of Bid" major equipment items, materials, and products for preparation of the TOTAL BID PRICE and outlines the procedure for proposal of substitute items by "alternate" manufacturers. The use of this bidding format is intended to provide a common basis for all bidders on which to base their LUMP SUM TOTAL BID PRICE. This bidding format also protects the Owner and bidders so that no one bidder gains an unfair bid price advantage by quoting a lower price for a major equipment item or product which is not "or equal". This format is intended to assure that the Owner receives full benefit of the savings in cost involved in any substitution of a major equipment item or product.
- B. The proposal for the bid is based on a total bid price contract using "Basis of Bid" major equipment items and products which have been identified and described in the specifications. Manufacturers of major equipment items and products identified in "Manufacturer" column in the proposal are considered "Basis of Bid" items. Specification sections defining "Basis of Bid" major equipment items or products include the following:
1. Section 46 07 53 Package Wastewater Treatment System
- C. The TOTAL BID PRICE noted in the proposal shall include the installed prices of only "Basis of Bid" major equipment items or products. The bidder shall note the installed price of each "Basis of Bid" major equipment item or product in the space provided in the "Total Price" column in the proposal. The installed price shall include the labor and material cost, profit and overhead, plus the cost for all necessary appurtenances to provide a complete system. The installed price is for the equipment and installation and does not include associated structures, pipe, valves, etc.
- D. Pursuant to Federal Regulations 40 CFR, Parts 33 and 35, it is not the intent of the Contract Documents to contain proprietary, exclusionary, of discriminatory requirements other than those based on performance. Manufacturers who believe that their equipment can meet the performance requirements and, with the exception of minor details, the technical requirements of the Contract Documents, are encouraged to submit a quotation to a Bidder for a substitute major equipment item or product. Model number designations for the major equipment items are included for information purposes. Proposed "Basis of Bid" major equipment items and "Alternate" major equipment items will be evaluated on the basis of the requirements contained in the contract documents.

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- E. Bidder's desiring to quote a price for a substitute major equipment item or product in lieu of a "Basis of Bid" item shall submit **14 days prior to the Bid Date** a "Qualification Package" for each "Alternate" major equipment item or product which the Bidder proposes to furnish in lieu of a "Basis of Bid" major equipment item or product identified in the "Manufacturer" column. The bidder shall submit each Qualification Package under separate cover. Each Qualification Package shall be bound with protective cover, identify the specification section number and title, and the product manufacturer's name on a cover sheet.
- F. The "Qualification Package" for the "Alternate" major equipment items shall include but not be limited to the following information:
1. A complete set of drawings, specifications, catalog cut sheets of the proposed major equipment items or products, to identify all technical and performance requirements as contained in the drawings and specifications.
 2. Detailed information shall be submitted for all buy-out items such as hardware, motors, motor controllers and instrumentation (field device, major control panel device, and anticipated control panel layout).
 3. List showing materials of construction of all components, including all buy-out items.
 4. List manufacturer's recommended spare parts, including all buy-out items.
 5. Information on equipment field erection requirements including total weight of assembled components and weight of each sub assembly.
 6. Process equipment electrical requirements and schematic diagrams. Examples of reports and hard copies of CRT displays similar to those required by the project.
 7. Detailed written documentation with discussion of all durations of equipment, including all buy-out items, from the Contract Documents.
- G. If the Bidder fails to furnish all the preceding information which has been deemed necessary by the Engineer to evaluate a proposed "Alternate" major equipment item or product for equivalency with the "Basis of Bid" major equipment item or product, the proposed "Alternate" qualification package may be rejected by the Engineer. If the "Alternate" qualification package is rejected by the Engineer, the Bidder shall furnish the "Basis of Bid" major equipment item or product for the installed price noted in "TOTAL PRICE" Column of the Bid Proposal Form.
- H. No proposal "Alternate" major equipment item or product will be considered unless, in the opinion of the Engineer, it conforms to the Contract Documents in all respects, except for make and manufacturer and minor details.
- I. The Engineer shall be the sole authority for determining conformance of a proposed "Alternate" major equipment item or product with the Contract Documents. Under no circumstances will the Engineer be required to prove that an "Alternate" major equipment item or product is not equal to the "Base of Bid" major equipment item or product.
- J. If a proposed "Alternate" qualification package is received, the ENGINEER and OWNER will evaluate the proposed "Alternate" and determine the responsive, responsible, qualified Bidder after the Bid Date.
- K. Award of the Contract will be made on the basis of the Bid Proposal Form from the lowest responsive, responsible, qualified Bidder using the TOTAL BASE BID PRICE plus additive bid items.

Commented [DT4]: This suggests that the substitutes will not be considered prior to award although it is not too clear.

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- L. Acceptance of a proposed "Alternate" major equipment item or product "Qualification Package", or naming of "Basis of Bid" equipment, does not eliminate the need for shop drawing submittals and reviews during construction, nor does it eliminate the requirements that the equipment manufacturer satisfy the requirements of the Contract Documents.
- M. Should the Bidder furnish a major equipment item or product requiring changes to the Contract Documents, he shall notify the Engineer in writing of all dimensional, mechanical, electrical and structural changes and/or requirements for the major equipment item's use in this Project and shall reimburse the Owner for any associated redesign and/or construction drawings. The Bidder shall consider all costs associated in furnishing and installing a major equipment item or product in his installed price proposal. Redesign and contract drawing revisions to accommodate equipment or products will be prepared by the Engineer during the shop drawing review process. Reimbursement shall be based on 2.5 times the Engineer's salary cost plus reimbursement expenses at cost.
- N. The bidder shall not use the installed price for any proposed "Alternate" major equipment item or product in preparing the TOTAL BID PRICE unless approved by ENGINEER through an addendum.
- O. An electronic submittal will not be accepted unless it is submitted formally with a single PDF divided appropriately to identify the above referenced requirements. Manufacturer's standard sales literature is not acceptable for submission and will be rejected, as well as unorganized submissions with multiple attachments.
- P. If a discrepancy appears between the written and the numerical, the written words will be used as the quoted price. If an error appears in an extension or the addition of items, the corrected extension or total of the parts shall govern.
- Q. It is understood and agreed that a Bid Proposal Form cannot be withdrawn within ninety (90) days without the consent of the City, Board, or Authority of which the bid documents herein are prepared and that the said City, Board or Authority of has the right to accept or reject any or all Bid Proposal Forms and to waive any irregularities and informalities.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 25 00

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SECTION 01 26 00 - CONTRACT MODIFICATION 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 handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
 - 2. Section 01 31 00 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 MINOR CHANGES IN THE WORK

- A. ENGINEER will issue field orders authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: ENGINEER will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by ENGINEER are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish

times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- e. Quotation Form: Use forms acceptable to ENGINEER.

- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to ENGINEER.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to ENGINEER.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 01 21 00 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 01 22 00 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

Commented [GS1]: Delete if not used. Goes for above (allowances) as well but generally should be included in most projects.

1.6 CHANGE ORDER PROCEDURES

- A. Change Order Procedures shall conform to the requirements of the General Conditions.
- B. A change in the project work that is consistent with the objective of the project and outside the scope of the project requires the execution and approval of a Change Order.
- C. On Owner's approval of a Work Changes Proposal Request, Engineer will issue a Change Order for signatures of Owner and Contractor on form included in the bid documents

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

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SECTION 01 29 00 - PAYMENT PROCEDURES

Commented [g1]: This section needs to be coordinated with Div. 00 sections related to payment procedures. Many municipal accounting departments have standardized the format they want contractors to submit and define the attachments required. There may be occasions when this section and its attachments are not required at all.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
 - 2. Section 01 26 00 - Contract Modification Procedures for administrative procedures for handling changes to the Contract.
 - 3. Section 01 32 00 - Construction Progress Documentation for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Engineer at earliest possible date, but no later than 14 days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
 - 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.

- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section where a submittal is required.
1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Engineer.
 - c. Engineer's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Arrange schedule of values consistent with format of Contract Documents used (EJCDC, AIA, etc.).
 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under contractor and principal subcontracts for Project closeout requirements in an amount totaling no less than 2.5% of the Contract Sum and subcontract amount.
 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
 7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by

measured quantity. Use information indicated in the Contract Documents to determine quantities.

9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by engineer and contractor and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Engineer by the 25th day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 1. Submit draft copy of Application for Payment five days prior to due date for review by Engineer.
- D. Application for Payment Forms: Use form consistent with Contract Documents (EJCDC, AIA, etc.) for Applications for Payment.
 1. Other Application for Payment forms proposed by the Contractor may be acceptable to Engineer and Owner. Submit forms for approval with initial submittal of schedule of values.
- E. Application for Payment Forms: Use forms provided by Owner for Applications for Payment. Sample copies are included in Project Manual.
- F. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.

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2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- G. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- H. Transmittal:
1. Deliverable:
 - a. Hard Copy: Submit three (3) signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - b. Digital: Submit one (1) signed and notarized copy of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 2. Contractor's Affidavit of Payment to Subcontractors
 - a. Shall be submitted with each Application for Payment.
 3. Contractor Progress Lien Waivers – Specification Section 01 29 00 A
 - a. Shall be submitted with each Application for Payment after No. 1.
 4. Subcontractor/Supplier Lien Waivers – Specification Section 01 29 00 B
 - a. Shall be submitted with each Application for Payment after No. 1.
 5. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

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- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. List of Contractor's staff assignments.
 6. Copies of building and other local/state permits.
 7. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 8. Report of preconstruction conference.
 9. Certificates of insurance and insurance policies.
 10. Performance and payment bonds.
 11. Data needed to acquire Owner's insurance.
- J. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. "Contractor's Affidavit of Payment of Debts and Claims."
 5. "Contractor's Affidavit of Release of Liens."
 6. "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

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CONTRACTOR'S UNCONDITIONAL LIEN WAIVER UPON PROGRESS PAYMENT

The undersigned hereby acknowledge that the amount of

was received from

The Owner

as Progress Payment for the following goods and/or services:

performed at the property described as:

The undersigned hereby waives the right to assert a lien and release any lien against the owner to this extent only. This lien waiver does not affect the right of the undersigned to recover payment for any other goods or services supplied before or after this release date not compensated by the progress payment or any rights which the undersigned may have by contract.

Title and Name of Claimant

Company Details

Signature

Date

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EXAMPLE

SUBCONTRACTOR'S UNCONDITIONAL LIEN WAIVER UPON PROGRESS PAYMENT

The undersigned hereby acknowledges that the amount of

was received from

as Progress Payment for the following goods and/or services:

for the following project:

(Project Name)

(Owner)

performed at the property described as:

through the following date:

The undersigned hereby waives the right to assert a lien and release any lien against the owner to this extent only. This lien waiver does not affect the right of the undersigned to recover payment for any other goods or services supplied before or after this release date not compensated by the progress payment or any rights which the undersigned may have by contract.

Title and Name of Claimant

(Company Name)

(Address)

Signature

Date

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EXAMPLE

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project Web site.
 - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements.
- C. Related Requirements:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
 - 2. Section 01 32 00 - Construction Progress Documentation, for preparing and submitting Contractor's construction schedule.

1.2 DEFINITIONS

- A. RFI: Request from Engineer seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. 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.
- B. Key Personnel Names: No less than 15 days prior to starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office and at existing treatment facility. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Engineer

6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: As acceptable to the Engineer.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Engineer Action: Engineer will review each RFI, determine action required, and respond. Allow seven (7) working days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Engineer's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.
 3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 - Contract Modification Procedures.
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within five days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly. Include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Engineer
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.

6. Date the RFI was submitted.
 7. Date Engineer's response was received.
- F. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within five (5) days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.6 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within seven days of the meeting.
- B. Preconstruction Conference: Engineer will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days before mobilization.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Preparation of record documents.
 - m. Use of the premises.
 - n. Work restrictions.

- o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for moisture and mold control.
 - s. Procedures for disruptions and shutdowns.
 - t. Construction waste management and recycling.
 - u. Parking availability.
 - v. Office, work, and storage areas.
 - w. Equipment deliveries and priorities.
 - x. First aid.
 - y. Security.
 - z. Progress cleaning.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer and Owner of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Engineer, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at minimum monthly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do

so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

- 1) Interface requirements.
- 2) Sequence of operations.
- 3) Status of submittals.
- 4) Deliveries.
- 5) Off-site fabrication.
- 6) Access.
- 7) Site utilization.
- 8) Temporary facilities and controls.
- 9) Progress cleaning.
- 10) Quality and work standards.
- 11) Status of correction of deficient items.
- 12) Field observations.
- 13) Status of RFIs.
- 14) Status of proposal requests.
- 15) Pending changes.
- 16) Status of Change Orders.
- 17) Pending claims and disputes.
- 18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings as necessary. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are

- required to ensure that current and subsequent activities will be completed within the Contract Time.
- b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Weekly construction reports.
5. Material location reports.
6. Site condition reports.
7. Special reports.
8. Preconstruction photographs.
9. Periodic construction photographs.
10. Final completion construction photographs.
11. Preconstruction video recordings.
12. Periodic construction video recordings.
13. Web-based construction photographic documentation.

- B. Related Requirements:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
2. Section 01 33 00 - Submittal Procedures, for submitting schedules and reports.
3. Section 01 40 00 - Quality Requirements, for submitting a schedule of tests and inspections.
4. Section 01 70 00 - Execution and Closeout Procedures, for submitting photographic documentation as project record documents at Project closeout.
5. Section 01 79 00 - Demonstration and Training, for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:

1. PDF electronic file.

- B. Startup construction schedule.

- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

- D. Construction Reports: Submit, at minimum, monthly intervals.

- E. Material Location Reports: Submit at monthly intervals.
- F. Site Condition Reports: Submit at time of discovery of differing conditions.
- G. Special Reports: Submit at time of unusual event.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each process or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than sixty (60) days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 2. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 - Submittal Procedures in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 3. Startup and Testing Time: Include no fewer than thirty (30) days for startup and testing.
 - 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.
 - 5. Punch List and Final Completion: Include not more than thirty (30) days for completion of punch list items and Final Completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Environmental control.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

- E. Recovery Schedule: When periodic update indicates the Work is fourteen (14) or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within thirty (30) days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10% percent increments within time bar.

2.3 REPORTS

- A. Monthly Construction Reports: Prepare a Monthly construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.
 - 5. Material deliveries.
 - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 7. Accidents.
 - 8. Meetings and significant decisions.
 - 9. Unusual events (see special reports).
 - 10. Stoppages, delays, shortages, and losses.
 - 11. Emergency procedures.
 - 12. Orders and requests of authorities having jurisdiction.
 - 13. Change Orders received and implemented.
 - 14. Work Directives received and implemented.
 - 15. Services connected and disconnected.
 - 16. Equipment or system tests and startups.
 - 17. Partial completions and occupancies.
 - 18. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within two (2) day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule two days before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

3.2 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Engineer.
- C. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Engineer.
1. Flag construction limits before taking construction photographs.
 2. Take photographs to show existing conditions adjacent to property before starting the Work.
 3. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Periodic Construction Photographs: Take photographs at necessary intervals with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- E. Engineer-Directed Construction Photographs: From time to time, Engineer will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.
- F. Final Completion Construction Photographs: Take color photographs after date of Substantial Completion for submission as project record documents.
1. Do not include date stamp.

END OF SECTION 01 32 00

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SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
 - 2. Section 01 29 00 - Payment Procedures, for submitting Applications for Payment and the schedule of values.
 - 3. Section 01 32 00 - Construction Progress Documentation, for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Section 01 78 23 - Operation and Maintenance Data, for submitting operation and maintenance manuals.
 - 5. Section 01 78 39 - Project Record Documents, for submitting record Drawings, record Specifications, and record Product Data.
 - 6. Section 01 79 00 - Demonstration and Training, for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 3. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Engineer's final release or approval.
 - g. Scheduled date of fabrication.
- B. Engineer's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Engineer for Contractor's use in preparing submittals.
1. Engineer will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and record documents.
 - a. Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Digital Drawing Software Program: The Contract Drawings are available in Revit and CAD files.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. 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. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
- E. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Engineer.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of subcontractor.
 - g. Name of supplier.
 - h. Name of manufacturer.
 - i. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal and a sequential number (e.g., 06 10 00.01). The sequential number denotes the number of submittals within a specification section, not for a project as a whole. Resubmittals shall include a second decimal and an alphabetic suffix (e.g., 06 10 00.01.A).
 - j. Number and title of appropriate Specification Section.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Other necessary identification.
4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

- a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Engineer.
5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form.
 - a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
 - 1) Project name.
 - 2) Date.
 - 3) Destination (To:).
 - 4) Source (From:).
 - 5) Name and address of Engineer.
 - 6) Name of Construction Manager.
 - 7) Name of Contractor.
 - 8) Name of firm or entity that prepared submittal.
 - 9) Names of subcontractor, manufacturer, and supplier.
 - 10) Category and type of submittal.
 - 11) Submittal purpose and description.
 - 12) Specification Section number and title.
 - 13) Specification paragraph number or drawing designation and generic name for each of multiple items.
 - 14) Drawing number and detail references, as appropriate.
 - 15) Indication of full or partial submittal.
 - 16) Transmittal number
 - 17) Submittal and transmittal distribution record.
 - 18) Remarks.
 - 19) Signature of transmitter.
- F. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Engineer.

- d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number.
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
- a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- G. Options: Identify options requiring selection by Engineer.
- H. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
- J. 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.
- K. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

1.4 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Submit electronic submittals via email as PDF electronic files.
 - a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Action Submittals: Submit one electronic copy of each submittal unless otherwise indicated. Engineer will not return copies.
 - 3. Informational Submittals: Submit one electronic copy of each submittal unless otherwise indicated. Engineer will not return copies.
 - 4. Certificates and Certifications Submittals: Provide a 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.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
- 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 published 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 catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before or concurrent with Samples.
 - 6. Submit Product Data in the following format:

- a. PDF electronic file.
 - b. One paper copies of Product Data unless otherwise indicated. Engineer will not return paper copies.
- 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, unless submittal based on Engineer's digital data drawing files is otherwise permitted.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. 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 42 inches.
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
 - b. One opaque (bond) copies of each submittal.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

- b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- 5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit 1 set of samples to the Engineer and Owner for review.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00 - Project Management and Coordination.
- F. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 - Construction Progress Documentation.
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 - Payment Procedures.
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 - Quality Requirements.
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 70 00 - Execution and Closeout Procedures.
- J. Maintenance Data: Comply with requirements specified in Section 01 78 23 - Operation and Maintenance Data.
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.
- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

- M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. 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.
- S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- T. Preconstruction Test Reports: Submit 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 in the Contract Documents.
- U. Compatibility Test Reports: Submit 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.
- V. Field Test Reports: Submit written reports 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 in the Contract Documents.
- W. Design Data: Prepare and submit 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.

1.5 DELEGATED-DESIGN SERVICES

- 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 Engineer.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file, 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.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 70 00 - Execution and Closeout Procedures.
- C. 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 ENGINEER'S ACTION

- A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

- B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Engineer without action.

END OF SECTION 01 33 00

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SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Quality control.
 - 2. Testing and inspection services.
 - 3. Manufacturers' field services.
 - 4. Shop Testing.
 - 5. Field Testing.

1.2 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.
- 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-assurance and -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 other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.

- C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 INSPECTION AND TESTING LABORATORY SERVICES

- A. Owner will employ and pay for the services of a Resident Project Representative (RPR)
- B. Owner will employ and pay for the services of an independent testing laboratory to perform all specified services and testing related to the design of mixes, products and equipment, to Engineer's review of proposed materials and equipment before, during and after incorporation in the Work and to retest materials and equipment which fail original tests.
 - 1. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract.
 - 2. Retesting or re-inspection required because of nonconformance with specified or indicated requirements shall be performed by same independent firm on instructions from Engineer. Payment for retesting or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.

1.5 ACCEPTABLE TESTING AGENCIES

- A. Goodwyn Mills & Cawood; Greenville, SC

1.6 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

1.7 ACTION SUBMITTALS

- 1. Indicate manufacturer and model number of individual components.

1.8 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Engineer.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Engineer.
- D. Testing Agency Qualifications: 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.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.9 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be

used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 - 3. Owner-performed tests and inspections indicated in the Contract Document.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.10 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. 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. Record of temperature and weather 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 reinspection.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representatives 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.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner'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.

1.11 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. 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, as well as sufficient production capacity to produce required units.
- C. 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.
- D. 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.

- 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 in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections 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. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. 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.
- J. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- K. 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 as specified in Section 01 33 00 - Submittal Procedures.
- L. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- M. Retesting/Reinspection: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspection, for construction that replaced Work that failed to comply with the Contract Documents.
- N. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- O. 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.
- P. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -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.
- Q. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
 1. Distribution: Distribute schedule to Owner, Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

- A. Goodwyn Mills & Cawood; Greenville, SC

3.2 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Engineer.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

3.3 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 Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 70 00 - Execution and Closeout Requirements.
- 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.

END OF SECTION 01 40 00

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SECTION 01 40 10 - MATERIALS TESTING

PART 1 - GENERAL

1.1 GENERAL REQUIRMENTS

- A. The following information regarding Employment of and Payment for Testing Services under the work of Specifications shall take precedence over any conflicting statement otherwise, which may have remained in the Project Manual after editing:
 - 1. Initial testing required by the Contract Documents for Divisions 3 and 31 shall be provided by a testing agency pre-approved by the Owner & Contractor, and employed, and paid by the Contractor.
 - a. Other testing required shall be performed by an independent third-party testing agency, and at the Contractor's expense.
 - 2. Any retesting required (due to questionable materials or construction methods, for verification purposes, and etc.) shall be at the Contractor's expense when the results of such retesting indicate any work or materials do not comply with requirements of the Contract Documents.
 - 3. Any retesting under the above provisions shall be performed by the same Owner accepted testing agency.
- B. The Contractor shall be responsible for contacting and directions to the accepted testing agency and for any follow-up communications required, for all testing required by the Contract Documents. Contractor shall copy Engineer on all materials testing correspondence and testing results.
- C. No unsuitable or unsatisfactory existing soils or building materials (other than work in Contract) shall be removed without either the presence of or concurrence of and prior approval of the Engineer and the accepted testing agency, so as to assure quality of the Work is maintained.
- D. All materials testing (geotechnical, concrete, etc.) shall be paid for by the Contractor and included in the base bid as incidental to the work.
- E. Contractor shall be required to have geotechnical analysis performed on any fill material to ensure it meets the earthwork/backfill specifications.

1.2 RELATED DOCUMENTS:

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

1.3 ALLOWANCES

- A. If no allowances are set, Contractor shall include all testing required for the completion of the project.

PART 2 - PRODUCTS – (Not Used)

PART 3 - EXECUTION – (Not Used)

END OF SECTION 01 40 10

SECTION 01 42 00 - REFERENCES

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 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities. This information is believed to be accurate as of the date of the Contract Documents.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities. Information is subject to change and is up to date as of the date of the Contract Documents.
 - 1. COE - Army Corps of Engineers; www.usace.army.mil.
 - 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 - 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 - 4. DOD - Department of Defense; www.quicksearch.dla.mil.
 - 5. DOE - Department of Energy; www.energy.gov.
 - 6. EPA - Environmental Protection Agency; www.epa.gov.
 - 7. FAA - Federal Aviation Administration; www.faa.gov.
 - 8. FG - Federal Government Publications; www.gpo.gov/fdsys.
 - 9. GSA - General Services Administration; www.gsa.gov.
 - 10. HUD - Department of Housing and Urban Development; www.hud.gov.
 - 11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
 - 12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 - 13. SD - Department of State; www.state.gov.
 - 14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 - 15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 - 16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
 - 17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 - 18. USP - U.S. Pharmacopeial Convention; www.usp.org.
 - 19. USPS - United States Postal Service; www.usps.com.

- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 10 00 – Summary, for work restrictions and limitations on utility interruptions.
 - 2. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to Engineer, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Sewer service use charges shall be by the Contractor utilizing portable facilities.
- C. Water Service: Water-service use charges for water used by all entities for construction operations shall be by the Contractor.
- D. Electric Power Service: Electric-power-service use charges for electricity used by all entities for construction operations shall be by the Contractor.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction (DHEC), whichever is more stringent.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.

3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.4 QUALITY ASSURANCE

- A. 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.

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Engineer and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot square tack and marker boards.
 3. Drinking water and private toilet.
 4. Coffee machine and supplies.
 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 1. Store combustible materials apart from building.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

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 by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. 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: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

- F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service overhead or underground or as indicated.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel.
 - 1. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Engineer's office.
 - f. Engineers' offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.

2. Provide superintendent with cellular telephone for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Final Completion.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads.
3. Recondition base after temporary use, including removing contaminated material, regrading, proof rolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 32 12 16 - Asphalt Paving.

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Provide temporary parking areas for construction personnel.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted. Subcontractors are not authorized to have signage.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary construction signs as required by funding agencies.
 - b. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touchup signs so they are legible at all times.

- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 70 00 - Execution and Closeout Requirements.
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
- I. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
 - 1. Do not load elevators beyond their rated weight capacity.
 - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- K. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.
- L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 01 10 00 - Summary.
- C. Temporary Erosion and Sedimentation Control: Comply with authorities having jurisdiction, and requirements specified in Section 31 25 00 - Erosion and Sedimentation Controls.

- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- F. Site Enclosure Fence: Before construction operations begin furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
 - 2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies
 - 3. Insulate partitions to control noise transmission to occupied areas.
 - 4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 5. Protect air-handling equipment.
 - 6. Provide walk-off mats at each entrance through temporary partition.

3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.

3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace, or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Engineer.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Maintenance: Maintain facilities in good operating condition until removal.
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.
- B. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- C. 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 property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, 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, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 70 00 - Execution and Closeout Requirements.

END OF SECTION 01 50 00

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SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 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.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 01 33 00 - Submittal Procedures.
 - b. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 - Submittal Procedures. Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.
 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

- A. Warranty requirements shall conform with the General Conditions followed by Specification Section 01 10 00.

1.8 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Engineer will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article and/or Section 01 25 00 – Substitution of Major Equipment Items to obtain approval for use of an unnamed product.

- B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.
4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with

requirements. Comparable products or substitutions for Contractor's convenience will be considered.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Engineer's sample", provide a product that complies with requirements and matches Engineer's sample. Engineer's decision will be final on whether a proposed product matches.
 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 - Substitution of Major Equipment Items and Products for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Engineer from manufacturer's full range" or similar phrase, select a product that complies with requirements. Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

1.9 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:
 1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners, if requested.
 5. Samples, if requested.
 6. The Contractor shall also include in the price bid the modifications necessary for the comparable product to be utilized. This includes but is not limited to, electrical and mechanical changes, engineering time to assess the changes, modifications to buildings, programmable controls and structural modifications.

EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Field engineering.
2. Closeout procedures.
3. Starting of systems.
4. Demonstration and instructions.
5. Testing, adjusting, and balancing.
6. Project record documents.
7. Operation and maintenance data.
8. Manual for materials and finishes.
9. Manual for equipment and systems.
10. Spare parts and maintenance products.
11. Product warranties and product bonds.
12. Examination.
13. Preparation.
14. Execution.
15. Cutting and patching.
16. Protecting installed construction.
17. Final cleaning.

B. Related Requirements:

1. Section 01 33 00 - Submittal Procedures, for submitting copies of submittals for operation and maintenance manuals.
2. Section 01 78 23 - Operation and Maintenance Data, for submitting operation and maintenance manuals.

1.2 FIELD ENGINEERING

- A. Employ land surveyor registered in state of Alabama acceptable to Engineer.
- B. Locate protect survey control and reference points. Promptly notify Engineer of discrepancies discovered.
- C. Control datum for survey is indicated on Drawings.
- D. Verify setbacks and easements; confirm Drawing dimensions and elevations.
- E. Provide field engineering services. Establish elevations, lines, and levels using recognized engineering survey practices.

- F. Protect survey control points prior to starting Site Work; preserve permanent reference points during construction.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Engineer.

1.3 CLOSEOUT PROCEDURES

- A. Prerequisites to Substantial Completion: Complete following items before requesting Certification of Substantial Completion, either for entire Work or for portions of Work:
 - 1. Submit operation and maintenance manuals, Project record documents, and other similar final record data in compliance with this Section.
 - 2. Complete facility startup, testing, adjusting, balancing of systems and equipment, demonstrations, and instructions to Owner's operating and maintenance personnel as specified in compliance with this Section.
 - 3. Conduct inspection to establish basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or nonconforming Work, reason for being incomplete, and date of anticipated completion for each item. Include copy of list with request for Certificate of Substantial Completion.
 - 4. Obtain and submit releases enabling Owner's full, unrestricted use of Project and access to services and utilities. Include certificate of occupancy, operating certificates, and similar releases from authorities having jurisdiction and utility companies.
 - 5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.
 - 6. Discontinue or change over and remove temporary facilities and services from Project Site, along with construction tools, mockups, and similar elements.
 - 7. Perform final cleaning according to this Section.
- B. Substantial Completion Inspection:
 - 1. When Contractor considers Work to be substantially complete, submit to Engineer:
 - a. Written certificate that Work, or designated portion, is substantially complete.
 - b. List of items to be completed or corrected (initial punch list).
 - 2. Within seven days after receipt of request for Substantial Completion, Engineer will make inspection to determine whether Work or designated portion is substantially complete.
 - 3. Should Engineer determine that Work is not substantially complete:
 - a. Engineer will promptly notify Contractor in writing, stating reasons for its opinion.
 - b. Contractor shall remedy deficiencies in Work and send second written request for Substantial Completion to Engineer.
 - c. Engineer will re-inspect Work.
 - d. Redo and Inspection of Deficient Work: Repeated until Work passes Engineer and Owner's inspection.
 - 4. When Engineer finds that Work is substantially complete, Engineer will:

- a. Prepare Certificate of Substantial Completion on EJCDC C-625 - Certificate of Substantial Completion accompanied by Contractor's list of items to be completed or corrected as verified and amended by Engineer and Owner (final punch list).
 - b. Submit Certificate to Owner and Contractor for their written acceptance of responsibilities assigned to them in Certificate.
 5. After Work is substantially complete, Contractor shall:
 - a. Allow Owner occupancy of Project under provisions stated in Certificate of Substantial Completion.
 - b. Complete Work listed for completion or correction within time period stipulated.
- C. Prerequisites for Final Completion: Complete following items before requesting final acceptance and final payment.
 1. When Contractor considers Work to be complete, submit written certification that:
 - a. Contract Documents have been reviewed.
 - b. Work has been examined for compliance with Contract Documents.
 - c. Work has been completed according to Contract Documents.
 - d. Work is completed and ready for final inspection.
 2. Submittals: Submit following:
 - a. Final punch list indicating all items have been completed or corrected.
 - b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 - c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.
 - d. Accounting statement for final changes to Contract Sum.
 - e. Contractor's affidavit of payment of debts.
 - f. Contractor affidavit of release of liens.
 - g. Consent of surety to final payment.
 3. Perform final cleaning for Contractor-soiled areas according to this Section.
- D. Final Completion Inspection:
 1. Within seven days after receipt of request for final inspection, Owner and Engineer will make inspection to determine whether Work or designated portion is complete.
 2. Should Engineer consider Work to be incomplete or defective:
 - a. Engineer will promptly notify Contractor in writing, listing incomplete or defective Work.
 - b. Contractor shall remedy stated deficiencies and send second written request to Work is complete.
 - c. Engineer will re-inspect Work.
 - d. Redo and Inspection of Deficient Work: Repeated until Work passes inspection.

1.4 STARTING OF SYSTEMS

- A. Coordinate schedule for startup of various equipment and systems.
- B. Notify Engineer and owner seven days prior to startup of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify that tests, meter readings, and electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute startup under supervision of manufacturer's representative or Contractors' personnel according to manufacturer's instructions.
- G. When specified in individual Specification Sections, require manufacturer to provide authorized representative who will be present at Site to inspect, check, and approve equipment or system installation prior to startup and will supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly, as well as a certificate/field report from the manufacturer from his inspection of the installation.

1.5 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Owner's personnel as equipment becomes available for use and not later than fourteen (14) days prior to date of Substantial Completion.
- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- C. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at designated location.
- D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.6 TESTING, ADJUSTING, AND BALANCING

- A. Contractor with Engineer approval will appoint and employ services of independent firm to perform testing, adjusting, and balancing. Contractor shall pay for services.
- B. Reports will be submitted by independent firm to Engineer indicating observations and results of tests and indicating compliance or noncompliance with requirements of Contract Documents.

1.7 PROJECT RECORD DOCUMENTS

- A. Maintain on Site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, product data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record, at each product Section, description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates used.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings: Legibly mark each item to record actual construction as follows:
 - 1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the Work, and change orders.
 - 2. Include locations of concealed elements of the Work.
 - 3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components that are parallel to utilities.
 - 4. Dimension ends, corners, and junctions of buried utilities to permanent facility components using triangulation.
 - 5. Identify and locate existing buried or concealed items encountered during Project.
 - 6. Measured depths of foundations in relation to finish floor datum.
 - 7. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 8. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 9. Field changes of dimension and detail.
 - 10. Details not on original Drawings.
- G. Submit marked-up paper copy documents to Engineer with claim for final Application for Payment.

1.8 OPERATION AND MAINTENANCE DATA

- A. See Section 01 78 23 - Operation and Maintenance Data for operation and maintenance manuals.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual Specification Sections.
- D. Verify that utility services are available with correct characteristics and in correct locations.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance according to manufacturer's instructions.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer-required or -recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

3.3 EXECUTION

- A. Comply with manufacturer's installation instructions, performing each step in sequence. Maintain one set of manufacturer's installation instructions at Project Site during installation and until completion of construction.
- B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Verify that field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.
- D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
 - 1. Secure Work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.
 - 2. Physically separate products in place, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.
 - 3. Exposed Joints: Provide uniform joint width and arrange to obtain best visual effect. Refer questionable visual-effect choices to Engineer for final decision.

- E. Allow for expansion of materials and building movement.
- F. Climatic Conditions and Project Status: Install each unit of Work under conditions to ensure best possible results in coordination with entire Project.
 - 1. Isolate each unit of Work from incompatible Work as necessary to prevent deterioration.
 - 2. Coordinate enclosure of Work with required inspections and tests to minimize necessity of uncovering Work for those purposes.
- G. Mounting Heights: Where not indicated, mount individual units of Work at industry recognized standard mounting heights for particular application indicated.
 - 1. Refer questionable mounting heights choices to Engineer for final decision.
- H. Adjust operating products and equipment to ensure smooth and unhindered operation.
- I. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by manufacturer.

3.4 CUTTING AND PATCHING

- A. Employ skilled and experienced installers to perform cutting and patching.
- B. Submit written request in advance of cutting or altering elements affecting:
 - 1. Structural integrity of element.
 - 2. Integrity of weather-exposed or moisture-resistant elements.
 - 3. Efficiency, maintenance, or safety of element.
 - 4. Visual qualities of sight-exposed elements.
 - 5. Work of Owner or separate contractor.
- C. Execute cutting, fitting, and patching including excavation and fill to complete Work and to:
 - 1. Fit the several parts together, to integrate with other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and nonconforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Execute Work by methods to avoid damage to other Work and to provide proper surfaces to receive patching and finishing.
- E. Cut masonry and concrete materials using masonry saw or core drill.
- F. Restore Work with new products according to requirements of Contract Documents.
- G. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.
- H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

- I. At penetrations of fire-rated walls, partitions, ceiling, or floor construction, completely seal voids with fire-rated material to full thickness of penetrated element.
- J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.
- K. Identify hazardous substances or conditions exposed during the Work to Engineer for decision or remedy.

3.5 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual Specification Sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Use durable sheet materials to protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

3.6 FINAL CLEANING

- A. Execute final cleaning prior to final Project assessment.
 - 1. Employ experienced personnel or professional cleaning firm.
- B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces, and vacuum carpeted and soft surfaces.
- C. Clean equipment and fixtures to sanitary condition with appropriate cleaning materials.
- D. Clean filters of operating equipment.
- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean Site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from Site.

END OF SECTION 01 70 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 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 01 33 00 - Submittal Procedures, for submitting copies of submittals for operation and maintenance manuals.

1.2 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.

1.3 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. Engineer 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 Engineer.
 - 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. Two paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Engineer will return copy with comments.
 1. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer'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 Construction Manager.
 7. Name and contact information for Engineer.
 8. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
 9. 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, binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch and 11 x 17 paper (Z folded); 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. 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 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.

2.4 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.

2.5 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. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. 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.
- C. 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.
- D. 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 01 78 39 - Project Record Documents.
- E. Comply with Section 01 70 00 - Execution and Closeout Procedures for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

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SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 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 01 70 00 - Execution and Closeout Procedures, for general closeout procedures.
 - 2. Section 01 78 23 - Operation and Maintenance Data, for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Submit copies of marked-up record prints as follows:
 - a. Initial Submittal:
 - 1) Submit electronic files or one (1) hard copy set. Engineer will review and return, with comments as necessary.
 - b. Final Submittal:
 - 1) After incorporation of Engineer's comments, submit electronic files and one (1) hard copy set of final marked-up record prints to the Engineer and electronic files and one (1) hard copy set to the Owner.
 - c. Engineer will be responsible for generating record drawings based on the Contractor's marked-up record prints and delivering three (3) hard copy sets to the Owner.
- 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. Contractor shall maintain a set of marked up prints on the job site for review prior to pay request approval.
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.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 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. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Work Change Directive.
 - k. Changes made following Engineer's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. 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.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Engineer.
 - e. Name of Contractor.

2.2 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.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

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 01 78 39

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SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner'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. Furnish demonstration and training instruction time as a subsidiary obligation of the price bid.
- C. Related Requirements
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 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 01 40 00 - Quality Requirements, experienced in operation and maintenance procedures and training.

1.3 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner'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 Engineer.

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. Performance and design criteria if Contractor has delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. 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. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. 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 01 78 23 - 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 Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Engineer will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner 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 Owner, through Engineer with at least seven 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. Cleanup: Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01 79 00

SECTION 01 81 00 – GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes report of explorations and tests of subsurface conditions at the site.
- B. Related Requirements
 - 1. Section 31 20 00 – Earth Moving
 - 2. Section 31 23 19 – Dewatering
 - 3. Section 31 50 00 – Excavation Support and Protection

1.2 INVESTIGATION

- A. Soil and subsurface investigations were conducted at the site, the results of which are to be found in the Report of Geotechnical Exploration issued by Goodwyn, Mills and Cawood (GMC), dated June 5, 2020, GMC Project Number GMOB200005, in Appendix A.
- B. Bidders are urged to examine soils investigation data and to make their own investigation of the site before bidding. The information in the report provided is not a warranty of existing site conditions.
- C. Boring results and soil improvement recommendations are included in the plans.

1.3 INTERPRETATION

- A. Soil investigation data is provided only for information and the convenience of bidders.
- B. Owner and Engineer disclaim responsibility for interpretations of geotechnical data by bidders, as in projecting soil-bearing values, rock profiles, soil stability and the presence, level, and extent of underground water.
- C. Bidders are urged to examine the GMC Geotechnical Report that addresses the purpose, basis, and warranties relevant to that report.
- D. Owner and Engineer disclaim all responsibility for the existence of other soil and subsurface investigations previously prepared for Owner, Engineer, or others. It is the sole responsibility of the Bidder to obtain other soil and subsurface investigations that may be available for interpretation, at no additional cost to the Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 81 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected site elements.
 - 2. Salvage of existing items to be reused or recycled.
 - 3. Protecting existing work to remain.
 - 4. Cleaning soiled materials that are to remain.
 - 5. Disconnecting and capping utilities.
 - 6. Removing debris and equipment.
 - 7. Removal of items indicated on Drawings.
 - 8. Salvageable items to be retained by the Owner as indicated on the Drawings and during pre-construction meeting.
- B. Related Requirements:
 - 1. Section 01 10 00 – Summary, for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Demolish: To forcefully tear down or take apart a structure.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- D. 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 Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
- E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces that might be misconstrued as damage caused by demolition operations. Comply with Section 01 32 33 - Photographic Documentation. Submit before Work begins.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. 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.

1.9 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.10 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- D. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs or video and survey/3D scan.
 - 1. Comply with requirements specified in Section 01 32 33 - Photographic Documentation.
 - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

- f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
- g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

- A. Temporary Protection: 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.
 - 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.
- B. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

- 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. 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 fire watch during and for at least two hours after flame-cutting operations.
 - 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.
- 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 used facilities.
- C. Removed and Salvaged Items:
 - 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 Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
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 Engineer, 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.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and/or recycle or dispose of them.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

3.6 CLEANING

A. 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.

END OF SECTION 02 41 19

SECTION 03 20 00 – ANCHORAGE IN CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the requirements for cast-in-place, mechanical, and adhesive anchors for concrete.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related work specified elsewhere includes:
1. Section 03 30 00 – Cast-in-Place Concrete
 2. Division 26 – Electrical
 3. Division 46 – Water and Wastewater Equipment

1.3 SUBMITTALS

- A. Submit product information to the Engineer for approval in accordance with Section 01 33 00 – Submittal Procedures.

PART 2 - PRODUCTS

2.1 WEDGE TYPE ANCHORS

- A. Anchors shall feature a stainless-steel split expansion ring; a threaded stud body; and integral cone expander, nut and washer.
- B. Anchor bodies smaller than 3/4 inch, excluding countersunk anchors, shall be made from AISI 316 and shall have the following minimum bolt fracture loads:

Anchor Diameter (in.)	Minimum Fracture Load (lb)
1/4	2,900
3/8	7,200
1/2	12,400
5/8	21,900

- 2.2 Anchor bodies 3/4 inch and larger, and all stainless-steel post nut anchor bodies, shall be made from AISI 316 stainless steel and shall have the following minimum mechanical properties:

Anchor Diameter (in.)	Min. Tensile Strength (ksi)	Min. Yield Strength (ksi)
$\leq 5/8$	90	76
$\geq 3/4$	76	64

- A. All nuts shall meet the dimensional requirements of ASTM F 594.
- B. Washers shall meet the dimensional requirements of ANSI B18.22.1, Type A, plain.
- C. Expansion sleeve for anchors shall be made from AISI 316. All nuts and washers shall be made from AISI 316.
- D. Anchor size and depth shall be as shown on drawings.
- E. Manufacturers:
 - 1. Trubolt as manufactured by ITW-Redhead, Inc.
 - 2. Kwik Bolt 3 as manufactured by Hilti, Inc.
 - 3. Or equal

2.3 ADHESIVE ANCHOR SYSTEM

- A. Adhesive anchor system shall consist of an injectable two-part epoxy.
- B. Application system shall be in accordance with manufacturer's recommendations. System shall keep the two components separated until application of product directly into drilled hole.
- C. System shall thoroughly blend the two parts by means of a static mixer nozzle.
- D. Injection adhesive shall be formulated to include resin and hardener to provide optimal curing speed as well as high strength and stiffness.
- E. Anchor rods shall be as shown on drawings or as specified in other sections of these specifications.
 - 1. Anchor rods shall be furnished with chamfered ends so that either end will accept a nut and washer.
 - 2. Alternately, anchor rods shall be furnished with a 45° chisel point on one end to allow for easy insertion into the adhesive-filled hole.
- F. Nuts and washers shall be provided for anchor rods in the same material as the anchor rod.
- G. Manufactures
 - 1. HIT RE 500 Epoxy Adhesive Anchor as manufactured by Hilti, Inc.
 - 2. G5 Adhesive Anchoring System as manufactured by ITW-Redhead, Inc.

3. Or equal

2.4 CAST-IN-PLACE ANCHORS BOLTS

- A. Cast-in-place anchors shall be made of corrosion resistant material in accordance with the dimensions shown on drawings.
 1. As a minimum, provide ASTM F1554 Grade 36 steel cast-in-place anchors.
 2. If anchor bolt size is not shown on drawings, Contractor shall provide anchors capable of providing four (4) times the load applied to the bolt.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Layout anchors before drilling into concrete to ensure proper placement. Following manufacturer's recommendation for spacing of anchors. Notify Engineer of conflicts between existing conditions and requirements by manufacturer.
- B. Install anchors per manufacturer's recommendations.
- C. Embedment length shall be per manufacturer's recommendations for load conditions.
- D. Check all equipment anchors after equipment has operated. Retighten any loose anchors.

END OF SECTION 03 20 00

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 03 50 00 – Anchorage in Concrete
 - 2. Division 31 – Earthwork

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, vapor-retarder installation, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness concrete repair procedures, and concrete protection.

1.4 ACTION SUBMITTALS

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

- 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. 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.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Engineer.
- E. Samples: For color finishes, normal weight aggregates, fiber reinforcement, reglets, waterstops, vapor retarder/barrier, and form liners.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. 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. Floor and slab treatments.
 - 8. Bonding agents.
 - 9. Adhesives.
 - 10. Vapor retarders.
 - 11. Semi-rigid joint filler.
 - 12. Joint-filler strips.
 - 13. Repair materials.
- C. Material Test Reports: From a qualified testing agency.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer. Placing drawings indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

1.6 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 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: Acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 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.

1.7 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.

1.8 FIELD CONDITIONS

- A. 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 °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.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain average concrete temperature below 90 °F at time of placement. Maximum concrete temperature at time of placement shall be 95 °F. 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.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301.
 2. ACI 117.
 3. ACI 350.
 4. ACI 308.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that 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. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
 3. Overlaid Finnish birch plywood.
- 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. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

- E. Void (Carton) Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated (maximum VOC content of 350 mg/L) form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, deformed bars, assembled with clips.
- C. Plain-Steel Wire: ASTM A 1064, as drawn.
- D. Deformed-Steel Wire: ASTM A 1064.
- E. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.
- F. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064, flat sheet.
- G. Galvanized-Steel Welded-Wire Reinforcement: ASTM A 1064, plain, fabricated from galvanized-steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Zinc Repair Material: ASTM A 780.
- 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 slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 1. Portland Cement: ASTM C 150, Type I or Type II.
 - a. The cement shall be low alkali, less than 0.60 percent. All cement used in concrete that will be in contact with wastewater shall have a tricalcium aluminate ($\text{Ca}_3\text{Al}_2\text{O}_6$) content of less than 8 percent.
 - b. Use one brand of cement throughout the Project unless otherwise acceptable to the Engineer.
 2. Fly Ash: ASTM C 618, Class F or C.
- C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. Normal weight river gravel and natural sand are acceptable for use as aggregate materials in concrete. All normal weight aggregates shall conform to ASTM C33.
 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
- D. Lightweight Aggregate: ASTM C 330, 1-inch-nominal maximum aggregate size.
- E. Air-Entraining Admixture: ASTM C 260.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do 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, Type A.
 2. Retarding Admixture: ASTM C 494, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
- G. Water: ASTM C 94 and potable.

2.6 FIBER REINFORCEMENT

- A. Synthetic Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
- B. Synthetic Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

2.7 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints, factory fabricated corners, intersections, and directional changes.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Sika Greenstreak
 - b. Williams Products, Inc.
 - c. JP Specialties, Inc.
 - d. Or approved equal.
 - 2. Profile: Ribbed with center bulb and/or Ribbed without center bulb.
 - 3. Dimensions: 6 inches by 3/8 inch thick; nontapered.
- B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints, factory fabricated corners, intersections, and directional changes.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BoMetals, Inc.
 - b. Sika Greenstreak.
 - c. JP Specialties, Inc.
 - d. Or approved equal.
 - 2. Profile: Ribbed with center bulb and/or Ribbed without center bulb.
 - 3. Dimensions: 6 inches by 3/8 inch thick; nontapered.
- C. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Barrier-Bac; Intoplast Group, Ltd.
 - b. JP Specialties, Inc.
 - c. Sika Greenstreak.
 - d. Or approved equal.

- D. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adeka Ultra Seal/OCM, Inc.
 - b. Sika Greenstreak.
 - c. Or approved equal.

2.8 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation; Construction Systems.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. Kaufman Products, Inc.
 - d. Sika Corporation.
 - e. SpecChem, LLC.
 - f. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation; Construction Systems.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. W. R. Meadows, Inc.
 - d. Or approved equal.

- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation; Construction Systems.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. L&M Construction Chemicals, Inc.
 - d. TK Products.
 - e. Or approved equal.
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation; Construction Systems.
 - b. Dayton Superior.
 - c. Euclid Chemical Company (The); an RPM company.
 - d. L&M Construction Chemicals, Inc.
 - e. W. R. Meadows, Inc.
 - f. Or approved equal.
- H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation; Construction Systems.
 - b. Dayton Superior.
 - c. Euclid Chemical Company (The); an RPM company.
 - d. L&M Construction Chemicals, Inc.
 - e. W. R. Meadows, Inc.
 - f. Or approved equal.
- I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dayton Superior.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. L&M Construction Chemicals, Inc.
 - d. W. R. Meadows, Inc.
 - e. Or approved equal.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, nonload bearing or Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

- A. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.12 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. Slag Cement: 50 percent.
 4. Combined Fly Ash or Pozzolan and Slag Cement: 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, Slag Cement, 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 0.10 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range 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 w/c ratio below 0.50.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Normal-weight concrete.
1. Minimum Compressive Strength: -As indicated in Structural General Notes at 28 days.
 2. Maximum W/C Ratio: 0.55.
 3. Slump Limit: 3 inches. 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
- B. Foundation Walls: Normal-weight concrete.
1. Minimum Compressive Strength: As indicated in Structural General Notes at 28 days.
 2. Maximum W/C Ratio: 0.50
 3. Slump Limit: 3 inches. 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture plus or minus 1 inch.
 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

C. Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: As indicated in Structural General Notes at 28 days.
2. Maximum W/C Ratio: 0.50
3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
4. Slump Limit: 3 inches, plus or minus 1 inch.
5. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
6. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
7. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
8. Maximum W/C Ratio: 0.50.

D. Suspended Slabs: Normal-weight concrete.

1. Minimum Compressive Strength: As indicated in Structural General Notes at 28 days.
2. Maximum W/C Ratio: 0.50.
3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
4. Slump Limit: 3 inches, plus or minus 1 inch.
5. Air Content: 4 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
6. Air Content: -4.5 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
7. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
8. Maximum W/C Ratio: 0.50.

E. Water Retaining Structures.

1. Minimum Compressive Strength: As indicated in Structural General Notes at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Minimum Cementitious Materials Content: 535 lb/cu. yd.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: 4.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
6. Air Content: 4.5 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

F. Concrete Toppings: Normal-weight concrete.

1. Minimum Compressive Strength: As indicated in Structural General Notes at 28 days.
2. Minimum Cementitious Materials Content: 600 lb/cu. yd.
3. Slump Limit: 3 inches, plus or minus 1 inch.
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: Do not allow air content of trowel-finished toppings to exceed 3 percent.
6. Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd.

G. Building Frame Members: Normal-weight concrete.

1. Minimum Compressive Strength: As indicated in Structural General Notes at 28 days.
2. Maximum W/C Ratio: 0.50.
3. Slump Limit: 4 inches. 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 4.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

H. Building Walls: Normal-weight concrete.

1. Minimum Compressive Strength: As indicated in Structural General Notes at 28 days.
2. Maximum W/C Ratio: 0.50.
3. Slump Limit: 4 inches. 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
1. When air temperature is between 85 and 90 °F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 °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. 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 INSTALLATION

- 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 347 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. Construct 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. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- 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 303.

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 °F for 48 hours after placing concrete with a 72 hour pour back for adjacent pours. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support 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 are not 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 by Engineer.

3.4 SHORING AND RESHORING INSTALLATION

- 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 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.6 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting 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 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.
- 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.

3.7 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 Engineer.
 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 beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 5. Space vertical joints in walls as indicated on Contractor's submitted and approved construction joint layout. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 6. 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 as soon as cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. 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.

3.8 WATERSTOP INSTALLATION

- 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 fabricated joints in waterstops according to manufacturer's written instructions.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
- 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 is 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 not to 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 floors and 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.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- C. Smooth Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
1. Perform no later than one day after form removal.
 2. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
 3. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
 4. Smooth-Rubbed Finish: Apply to the top of exposed concrete walls and the outside exposed face to 1' below grade on all new concrete structures and new concrete additions.

- D. Grout Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.
 - 1. Combine 1 part Portland cement to 1-1/2 parts fine sand by volume, complying with ASTM C144 or ASTM C404, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard Portland cement and white Portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
 - 2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- E. 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.

3.11 FINISHING FLOORS AND 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: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.
 - 1. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
- C. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.
 - 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- D. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
 - 1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface.

Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155. Grind smooth any surface defects that would telegraph through applied floor covering system.

- E. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
- F. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.
- G. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and where indicated.
 - 1. After completing float finishing and before starting trowel finish, uniformly spread 25 lb of dampened nonslip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as specified.
 - 2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. 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. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases 6 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: 4000 psi at 28 days.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 - 6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

- 7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301 and ACI 306.1 for cold-weather protection and ACI 301 and ACI 305.1 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 remainder of 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: Required for all water retaining structures. 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.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3. Curing Compound: For non-liquid retaining structures and floors only. Comply with ASTM C171. 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. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies in writing that the curing compound does not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: For non-liquid retaining structures and floors only. Comply with ASTM C171. Apply uniformly to floors and slabs indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 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 three (3) 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 joints clean and dry.
- C. Install semi-rigid 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.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part Portland cement to 2-1/2 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 to solid concrete. Limit cut depth to 3/4 inch. 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 matches 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 Engineer.
- 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 receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 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 blending 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 Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.16 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a-qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.

D. 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.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143; 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; one test hourly when air temperature is 40 °F and below or 80 °F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31.
 - 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; 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 Engineer, 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 Engineer 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 Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer.
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.

- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing for laboratory and office buildings.
- F. For floors required for sloping, the slope must be within 1/16" tolerances of that required in the plans.

3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

3.18 WET TESTING

A. General

1. All new, water-retaining concrete structures shall be tested for water-tightness by the testing procedure described below and in accordance with ACI 350.1.
2. All testing work shall be performed by the Contractor in the presence of the Engineer. The Engineer shall be notified at least five (5) days in advance of the time at which testing will be performed.

B. Testing Water

1. Water for wet testing shall be furnished by the Contractor. The source of the water must be approved by the Engineer prior to filling of the structure. As a general rule, plant effluent water is acceptable for use as testing water; however, this must be confirmed by the Engineer.
2. Once testing is complete, testing water shall be disposed of in a manner acceptable to the Engineer and, unless otherwise permitted by the Engineer, shall not be allowed to enter other parts of the system.

C. Test Equipment

1. All temporary equipment needed for wet testing must be provided by the Contractor (e.g. connections between the structure to be tested and the water source, pumping equipment, metering devices, pressure or vacuum gauges, temporary flanges, valves, bulkheads, bracing, blocking, and other equipment that may be necessary to perform the testing).
2. All temporary equipment shall be removed upon satisfactory completion of wet testing.

D. Test Preparation

1. Unless otherwise specified, wet testing shall be performed after installation of pipe sleeves and before placement of backfill, cleaning, disinfection, installation of process equipment, or any other activities that would hinder visual inspection of the structure during the test.
2. Exposed concrete surfaces of the structure (including the floor) shall be cleaned of all foreign material and debris prior to the test. Standing water in or outside the structure that would interfere with the observation of the exposed concrete surfaces of the structure shall be removed. The concrete surfaces and concrete joints shall be thoroughly inspected for potential points of leakage, and those areas shall be repaired prior to filling the structure with water.
3. Adjacent structures having common walls shall be tested individually at different times to allow examination of the dividing walls for leaks.
4. Pipe connections or openings to structures, if not provided with drip tight valves, shall be temporarily plugged during testing. Where slide gates, sluice gates or similar devices are located, the Contractor shall provide bulkheads or the means to make them drip tight, and shall measure any leakage.
5. Filling of the structure shall not begin before the designed compressive strength of all concrete elements of the structure has been reached or before fourteen (14) days after all concrete walls or base slabs have been placed.

E. Test Procedure

1. Soaking Period: Fill the unlined concrete structure to 1 foot above the maximum operating water surface level and maintain that water level for a minimum of 72 hours, to minimize absorption of water into the concrete during testing. Identify and repair all visible leaks during the soaking period.
2. Testing Period: At the end of this soaking period, once all leaks have been repaired and the water level brought back to the required elevation, the testing period shall begin. Mark the water level with a weight suspended from a string and measure its elevation with a surveyor's level. Allow the structure to sit for a minimum of 48 hours. Following this period, identify and repair all visible leaks. Record and submit to the Engineer measurements of the water level at the beginning and end of the testing period.
3. Evaporation/Precipitation: During the testing period, suspend a bucket or pan in the structure and fill it halfway with testing water. Record and submit to the Engineer measurements of the water level at the beginning and end of the testing period, for use in accounting for any evaporation and precipitation that may have occurred during testing.

F. Leakage

1. Leakage requiring repair shall be defined as any moisture on the exterior surface of the structure, ranging from damp spots to dripping or trickling to shooting streams of water. All visible leakage is to be repaired even if magnitude is within allowable leakage.
2. Allowable leakage: For unlined tanks with a side-water depth of 25 feet or less, the net loss of water volume (including evaporation/precipitation) shall not exceed 0.1 percent in 24 hours.

G. Test Conclusion

1. If the leakage observed during testing (including evaporation/precipitation) is less than the allowable leakage, the structure shall be considered sufficiently water-tight. If it is greater than the allowable, the structure shall be drained, necessary repairs shall be made, and the structure shall be re-tested.

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SECTION 03 39 00 - CONCRETE CURING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Initial and final curing of horizontal and vertical concrete surfaces.
- B. Related Requirements
 - 1. Section 03 30 00 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frames, slabs on fill or grade, and other concrete components associated with construction.

1.2 REFERENCE STANDARDS

- A. American Concrete Institute
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 302.1 - Guide to Concrete Floor and Slab Construction.
 - 3. ACI 308.1 - Specification for Curing Concrete.
 - 4. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
 - 5. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures and Commentary
- B. ASTM International
 - 1. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
 - 2. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 3. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - 4. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's information on curing compounds, mats, paper, and film, including compatibilities and limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- E. Qualifications Statement

1. Submit qualifications for manufacturer.

1.4 QUALITY ASSURANCE

- A. Perform Work according to ACI 350.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Membrane-Curing Compound
 1. Description: Comply with ASTM C171.
- B. Water: Potable; not detrimental to concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application examination.
- B. Verify that substrate surfaces are ready to be cured.

3.2 APPLICATION

A. Horizontal Surfaces

1. Comply with ACI 308.1, using Section 7 (Addition of Water: Water-Absorbent Materials); Section 3 (Moisture Retention: Liquid Membrane-Forming Curing Compounds).
2. Absorptive Mat
 - a. Saturate burlap-PE and place burlap-side down over floor slab areas.
 - b. Lap ends and sides.
 - c. Maintain in place for seven days.
3. Membrane-Curing Compound: Apply curing compound uniformly at the rate recommended by the manufacturer.

B. Vertical Surfaces

1. Comply with ACI 308.1, using Water Absorbent Materials method.
2. Spraying: Spray water over surfaces and maintain wet for seven days.
3. Membrane-Curing Compound: Apply compound uniformly at the rate recommended by the manufacturer.

3.3 PROTECTION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Do not permit traffic over unprotected floor surfaces.

3.4 ATTACHMENTS

A. Liquid Retaining Structures

1. Description: Absorptive mats.
2. Type: Burlap-PE.

B. Elevated Slabs

1. Description: Membrane-curing compound.
2. Type: Acrylic.
3. Color: Clear.

C. Concrete Pavement

1. Description: Membrane-curing compound.
2. Color: Opaque.

D. Other Floor Areas

1. Description: Membrane-curing compound.
2. Type: Acrylic.
3. Color: Translucent.

END OF SECTION 03 39 00

SECTION 03 60 00 - GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Portland cement grout.
2. Rapid-curing epoxy grout.
3. Nonshrink cementitious grout.

B. Related Requirements:

1. Section 03 30 00 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frames, slabs on fill or grade, and other concrete components.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete for Buildings.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures

B. ASTM International:

1. ASTM C33 - Standard Specification for Concrete Aggregates.
2. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
3. ASTM C150 - Standard Specification for Portland Cement.
4. ASTM C191 - Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle.
5. ASTM C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
6. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
7. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
8. ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.

C. U. S. Army Corps of Engineers Concrete Research Division (CRD):

1. CRD-C621 - Non-Shrink Grout.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information regarding grout.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit instructions for mixing, handling, surface preparation, and placing epoxy-type and nonshrink grouts.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

1.5 AMBIENT CONDITIONS

- A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Maximum Conditions: Do not perform grouting if temperatures exceed manufacturer's recommendations.
- C. Minimum Conditions: Maintain minimum temperature per the manufacturer before, during, and after grouting, until grout has set.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT GROUT

- A. Portland Cement: Comply with ASTM C150, Type I and II.
- B. Water:
 - 1. Potable.

2. No impurities, suspended particles, algae, or dissolved natural salts in quantities capable of causing:
 - a. Corrosion of steel.
 - b. Volume change increasing shrinkage cracking.
 - c. Efflorescence.
 - d. Excess air entraining.

C. Fine Aggregate:

1. Washed natural sand.
2. Gradation:
 - a. Comply with ASTM C33.
 - b. Represented by smooth granulometric curve within required limits.
3. Free from injurious amounts of organic impurities according to ASTM C40.

D. Mix:

1. Portland cement, sand, and water.
2. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.2 RAPID-CURING EPOXY GROUT

A. Manufacturers:

1. L&M Construction Chemicals
2. Sika Corporation
3. WR Meadows
4. Or Approved Equal

B. Description:

1. High-strength, three-component epoxy grout formulated with thermosetting resins and inert fillers.
2. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids, and alkalis.

C. Performance and Design Criteria:

1. Compressive Strength:
 - a. 12,000 psi at seven days.
 - b. Comply with ASTM C579.
2. Minimum Tensile Strength:
 - a. 2,000 psi.
 - b. Comply with ASTM C307.
3. Coefficient of Expansion:

- a. 30x10-6 inch per degree F.
 - b. Comply with ASTM C531.
4. Shrinkage:
- a. None.
 - b. Comply with ASTM C827.

2.3 NONSHRINK CEMENTITIOUS GROUT

A. Manufacturers:

- 1. Euclid Chemical Company
- 2. Sika Corporation
- 3. L&M Construction Chemicals
- 4. Or Approved Equal

B. Description:

- 1. Pre-mixed and ready-for-use formulation requiring only addition of water.
- 2. Nonshrink, non-corrosive, nonmetallic, non-gas forming, and no chlorides.

C. Performance and Design Criteria:

- 1. Certified to maintain initial placement volume or expand after set, and to meet following minimum properties when tested according to CRD-C621 for Type D nonshrink grout:
 - a. Setting Time:
 - 1) Initial: Approximately 2 hours.
 - 2) Final: Approximately 3 hours.
 - 3) Comply with ASTM C191.
 - b. Maximum Expansion: 0.10 to 0.40 percent.
 - c. Compressive Strength:
 - 1) One-Day: 4,000 psi.
 - 2) Seven-Day: 7,000 psi.
 - 3) 28-Day: 10,000 to 10,800 psi.
 - 4) Comply with CRD-C621.

2.4 FORMWORK

- A. As specified in Section 03 30 00 – Cast-In-Place Concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify areas to receive grout.

3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Remove defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by brushing, hammering, chipping, or other similar means until sound and clean concrete surface is achieved.
- C. Roughen concrete lightly, but not to interfere with placement of grout.
- D. Remove foreign materials from metal surfaces in contact with grout.
- E. Align, level, and maintain final positioning of components to be grouted.
- F. Saturate concrete surfaces with clean water, and then remove excess water.

3.3 INSTALLATION

- A. Formwork:
 - 1. Construct leak proof forms anchored and shored to withstand grout pressures.
 - 2. Install formwork with clearances to permit proper placement of grout.
 - 3. As specified in Section 03 30 00 – Cast-In-Place Concrete.
- B. Mixing:
 - 1. Portland Cement Grout:
 - a. Use proportions of two parts sand and one part cement, measured by volume.
 - b. Prepare grout with water to obtain consistency to permit placing and packing.
 - c. Mix water and grout in two steps:
 - 1) Pre-mix using approximately 2/3 of water.
 - 2) After partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing two to three minutes.
 - d. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
 - e. Do not add additional water after grout has been mixed.
 - f. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.

2. Rapid-Curing Epoxy Grout:
 - a. Mix and prepare according to manufacturer instructions.
 - b. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
3. Nonshrink Cementitious Grout:
 - a. Mix and prepare according to manufacturer instructions.
 - b. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
4. Mix grout components in proximity to Work area and transport mixture quickly and in manner not permitting segregation of materials.

C. Placing of Grout:

1. Place grout material quickly and continuously.
2. Do not use pneumatic-pressure or dry-packing methods.
3. Apply grout from one side only to avoid entrapping air.
4. Do not vibrate placed grout mixture or permit placement if area is being vibrated by nearby equipment.
5. Thoroughly compact final installation and eliminate air pockets.
6. Do not remove leveling shims for at least 48 hours after grout has been placed.

D. Curing:

1. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or by using wet burlap method.
2. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
3. After grout has attained its initial set, keep damp for minimum three (3) days.

3.4 FIELD QUALITY CONTROL

A. Inspection and Testing:

1. Comply with ACI 301 and as specified in Section.
2. Submit proposed mix design of each class of grout to Engineer for review prior to commencement of Work.
3. Tests of grout components may be performed to ensure compliance with specified requirements.

END OF SECTION 03 60 00

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Work described in this section includes joint sealer systems.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related work specified elsewhere includes:
 - 1. Section 03 30 00 – Cast-in-Place Concrete

1.3 SYSTEM PERFORMANCES

- A. Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications, handling, installation, curing instructions, color charts and performance tested data sheets for each product required.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an Installer who has successfully completed within the last three years at least three (3) joint sealer applications similar in type and size to that of this project and who will assign mechanics from these earlier applications to this project, of which one will serve as lead mechanic.
- B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.

1.6 DELIVER, STORAGE AND HANDLING

- A. Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.

- B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40°F.
 - 2. When joint substrates are wet due to rain, frost, condensation or other causes.
- B. Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than allowed by joint sealer manufacturer for application indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.
- B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by from manufacturer's standard colors.

2.2 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class and Uses.
- B. Multi-Part Nonsag Urethane Sealant: Type M, Grade NS, Class 25, Uses NR, M, A and, as applicable to joint substrates indicated, O.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Dynatrol 11" Pecora Corp.
 - b. "Sonolastic NP-2"; Sonneborn.
 - c. "Dymeric 511"; Tremco Inc.
 - d. "Vulkem 922"; Mameco International, Inc.
 - 2. Locations for Use: Exterior joints and penetrations in vertical surfaces of stucco, concrete, and between metal and concrete, mortar of stone; overhead or ceiling joints; perimeters of metal frames in exterior walls; vertical expansion and control joints in masonry and concrete; and at all miscellaneous locations requiring a joint sealant.
 - 3. Equivalent 1-part sealants will be acceptable, by one of the above named manufacturers.

- C. Two-Part Pourable Urethane Sealant: Type M, Grade P, Class 25; Uses T, M, A and, as applicable to joint substrates indicated, O.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Chem-Calk 550"; Bostik Construction Product Div.
 - b. "Vulkem 245"; Mameco International, Inc.
 - c. "Pourthane"; W. R. Meadows, Inc.
 - d. "NR-200 Urexpan"; Pecora Corp.
 - e. "Sonolastic Paving Joint Sealant"; Sonneborn Building Products Div.,
 - f. "Rexnord Chem. Prod. Inc.
 - g. "THC-900/901"; Tremco Corp.
 2. Locations for Use: Exterior and interior expansion, control and construction joints in horizontal surfaces; and joints subject to pedestrian and light vehicular traffic.
 3. Equivalent 1-part sealants will be acceptable, by one of the above named manufacturers.
- D. One-Part Mildew-Resistant Silicone Sealant: Type S, Grade NS; Class 25, Uses NT, G, A and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide for sealing interior joints with nonporous substrates around ceramic tile, showers, sinks and plumbing fixtures.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Dow-Corning 786"; Dow Corning Corp.
 - b. "SCS 1702"; General Electric.
 - c. "863 #345 White"; Pecora Corp.
 - d. "Proglaze White"; Tremco Corp.
 2. Locations for Use: Interior joints in vertical surfaces and terminal edges of tile; and joints at damp areas, such as around sinks and plumbing fixtures and pipe penetrations; and exposed terminal edges of vinyl flooring, such as around door frames and terminations at concrete.

2.3 LATEX JOINT SEALERS

- A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part nonsag, acrylic, mildew resistant, acrylic emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior and on protected exterior exposures involving joint movement of not more than + 7.5%.
1. Products: Subject to compliance with requirements, provide with one of the following:
 - a. "Chem-Calk 600"; Bostik Construction Products Div.
 - b. "AC-20"; Pecora Corp.
 - c. "Sonolac"; Sonneborn Building Products Div; Rexnord Chemical Prod., Inc.
 - d. "Tremco Acrylic Latex Caulk"; Tremco Inc.

2. Locations for Use: Interior joints in field-painted vertical and overhead surfaces at perimeter of metal door frames, gypsum drywall, plaster and concrete or concrete masonry; and all other interior locations not indicated otherwise.

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint-Fillers:
 1. Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of material indicated below, and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 2. Backer Rod: Premium grade, closed cell polyethylene foam rod; Sealtight Backer Rod, as manufactured by W.R. Meadows, Inc., or approved equal.
 3. Joint Filler: "Ceramar" flexible foam expansion joint filler, as manufactured by W.R. Meadows, Inc., or approved equal.
- C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing bond between sealant and joint filler or other materials at back (3rd) surface of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

- A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated.
- B. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.
- C. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surface adjacent to joints.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Require Installer to inspect joints indicated to receive joint sealers for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Obtain Installer's written report listing any conditions detrimental to performance of joint sealer work. Do not allow joint sealer work to proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
 - 1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil; grease; waterproofing; water repellents; water; surface dirt and frost.
 - 2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form release agents from concrete.
 - 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications and conditions indicated.
- C. Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants.
- D. Installation of Sealant Backings:
 - 1. Install sealant backings to comply with the following requirements:
 - 2. Install joint-fillers of type indicated or recommended by sealant manufacturer to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint-fillers.

- b. Do not stretch, twist, puncture or tear joint-fillers.
 - c. Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.
- 3. Install bond breaker tape between sealants and joint-fillers, compression seals or back of joints where required to prevent third-side adhesion of sealant to back of joint.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants:
 - 1. Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 - 2. Concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 PROTECTION AND CLEANING

- A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of substantial completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.
- B. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.
 - 1. Sound sealant shall not be visible on exposed surfaces.
- C. END OF SECTION 07 92 00

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: High-performance coatings and special preparation of surfaces.
1. Use high performance coating systems specified in this section to finish water tank components, unless otherwise indicated. Without restricting volume or generality, work to be performed under this section may include, but is not limited to:
 - a. Exterior steel
 - b. Interior steel
 - c. Exterior concrete
 - d. Interior concrete
 - e. Piping, hangers, and supports
 - f. Exposed bare pipes (including color coding)
 2. Painting or finishing is not needed for following:
 - a. Surfaces or materials specifically scheduled or shown on Drawings to remain unfinished
 - b. Items provided with factory finish.
 - c. Equipment nameplates, fire rating labels, and operating parts of equipment
 3. Materials and products having factory-applied primer shall not be considered factory finished.

1.2 REFERENCE STANDARDS

- A. American Society for Testing and Materials:
1. ASTM D16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products
- B. SSPC: The Society for Protective Coatings:
1. SSPC - Painting Manual, Volume 2: Systems and Specifications.
 2. SSPC-Paint 16 - Coal Tar Epoxy-Polyamide Black (or Dark Red).
 3. SSPC-SP 2 - Hand Tool Cleaning.
 4. SSPC-SP 3 - Power Tool Cleaning.
 5. SSPC-SP 5 - White Metal Blast Cleaning.
 6. SSPC-SP 6 - Commercial Blast Cleaning.
 7. SSPC-SP 7 - Brush-Off Blast Cleaning.
 8. SSPC-SP 10 - Near-White Metal Blast Cleaning.
 9. SSPC-SP 11 - Power Tool Cleaning to Bare Metal.
- C. National Association of Pipe Fabricators

1. NAPF 500-03-01 Solvent Cleaning
2. NAPF 500-03-02 Hand Tool Cleaning
3. NAPF 500-03-03 Power Tool Cleaning
4. NAPF 500-03-04 Abrasive Blast Cleaning of Ductile Iron Pipe
5. NAPF 500-03-05 Abrasive Blast Cleaning of Cast Ductile Iron Fittings

1.3 PREINSTALLATION MEETINGS

- A. Section 01 31 00 – Project Management and Coordination.
- B. Convene minimum two weeks prior to commencing Work of this Section.
- C. Schedule a conference and inspection to be held on-site before field application of coating systems begins.
- D. Conference shall be attended by Contractor, Owner's Representative, Engineer, coating applicators, and a representative of coating material manufacturer.
- E. Topics to be discussed at meeting shall include:
 1. A review of Contract Documents and accepted shop drawings shall be made and deviations or differences shall be resolved.
 2. Review items such as environmental conditions, surface conditions, surface preparation, application procedures, and protection following application.
 3. Establish which areas on-site will be available for use as storage areas and working area
- F. Pre-construction conference and inspection shall serve to clarify Contract Documents, application requirements and what work should be completed before coating application can begin.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 1. Submit manufacturer information indicating coating materials, manufacturer's name, product name, product number, performance ratings, curing times, mixing, thinning and application requirements.
 - a. Provide material analysis, including vehicle type and percentage by weight and by volume of vehicle, resin and pigment.
 - b. Submit manufacturer's Material Safety Data Sheets (MSDS) and other safety requirements.
- C. Samples: Submit one color chart/color samples, illustrating colors for selection.
- D. Schedule: Contractor shall submit a schedule of items that will receive high-performance coatings per Specification 09 96 00.

- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer Instructions: Submit special procedures, perimeter conditions requiring special attention.
- G. Quality Assurance Submittals:
 - 1. Certificates:
 - a. Coatings manufacturer shall certify that coating materials utilized are "non-lead" (less than 0.06% lead by weight in dried film) as defined in Part 1303 of Consumer Product Safety Act.
 - b. Provide certification that specialized equipment as may be required by manufacturer for proper application of coating materials shall be utilized for work of this Section.
 - c. Provide manufacturer's certification that products to be used comply with specified requirements and are suitable for intended application.
 - 2. Manufacturer's Instructions:
 - a. Submit manufacturer's installation procedures which shall be basis for accepting or rejecting actual installation procedures.
- H. Qualifications Statements:
 - 1. Submit qualifications for manufacturer and applicator.
 - 2. Submit manufacturer's approval of applicator.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Operation and Maintenance Data: Submit maintenance and cleaning requirements for coatings, repair, and patching techniques.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance materials.
- B. Extra Stock Materials:
 - 1. Furnish 1 gal of each color of each type of coating specified, for Owner's maintenance use.
 - 2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.7 QUALITY ASSURANCE

- A. Conform to applicable codes and ordinances for flame, fuel, smoke, and volatile organic compound (VOC) ratings requirements for finishes at time of application.

1.8 QUALIFICATIONS

- A. Provide products from a company specializing in manufacture of high performance coatings with a minimum of 10 years experience.
- B. Applicator shall be trained in application techniques and procedures of coating materials and shall demonstrate a minimum of 2 years successful experience in such application.
 - 1. Maintain, throughout duration of application, a crew of painters who are fully qualified to satisfy specified qualifications.
- C. Single Source Responsibility:
 - 1. Materials shall be products of a single manufacturer or items standard with manufacturer of specified coating materials.
 - 2. Provide secondary materials which are produced or are specifically recommended by coating system manufacturer to ensure compatibility of system.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Container Labeling: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Inspection:
 - 1. Accept materials on Site in manufacturer's sealed and labeled containers.
 - 2. Inspect for damage and to verify acceptability.
- D. Store materials in ventilated area and otherwise according to manufacturer instructions.
- E. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

1.10 AMBIENT CONDITIONS

- A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

- B. Minimum Conditions: Do not install materials when temperature is below 35°F or above 110°F.
- C. Refer to specific product information sheets for minimum surface temperature requirements. Surface temperatures shall be at least 5°F (15°C) above dew point and in a rising mode.
- D. Subsequent Conditions: Maintain above temperature range, 24 hours before, during, and 72 hours after installation of coating.
- E. Relative humidity shall be no higher than 85%.
- F. For exterior spray application, wind velocity shall be less than 15 mph (25 kph).
- G. Atmosphere shall be relatively free of airborne dust.
- H. Restrict traffic from area where coating is being applied or is curing.

1.11 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.
- B. Include coverage for bond to substrate, and degradation of chemical resistance.

PART 2 - PRODUCTS

2.1 HIGH-PERFORMANCE COATINGS

- A. Manufacturers:
 - 1. Tnemec Company, Inc.
 - 2. Sherwin Williams Company
 - 3. Carboline
 - 4. Or Approved Equal.

2.2 COMPONENTS

- A. Coatings:
 - 1. Description:
 - a. Complete multicoat systems formulated and recommended by manufacturer for intended applications and in indicated thicknesses.
 - b. Specified number of coats does not include primer or filler coat.
 - 2. Lead content: None.
 - 3. Chromium Content as Zinc Chromate or Strontium Chromate: None.
 - 4. Maximum VOC Content: As required by applicable regulations.
 - 5. Colors: As selected from manufacturer's standard colors.

B. Epoxy Coating:

1. Modified Polyamine Epoxy

- a. Usage: A thick film, 100% solids, abrasion-resistant lining designed for wastewater immersion and fume environments. Provides low permeation to H₂S gas, protects against MIC and provides chemical resistance to severe wastewater environments.
- b. Exposure: Severe.
- c. Number of Coats: See schedule.
- d. Finish: Gloss.
- e. Minimum Solids Content: 100% (mixed).
- f. Minimum Dry Film Thickness Per Coat: See schedule.
- g. Perma-Glaze, Series 435, as manufactured by Tnemec, or DuraPlate 5900, as manufactured by Sherwin Williams.
- h. Primer: See schedule.

2. Modified Polyamine Epoxy Mortar

- a. Usage: A 100% solids, hybrid epoxy mortar designed for severe wastewater immersion and fume environments. Specifically formulated to withstand high levels of hydrogen sulfide gas (H₂S), sulfuric acid (H₂SO₄), as well as other gases common to sewer exposures. Aggregate reinforcement provides additional resistance to abrasions and impacts.
- b. Exposure: Severe.
- c. Number of Coats: See schedule.
- d. Finish: Gloss.
- e. Minimum Solids Content: 100% (mixed).
- f. Minimum Dry Film Thickness Per Coat: See schedule.
- g. Perma-Shield H₂S, Series 434, as manufactured by Tnemec, or DuraPlate 5900 Mortar, as manufactured by Sherwin Williams.
- h. Primer: See schedule.

3. Glass Flake Modified Polyamine Epoxy

- a. Usage: Abrasion resistant, high solids, epoxy coating which offers high-build edge protection and excellent corrosion resistance. Contains glass flake and aluminum oxide for improved film integrity.
- b. Exposure: Severe.
- c. Number of Coats: See schedule.
- d. Minimum Solids Content: 82.0 ± 2.0%
- e. Minimum Dry Film Thickness Per Coat: 8 -18 mils DFT
- f. Epoxoline, Series 142, as manufactured by Tnemec, or Macropoxy 5500LT, as manufactured by Sherwin Williams.
- g. Primer: See schedule.

4. Modified Polyamine Epoxy

- a. Usage: NSF Approved, abrasion resistant, high solids, epoxy coating which offers high-build edge protection and excellent corrosion resistance.
- b. Exposure: Severe.

- c. Number of Coats: See schedule.
 - d. Minimum Solids Content: $82.0 \pm 2.0\%$
 - e. Minimum Dry Film Thickness Per Coat: 4 -18 mils DFT
 - f. Epoxoline, Series 141, as manufactured by Tnemec, or Macropoxy 5500LT, as manufactured by Sherwin Williams.
 - g. Primer: See schedule.
5. Surface Tolerant Modified Polyamidoamine Epoxy
- a. Usage: High-build coating with superior wetting for marginally prepared rusty steel and tightly adhering old coatings. Excellent abrasion-, chemical- and corrosion-resistance. Perfect foundation for aliphatic-polyurethanes. NOT FOR IMMERSION SERVICE.
 - b. Exposure: Moderate.
 - c. Number of Coats: See schedule.
 - d. Finish: Semi-gloss.
 - e. Minimum Solids Content: $84.0 \pm 2.0\%$ (mixed).
 - f. Minimum Dry Film Thickness Per Coat: See schedule.
 - g. Chembuild, Series 135, as manufactured by Tnemec, or Macropoxy 5500 LT, as manufactured by Sherwin Williams.
 - h. Primer: See schedule.
6. NSF Approved Pure Polyamide Epoxy
- a. Usage: Potable water coating which offers high-build edge protection and allows for application at a wide range of temperatures (down to 35°F or 2°C). For use on the interior and exterior of steel or concrete tanks, reservoirs, pipes, valves, pumps and equipment in potable water service.
 - b. NSF Certification: Yes
 - c. Exposure: Moderate.
 - d. Number of Coats: See schedule.
 - e. Minimum Solids Content: $56.0 \pm 2.0\%$
 - f. Minimum Dry Film Thickness Per Coat: See schedule.
 - g. Pota-Pox, Series 20 or 20HS, as manufactured by Tnemec, or Macropoxy 646 PW, as manufactured by Sherwin Williams.
 - h. Primer: See schedule.
7. Polyamidoamine Epoxy
- a. Usage: Potable water and wastewater primer which offers high-build edge protection and allows for application at a wide range of temperatures (down to 35°F or 2°C). For use on the interior and exterior of steel or concrete tanks, reservoirs, pipes, valves, pumps and equipment in potable water service.
 - b. Exposure: Moderate.
 - c. Number of Coats: See schedule.
 - d. Color: 1211 Red – Ductile Iron Pipe
 - e. Minimum Solids Content: $67.0 \pm 2.0\%$ (mixed).
 - f. Minimum Dry Film Thickness Per Coat: See schedule.
 - g. Pota-Pox Plus, Series N140, as manufactured by Tnemec, or Macropoxy 5500LT, as manufactured by Sherwin Williams.
 - h. Primer: See schedule.

8. High-Build Epoxy Coating – Pure Polyamide Epoxy
 - a. Usage: Application characteristics in adverse and varied conditions.
 - b. Exposure: Moderate.
 - c. Number of Coats: See schedule.
 - d. Finish: Satin.
 - e. Minimum Solids Content: 56.0% +/- 2.0% (mixed).
 - f. Minimum Dry Film Thickness Per Coat: See schedule.
 - g. Hi-Build Epoxoline, Series 66 or 66HS, as manufactured by Tnemec, or Macropoxy 646 Fast Cure, as manufactured by Sherwin Williams.
 - h. Primer: See schedule.
9. Waterborne Acrylic Epoxy
 - a. Usage: High performance coating suitable for concrete, steel and other commonly used building materials. Features include high-build, low odor, non-yellowing white and fade resistant colors; easy cleanup and stain-, abrasion-, chemical- and moisture-resistance. Good exterior performance.
 - b. Exposure: Moderate
 - c. Number of Coats: See schedule.
 - d. Color: Refer to Tnemec Color Guide.
 - e. Finish: Satin.
 - f. Minimum Solids Content: 44.0 ± 2.0% (mixed)
 - g. Minimum Dry Film Thickness Per Coat: See schedule.
 - h. H.B. Tneme-Tufcoat, Series 113, as manufactured by Tnemec, or Pro Industrial Water Based Epoxy.
 - i. Primer: See schedule.
10. Modified Polyamine Epoxy
 - a. Usage: High-solids moisture tolerant epoxy used for priming concrete, wood and drywall. Also as a stand-alone one-coat clear floor sealer.
 - b. Exposure:
 - c. Number of Coats: See schedule.
 - d. Color: Clear. Can be field-tinted (Series 820 Field Tint) in 16 StrataShield colors and certain custom colors. Sherwin Williams products is available in clear standard and customer colors
 - e. Minimum Solids Content: 100% (mixed).
 - f. Minimum Dry Film Thickness Per Coat: See schedule.
 - g. Epoxoprime, Series 201, as manufactured by Tnemec, or General Polymers 3746, as manufactured by Sherwin Williams.
 - h. Primer: See schedule.
11. Modified Polyamine Epoxy
 - a. Usage: A multi-purpose epoxy coating that can be used as a primer, broadcast, slurry/broadcast, mortar, grout coat, and topcoat. Excellent application properties with good flow and self-leveling characteristics. Protects concrete surfaces from impact, abrasion and mild chemicals.

- b. Exposure: Moderate.
- c. Number of Coats: See schedule.
- d. Color: Clear or pigmented. Can be factory or field-tinted (Series 820 Field Tint) in 16 StrataShield colors and certain custom colors. Reference Sherwin Williams data sheets for color details
- e. Minimum Solids Content: 100% (mixed).
- f. Minimum Dry Film Thickness Per Coat: See schedule.
- g. Power-Tread, Series 237, as manufactured by Tnemec, or General Polymers 4080 (FasTop 12S), as manufactured by Sherwin Williams.
- h. Primer: See schedule.

12. Modified Novolac Epoxy

- a. Usage: A multi-purpose resin for fiberglass reinforced mat secondary containment systems. Protects against chemicals, thermal cycling, impact and abrasion.
- b. Exposure: Severe/moderate
- c. Number of Coats: See schedule.
- d. Color: 00GR Gray or clear from Sherwin Williams.
- e. Minimum Solids Content: 100% (mixed)
- f. Minimum Dry Film Thickness Per Coat: See schedule.
- g. Chembloc, Series 239SC, as manufactured by Tnemec, or Cor-Cote HCR, as manufactured by Sherwin Williams.
- h. Primer: See schedule.

C. Polyurethane Coating:

1. Modified Aromatic Polyurethane Primer

- a. Usage: A single component, surface tolerant, NSF approved, moisture-cured resin, containing micaceous iron oxide and zinc to function as a primer which is field and shop friendly. Exposure: Moderate.
- b. Number of Coats: See schedule.
- c. Color: 1216 Greenish-Gray.
- d. Minimum Solids Content: $61.0 \pm 2.0\%$ (mixed).
- e. Minimum Dry Film Thickness Per Coat: See schedule.
- f. Omnithane, Series 1, as manufactured by Tnemec, or Corothane 1 GalvaPac 1K or 2K Zinc Primer, as manufactured by Sherwin Williams.
- g. Primer: See schedule.

2. Aromatic Urethane, Zinc-Rich Primer

- a. Usage: A two-component, moisture-cured, zinc-rich urethane primer for the interior and exterior steel surfaces. Exposure: Moderate.
- b. Color: Greenish-gray.
- c. Minimum Solids Content: $63.0 \pm 2.0\%$ (mixed).
- d. Metallic Zinc Content: 83% minimum in dried film. ASTM D 522 Type III Zinc dust.
- e. Standard of Quality: Hydro-Zinc, Series 91-H₂O, as manufactured by Tnemec, or Corothane 1 GalvaPac 1K or 2K Zinc Primer, as manufactured by Sherwin Williams.

- f. Primer: See schedule.
 - 3. Aliphatic Acrylic Polyurethane
 - a. Usage: A coating highly resistant to abrasion, wet conditions, corrosive fumes and exterior weathering. High build quality combines with project specific primers for two-coat, labor saving systems. Fast curing options are available; see Curing Time below. NOT FOR IMMERSION SERVICE.
 - b. Exposure: Moderate.
 - c. Number of Coats: See schedule.
 - d. Finish: Gloss.
 - e. Minimum Solids Content: $66 \pm 2.0\%$ (mixed).
 - f. Minimum Dry Film Thickness Per Coat: See schedule.
 - g. Endura-Shield, Series 1095, as manufactured by Tnemec, or Acolon 218 HS, as manufactured by Sherwin Williams.
 - h. Primer: See schedule.
 - 4. Aliphatic Moisture Cured Urethane
 - a. Usage: Extremely hard, chemical-resistant urethane floor coating with superb wear characteristics. Excellent resistance to abrasion, wet conditions, corrosive fumes and chemical contact. Excellent gloss and color retention. Low odor characteristic allows for use near occupied space. Note: For horizontal surfaces only.
 - b. Exposure: Moderate.
 - c. Number of Coats: See schedule.
 - d. Finish: Semi-gloss.
 - e. Minimum Solids Content: $92 \pm 2.0\%$ (clear mixed).
 - f. Minimum Dry Film Thickness Per Coat: See schedule.
 - g. Everthane, Series 248, as manufactured by Tnemec, or Amorseal Rextthane 1, as manufactured by Sherwin Williams.
 - h. Primer: See schedule.
 - 5. Polyurethane Modified Concrete
 - a. Usage: High performance designed to reduce moisture vapor emissions prior to the application of non-breathing, polymer floor topping finishes. Must be able to withstand up to 20lbs moisture vapor transmission and 99% RH.
 - b. Exposure: Moderate/Severe
 - c. Number of Coats: See schedule.
 - d. Finish: Matt.
 - e. Minimum Solids Content: 100%%.
 - f. Minimum Dry Film Thickness Per Coat: See schedule.
 - g. Everthane, Series 241 MVT, as manufactured by Tnemec, or General Polymers FasTop 12S, as manufactured by Sherwin Williams.
 - h. Primer: See schedule.
- D. Alkyd Coating:
- 1. Alkyd

- a. Usage: High gloss industrial enamel offering good flow, hiding and protection for recommended surfaces in mild to moderately severe exposures. Not for use on surfaces that are continually wet or sweat frequently.
 - b. Exposure: Mild to moderately severe.
 - c. Number of Coats: See schedule.
 - d. Finish: Gloss.
 - e. Minimum Solids Content: $49.0 \pm 2.0\%$.
 - f. Minimum Dry Film Thickness Per Coat: See schedule.
 - g. Hi-Build Tneme-Gloss, Series 2H, as manufactured by Tnemec, or Industrial Enamel, as manufactured by Sherwin Williams.
 - h. Primer: See schedule.
2. Phenolic Alkyd
- a. Usage: Lead- and chromate-free, fast-drying, corrosion-resistant primer that accepts a variety of high-performance topcoats. Ideally suited for steel fabricators, OEM's and field applications where "dry-fall" characteristics are desired. Note: Not recommended for immersion.
 - b. Exposure: Moderate.
 - c. Number of Coats: See schedule.
 - d. Color: 77 Red or 78 Gray.
 - e. Minimum Solids Content: $58.0 \pm 2.0\%$.
 - f. Minimum Dry Film Thickness Per Coat: See schedule.
 - g. Chem-Prime H.S., Series 37H, as manufactured by Tnemec, or Kem Bond HS Primer, as manufactured by Sherwin Williams.
 - h. Primer: See schedule.
- E. Acrylic
1. HDP Acrylic Polymer
- a. Usage: Water-based, low VOC, High Dispersion Pure acrylic polymer coating providing excellent long-term protection in both interior/exterior exposures. May be applied by spray, brush or roller over a variety of solvent and waterborne steel primers. May also be used over many aged coatings. It is mildew resistant and exhibits very good gloss and color stability. Application methods include "dry-fall" under certain conditions (See Application). Note: Series 1029's "dry-fall" characteristics help reduce the potential for overspray problems on buildings and surrounding property.
 - b. Exposure: Moderate.
 - c. Number of Coats: See schedule.
 - d. Color: Refer to Tnemec Color Guide.
 - e. Minimum Solids Content: $40.0 \pm 2.0\%$.
 - f. Minimum Dry Film Thickness Per Coat: See schedule.
 - g. Enduratone, Series 1029, as manufactured by Tnemec, or SherCryl HPA, as manufactured by Sherwin Williams.
 - h. Primer: See schedule.
2. Modified Waterborne Acrylate

- a. Usage: Flexible, breathable coating primarily for concrete and masonry that can fill and bridge minor hairline cracks. Excellent elastomeric protection against driving rain, alternate freezing-thawing and UV light. Series 156 can also be used as a low cohesive stress overcoat for aged oil or alkyd systems.
- b. Exposure: Moderate.
- c. Number of Coats: See schedule.
- d. Color: Refer to Tnemec Color Guide.
- e. Minimum Solids Content: $50.9 \pm 2.0\%$
- f. Minimum Dry Film Thickness Per Coat: See schedule.
- g. Enviro-Crete, Series 156, as manufactured by Tnemec, or ConFlex XL Smooth, as manufactured by Sherwin Williams.
- h. Primer: See schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application examination.
- B. Examine areas and conditions under which application of coating systems shall be performed for conditions that will adversely affect execution, permanence, or quality of coating system application.
- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes until moisture content of surface is below following limits:
 - 1. Masonry Surfaces: 12% maximum
 - 2. Vertical Concrete Surfaces: 12% maximum
 - 3. Horizontal Concrete Surfaces: 8% maximum
- D. Correct conditions detrimental to timely and proper execution of Work.
- E. Do not proceed until unsatisfactory conditions have been corrected.
- F. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance.

3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application preparation.
- B. Protection:
 - 1. Take precautionary measures to prevent fire hazards and spontaneous combustion. Remove empty containers from Site.
 - 2. Place cotton waste, cloths and hazardous materials in containers, and remove from Site daily.

3. Provide drop cloths, shields, and other protective equipment.
 4. Protect elements surrounding work of this section from damage or disfiguration.
 5. As Work proceeds, promptly remove spilled, splashed, or splattered materials from surfaces.
 6. During application of coating materials, post Wet Paint signs.
 7. During application of solvent-based materials, post No Smoking signs.
- C. Clean surfaces of loose foreign matter.
- D. Remove substances that would bleed through finished coatings; if removal is not possible, seal surface with shellac.
- E. Remove finish hardware, fixture covers, and accessories and store.
- F. Existing Painted and Sealed Surfaces:
1. Remove loose, flaking, and peeling paint, and feather edge and sand smooth edges of chipped paint.
 2. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.
- G. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Surfaces shall be mechanically cleaned to remove passivation and to provide a uniform 1.0 mil anchor profile.
- H. Ferrous Metal:
1. Surfaces shall be free of residual deposits of grease, rust, scale, dirt, dust, and oil.
 - a. Immersion Service: SSPC-SP 10 Near White Blast Cleaning
 - b. Non-Immersion Service: SSPC-SP 6 Commercial Blast Cleaning.
 2. Field Repair of Shop Primed Surfaces:
 - a. Non-Immersion Service: Remove all dirt, dust, chalk, oil, grease, as well as any other foreign matter by solvent cleaning (SSPC-SP 1) and/or power washing. All areas damaged during transportation, construction or installation shall be cleaned in accordance with SSPC-SP 11 Power Tool Cleaning to Bare Metal or SSPC-SP 6 Commercial Blast Cleaning. All edges shall be feathered. All surfaces shall be clean and dry prior to coating
 - b. Immersion Service: Remove all dirt, dust, chalk, oil, grease, as well as any other foreign matter by solvent cleaning (SSPC-SP 1) and/or power washing. All areas damaged during transportation, construction or installation shall be cleaned in accordance with SSPC-SP 10 Near White Blast Cleaning. All edges shall be feathered. The remainder of the intact shop primer shall be cleaned in accordance with SSPC-SP 7 Brush-Off Blast Cleaning to provide a minimum, uniform, anchor profile of at least 1.0 mil. In order to prevent injury to surrounding painted areas, blast cleaning may necessitate use of lower air pressure, small nozzle and abrasive particle sizes, short blast nozzle distance from surface, shielding and masking. If damage is too extensive to touch-up, item shall be re-cleaned and coated or

painted. All surfaces shall be clean and dry prior to receiving the specified finish coat(s).

3. For surfaces not shop primed, surfaces shall be cleaned in compliance with specifications of Steel Structures Painting Council as indicated in Schedule of Coating Systems below.

3.3 APPLICATION

- A. Comply with MPI - Architectural Painting Manual.
- B. Apply primer to each surface, unless specifically not required by coating manufacturer.
- C. Apply coating systems in compliance with manufacturer's instructions and using application method best suited for obtaining full, uniform coverage of surfaces to be coated.
- D. Apply primer, intermediate, and finish coats to comply with wet and dry film thickness and spreading rates for each type of material as recommended by manufacturer.
 1. Application rates in excess of those recommended and fewer numbers of coats than specified shall not be accepted.
- E. Number of coats specified shall be minimum number acceptable. Apply additional coats as needed to provide a smooth, even application.
 1. Closely adhere to re-coat times recommended by manufacturer. Allow each coat to dry thoroughly before applying next coat. Provide adequate ventilation for tank interior to carry off solvents during drying phase.
- F. Employ only application equipment that is clean, properly adjusted, and in good working order, and of type recommended by coating manufacturer.
- G. After surface preparation, interior weld seams shall receive a stripe coat applied by brush.
- H. Make edges of paint adjoining other materials or colors sharp and clean, without overlapping.
- I. Apply coatings to specified thicknesses.
- J. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish.
- K. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.
- B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- C. Inspecting and Testing: Comply with MPI - Architectural Painting Manual.

3.5 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Collect waste material that may constitute fire hazard, place in closed metal containers, and remove daily from Site.
- C. Clean surfaces immediately of overspray, splatter, and excess material.
- D. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.6 SCHEDULE

A. INTERIOR SERVICE

*Interior service refers to the interior of buildings and rooms and not the interior of tanks, structures, etc.

- 1. Interior Exposed Ferrous Metals: 16 gauge or heavier
 - a. Shop primed; field applied finish coats or field applied system
 - 1) Surface Preparation: SSPC SP10 Near White Blast Cleaning
 - 2) Primer/Shop Coat: ^{Note (1)}
 - a) Tnemec: Series 91 H20 Hydro-Zinc
 - b) Sherwin Williams: GalvaPac 1K or 2K Zinc Primer
 - c) Carboline: Carbomastic 615
 - d) Dry Film Thickness: 2.5 – 3.5 mils (Carboline: 5.0 - 10.0)
 - 3) First Coat:
 - a) Tnemec: Series 66 Epoxoline ^{Note (2), (3)}
 - b) Sherwin Williams: Macropoxy 646 Fast Cure
 - c) Carboline: Carboguard 635
 - d) Dry Film Thickness: 3.0 – 5.0 mils (Carboline: 4.0 - 6.0)
 - 4) Finish Coat:
 - a) Tnemec: Series 1095 Endura-Shield
 - b) Sherwin Williams: Acolon 218 HS
 - c) Carboline: Carbothane 8845
 - d) Dry Film Thickness: 2.0 – 3.0 mils (Carboline: 3.0 - 5.0)
 - 5) Total Dry Film Thickness: 6.5 to 9.5 mils

Note (1) Coordinate shop cleaning and primer coat with appropriate Metals Specifications.

Note (2) Series 66 may be interchanged with Series 161 when surface temperature is below 50 degrees (21 degrees C) or when faster recoat is desired.

Note (3) 66HS Epoxoline may be substituted for 66 Epoxoline.

2. Lightweight Metals: (18 gauge or lighter)
 - a. Shop primed; field applied finish coats or field applied system
 - b. Surface Preparation: For Galvanized Metal, Aluminum, Other Non-Ferrous Metals. Etch entire surface using Clean & Etch by Great Lakes Laboratories. For Ferrous Metals clean per SSPC- SP3 Power Tool Cleaning
 - 1) Primer/Shop Coat: Manufacturers Standard Type Primer Compatible with finish coats below
 - a) Perform crosshatch field adhesion test per ASTM D 3359 to determine compatibility of manufacturer's primer with herein specified coating system prior to coating system application.
 - 2) First Coat:
 - a) Tnemec: Series 37H-77 Chemprime
 - b) Sherwin Williams: Kem Bond HS Primer
 - c) Carboline: Sanitile 120
 - d) Dry Film Thickness: 2.0 - 3.0 mils (Carboline: 1.0 - 2.0)
 - 3) Intermediate Coat:
 - a) Tnemec: Series 2H Tneme-Gloss
 - b) Sherwin Williams: Industrial Enamel
 - c) Carboline: Carbocoat 8215
 - d) Dry Film Thickness: 2.0 - 3.0 mils
 - 4) Finish Coat:
 - a) Tnemec: Series 2H Tneme-Gloss
 - b) Sherwin Williams: Industrial Enamel
 - c) Carboline: Carbocoat 8215
 - d) Dry Film Thickness: 2.0 - 3.0 mils
 - 5) Total Dry Film Thickness: 6.0 to 9.0 mils (excluding shop primer coat)
 - a. Surface Preparation: All surfaces shall be free of all coatings, sealers, etc. Pressure wash to remove loose material and contamination.
 - 1) First Coat:
 - a) Tnemec: Series 629 CT Densifyer 201
 - b) Sherwin Williams: H&C Pro Series Endurapolish Waterbased Clear Hardener & Densifyer
 - c) Carboline: Carbocrete Sealer WB (DFT: 1.0 – 3.0 mils)
 - d) Coverage Rate: 300-350 sq. ft. per gallon
 - 2) Second Coat:

- a) Tnemec: Series 629 CT Densifyer 201
- b) Sherwin Williams: H&C Pro Series Endurapolish Waterbased Clear Hardener & Densifyer
- c) Coverage Rate: 350-400 sq. ft. per gallon

4. Gypsum Wallboard

a. Surface Preparation: Clean and dry.

1) First Coat:

- a) Tnemec: Series 1026 Enduratone
- b) Sherwin Williams: ProMar 200 Zero VOC Interior Latex Primer
- c) Dry Film Thickness: 2.0 – 3.0 mils

2) Second Coat:

- a) Tnemec: Series 1026 Enduratone
- b) Sherwin Williams: SherCryl HPA
- c) Dry Film Thickness: 2.0 – 3.0 mils

3) Third Coat:

- a) Tnemec: Series 1026 Enduratone
- b) Sherwin Williams: SherCryl HPA
- c) Dry Film Thickness: 2.0 – 3.0 mils

4) Total Dry Film Thickness: 6.0 – 9.0 mils

5. Wood

a. Surface Preparation: Clean and dry.

1) First Coat:

- a) Tnemec: Series 1099W Tnemec Primer
- b) Sherwin Williams: PrepRite Interior/Exterior Latex Primer/Sealer
- c) Carboline: (Opaque finish) Sanitile 120
- d) Dry Film Thickness: 2.0 – 3.0 mils (Carboline: 1.0 - 2.0)

2) Second Coat:

- a) Tnemec: Series 1029 Enduratone
- b) Sherwin Williams: SherCryl HPA
- c) Carboline: (Opaque finish) Carbocoat 8215
- d) Dry Film Thickness: 2.0 – 3.0 mils

3) Third Coat:

- a) Tnemec: Series 1029 Enduratone
- b) Sherwin Williams: SherCryl HPA

- c) Carboline: (Opaque finish) Carbocoat 8215
 - d) Dry Film Thickness: 2.0 – 3.0 mils
- 4) Total Dry Film Thickness: 6.0 – 9.0 mils

B. EXTERIOR SERVICE

*All coating thickness are expressed in dry film thickness (DFT.)

1. Exterior Exposed Ferrous Metals: 16 gauge or heavier
 - a. Shop primed; field applied finish coat or field applied system
 - b. Surface Preparation: SSPC SP6 Commercial Blast Cleaning
 - 1) Spot primer:
 - a) Tnemec: Tnemec 135 Chembuild
 - b) Dry Film Thickness: 2.0 to 3.0 mils
 - 2) First Coat:
 - a) Tnemec: Tnemec 135 Chembuild
 - b) Dry Film Thickness: 2.0-3.0 mils
 - 3) Finish Coat:
 - a) Tnemec: Tnemec 1094 Endura-Shield
 - b) Dry Film Thickness: 2.0-3.0 mils
 - c. Total Dry Film Thickness: 6.0 to 9.0 mils
2. Non-Submerged Ductile Iron:
 - a. Surface Preparation: Abrasive blast to remove all contaminants.
 - 1) Primer:
 - a) Tnemec: Series N140-1211 Pota-Pox Plus
 - b) Sherwin Williams: Macropoxy 5500 LT
 - c) Carboline: Carboguard 635
 - d) Dry Film Thickness: 6.0 – 8.0 (Carboline: 4.0 - 6.0)
 - 2) Intermediate:
 - a) Tnemec: Series 66 Epoxoline ^{Note (1), (2)}
 - b) Sherwin Williams: Macropoxy 646 Fast Cure
 - c) Carboline: Carboguard 635
 - d) Dry Film Thickness: 3.0 – 5.0 (Carboline: 4.0 - 6.0)
 - 3) Finish Coat:

- a) Tnemec: Series 1095 Endura-Shield
- b) Sherwin Williams: Acrolon 218 HS
- c) Carboline: Carbothane 8845
- d) Dry Film Thickness: 2.0 – 3.0 (Carboline: 3.0 - 5.0)

4) Total Dry Film Thickness: 11.0 – 16.0

Note (1) Series 66 may be interchanged with Series 161 when surface temperature is below 50 degrees (21degrees C) or when faster recoat is desired

Note (2) 66HS Epoxoline may be substituted for 66 Epoxoline.

C. COLOR SYSTEM MATERIAL IDENTIFICATION

- 1. The color system shall be selected by the Owner from manufacturer's standard color chart.

END OF SECTION 09 96 00

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SECTION 13 10 00 – BYPASS PUMPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Under this item, the Contractor is required to furnish all materials, labor, equipment, power, maintenance, fuel, etc. to implement a temporary pumping system for the purpose of diverting flow around the work area throughout the required duration.
- B. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related work specified elsewhere includes:
 - 1. Division 2 – Existing Conditions
 - 2. Division 40 – Process Interconnections

1.3 QUALITY ASSURANCE

- A. Follow national standards and as specified herein.
- B. Perform leakage and pressure tests on discharge piping using clean water, before operation.
- C. Keep and maintain spare parts for piping on site, as required.
- D. Maintain adequate hoisting equipment and accessories for the pump on-site.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. The Contractor shall prepare a detailed description of the proposed pumping system and submit. Bid proposals without an acceptable detailed plan for the temporary bypass pumping system shall be rejected.
- C. The Contractor shall submit to the Engineer a detailed plan and description outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows in all locations requiring bypass pumping. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, ma-

terials and all other incidental items necessary and/or required to ensure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract Documents. No construction shall begin until all provisions and requirements have been reviewed by the Engineer.

D. The plan shall include but not be limited to details of the following:

1. Staging areas for pumps;
2. Sewer plugging method and types of plugs;
3. Number, size, material, location and method of installation of suction piping;
4. Number, size, material, location and method of installation of discharge piping;
5. Bypass pump sizes, capacity, number of each size to be on site and power requirements;
6. Calculations of static lift, friction losses, flow velocity (pump curves showing pump operating range shall be submitted), and bypass pump pipe size;
7. Downstream discharge plan;
8. Thrust and restraint block sizes and locations;
9. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill;
10. Method of noise control for each pump and/or generator;
11. Any temporary pipe supports and anchoring required;
12. Design plans and computation for access to bypass pumping locations indicated on the drawings;
13. Schedule for installation of and maintenance of bypass pumping lines; and
14. Plan indicating selection location of bypass pumping line locations.

1.5 COORDINATION AND SCHEDULING

- A. Section 01 31 00 – Project Management and Coordination: Requirements for coordination.
- B. Coordinate Work of this Section with plant operations

1.6 CONTRACTORS RESPONSIBILITY FOR OVERFLOWS AND SPILLS

- A. Schedule and perform work in manner that does not cause or contribute to incidence of overflows, releases or spills of sewage from sanitary sewer system or bypass operation.

1.7 DELIVERY AND STORAGE

- A. Transport, deliver, handle, and store pipe, fittings, pumps, ancillary equipment and materials to prevent damage and following manufacturer's recommendations.
 1. Inspect all material and equipment for proper operation before initiating work.
- B. Material found to be defective or damaged due to manufacturer or shipment shall be repair as recommended by the manufacturer.

1.8 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All bypass pumping for the duration of this project shall occur during low flow periods and as directed by the Owner.

2.2 DESIGN REQUIREMENTS

A. Bypass Pumping System

1. The Contractor shall provide all temporary bulk heads, pipeline plugs, and temporary discharge piping as required
2. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be installed at the bypassing locations, ready for use in the event of primary pump failure.
3. Bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full available flow into the work area as necessary for satisfactory performances of work.

B. Performance Requirements

1. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with his work, carry it past his work and return it to the existing sewer downstream of his work.
2. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.
3. The Contractor shall provide all necessary means to safely convey the secondary effluent flow past the work area. The Contractor will not be permitted to stop or impede the main flows under any circumstances.
4. The Contractor shall maintain flow around the work area in a manner that will not cause surcharging or overflows of the upstream processes.
5. The Contractor shall protect water resources, wetlands and other natural resources.

2.3 MATERIALS

A. Discharge and Suction Pipes

1. To prevent the accidental spillage of flows, all suction/discharge systems shall be temporarily constructed of rigid pipe with positive, restrained joints. Under no circumstances will aluminum "irrigation" type piping or glued PVC pipe be allowed. Discharge hose will only be allowed in short sections and by specific permission from the Engineer.

B. Polyethylene Plastic Pipe

1. High density solid wall and following ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-DR) based on Outside Diameter, ASTM D1248 and ASTM D3550.
2. Homogenous throughout, free of visible crack, discoloration, pitting, varying wall thickness, holes, foreign materials, blisters, or other deleterious faults.

C. High-Density Polyethylene (HDPE)

1. Homogenous throughout, free of visible crack, discoloration, pitting, varying wall thickness, holes, foreign materials, blisters, or other deleterious faults.
2. Assembled and joined at site using couplings, flanges or butt-fusion method to provide leak proof joint. Following manufacturer's instructions and ASTM D 2657.
 - a. Threaded or solvent joints and connections are not permitted.
3. Fusing shall be conducted by personnel certified as fusion technicians by manufacturer of HDPE pipe and/or fusing equipment.
4. Butt-fused joint shall be truly aligned and contain uniform roll-back beads resulting from use of proper temperature and pressure.
 - a. Allow adequate cooling before removal of pressure.
 - b. Watertight and have tensile strength equal to that of pipe.

D. Flexible Hoses and Associated Couplings and Connectors

1. Abrasion resistant.
2. Suitable for intended service.
3. Rated for external and internal loads anticipated, including test pressure.
 - a. External loading shall incorporate anticipated traffic loadings if required.
4. When subjected to traffic loading, compose system, such as traffic ramps or covers.
 - a. Install system and maintain H-20 loading requirements while in use.

E. Valves and Fittings

1. Determined according to flow calculations, pump sizes previously determined, and system operating pressures.

F. Plugs

1. Plugs shall be selected and installed according to size of line to be plugged, pipe, and manhole configurations, and based on specific site.

2.4 EQUIPMENT

A. Pumps

1. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps may be electric or diesel powered. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows.

B. Controls

1. The Contractor shall provide the necessary stop/start controls for each pump.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify layout, type, and orientation of piping connections.
- C. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.2 PREPARATION

- A. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the Owner and the Engineer. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.
- B. During all bypass pumping operation, the Contractor shall protect any existing processes and equipment next to or in near proximity. The Contractor shall be responsible for all physical damage caused by human or mechanical failure.

3.3 INSTALLATION AND REMOVAL

- A. The Contractor shall be responsible for all coordination, installation, operation, and removal of the temporary bypass pumping.
- B. When working confined space entry areas, the Contractor shall exercise caution and comply with OSHA requirements.

END OF SECTION 13 10 00

SECTION 13 30 00 – CONTROLS AND SYSTEMS INTEGRATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the requirements for the control equipment and system integrations for the Work as shown on the drawings and specified herein.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related work specified elsewhere includes:
 - 1. Section 13 20 00 – Instrumentation
 - 2. Division 26 – Electrical
 - 3. Division 46 – Water & Wastewater Equipment

1.3 SUBMITTALS

- A. Hardware Submittals: Before any components are fabricated, and/or integrated into assemblies or shipped to the job site, furnish to the ENGINEER, for their review, submittal documents in accordance with Section 01330. Submittals shall include full details, shop drawings, catalog cuts and such other descriptive matter and documentation as may be required to fully describe the equipment and to demonstrate its conformity to these specifications. Specifically, the CONTRACTOR shall submit the following materials:
 - 1. Block diagram and operational description of the system showing all major components and their interconnections and interrelationships. Label each diagram and specify all external power and communications interfaces. All diagrams shall be in an 11 by 17 format. Required documentation sets shall be furnished in bound hardcopy and final documentation shall also be provided in electronic format on CD.
 - 2. Drawings of equipment to be supplied shall include, as a minimum: overall dimension details for each panel, console, etc., including internal and external arrangements and door mounted operator devices with nameplate designations. Wiring diagrams of equipment including field device connections shall be included and specific installation/wiring requirements identified.
 - 3. Operational Description shall include the principal functions/capabilities of the PLC's as provided and configured /programmed. Included shall be a description of system communications.
 - 4. Provide a detailed Bill of Materials along with descriptive literature identifying component name, manufacturer, model number, and quantity supplied.
 - 5. Training Material
- B. Test Outlines and Procedures Submittals: Test descriptions shall be in sufficient detail to fully describe the specific tests to be conducted to demonstrate conformance with this specification.

- C. Operations and Maintenance Data: At a minimum, include the following information in accordance with Section 01782.
 - 1. Operating and Calibration instructions.
 - 2. Troubleshooting Information.
 - 3. Wiring Diagrams with wire numbers and termination point.

1.4 COORDINATION AND SCHEDULING

- A. All programming and wire termination shall be performed by a systems integrator.
- B. Equipment Installation:
 - 1. Orenco T-COM Control Panel by Orenco – Refurbished per direction of Manufacturer.
 - 2. All Electrical Power and Control Conduit and Wire – Installed by Electrical Contractor.
 - 3. All Control Terminations by System Integrator/Orenco.

1.5 QUALITY ASSURANCE

- A. The CONTRACTOR'S attention is directed to the fact that all specified instruments and controls must form a completely integrated system and, as such, the system integrator shall become familiar with requirements necessary to provide equipment specified for the system regardless of manufacture, and shall be responsible to the CONTRACTOR for the complete and satisfactory operation of the entire plant instrumentation and control system.
 - 1. These specifications cover the intended function of the equipment, but do not necessarily cover all details necessary for a complete, operable and functional system. The manufacturer shall supply all devices and appurtenances necessary to provide a complete, operable and satisfactory system as indicated or specified.
- B. CONTRACTOR shall use one of the approved Systems Integrators. The System Integrator shall be responsible for all final terminations from the MCC and instruments to the I/O termination points. Electrical Contractor shall pull all wires to this point, label each wire, and provide this list to the System Integrator.
- C. System Integrator:
 - 1. Orenco.
- D. All components shall be from the same manufacturer and supplied by a single source, the system integrator.
- E. Individual Responsibilities
 - 1. System Integrator
 - a. The system integrator shall have the authority to organize the data layout within each individual device used in the user interface system. This said data layout will be based on the device provider's listing of available data points for monitor and control. The system integrator will dictate the data used and the layout needed to facilitate the most efficient system possible. This efficient system methodology will be to minimize the number of queries needed to retrieve the necessary information. The system integrator may also require the separation of status and control registers to more easily facilitate expansion and/or changes to the data structure. The system integrator does not have the authority to change the program

algorithm for the subsystem device. The actual functionality of the system is under direct control of the ENGINEER and the pertinent specifications. The system integrator is responsible for contacting each device provider and attaining the listing of data available and then communicating with the provider the proper organization of data in the system.

2. Device Providers

- a. Device providers must generate a listing of all pertinent data available for monitor and control within the user interface system. It is the device provider's responsibility to be in contact with the system integrator to ensure proper operation within the integrators scope of work. The device provider has direct control over the program algorithm for the portion of the system the said device is specified.

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

2.2 INSTALLATION

- A. Install the work of this Section in strict accordance with the original design and the manufacturer's recommended installation procedures as approved by the ENGINEER, anchoring all components firmly into position for long life under hard use.
- B. Unload, unpack and transport equipment to prevent damage or loss.
- C. Replace damaged components as directed by ENGINEER.
- D. Protect from dust and other harmful materials.
- E. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

2.3 INTERFACE WITH OTHER PRODUCTS

- A. Provide all required cables, cords, and connective devices for interface with other control system components.
- B. Coordinate size and configuration of enclosure to meet project requirements.

2.4 STARUP SERVICE

- A. Upon final completion of all components determine date of start-up jointly with ENGINEER, OWNER and CONTRACTOR.

2.5 CLEANING

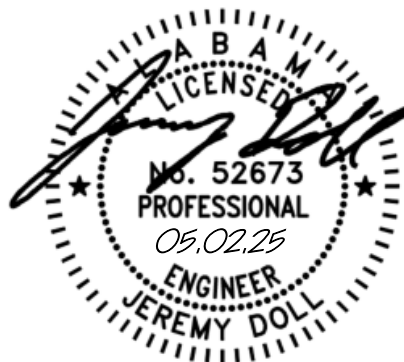
- A. Clean units as recommended by manufacturer.

END OF SECTION 01 31 00

DIVISION 26

ELECTRICAL SPECIFICATIONS

PREPARED BY



Jeremy Doll, PE

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SECTION 26 0000 - ELECTRICAL

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Work under this item of the Contract shall include the furnishing of all labor, material, equipment, supplies, and services necessary to construct and install the complete electrical systems, including exterior and interior of buildings as shown on the drawings and specified herein.
- B. The Contractor shall base his proposal on the materials specified herein and on the drawings. Reference to a particular product by the manufacturer, trade name, or catalog number establishes the quality standards of materials and equipment required for this installation and is not intended to exclude products equal in quality and similar in design. Where two or more designations are listed, choice shall be optional with the Contractor. The Engineer reserves the sole right to decide the equality of materials proposed for use in lieu of those specified.

1.2 RELATED DOCUMENTS:

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

1.3 CODES, PERMITS, AND INSPECTIONS

- A. Comply with applicable laws of the community, with latest edition of NEC where not in conflict with those laws, and with the service rules of the local utility company. Obtain and pay for all permits required. After completion of the work, submit certificate of final inspection and approval from the local electrical inspector, certifying that the installation complies with all regulations governing same.

1.4 DRAWINGS AND SPECIFICATIONS

- A. Consider as complementary each to the other. What is called for by one shall be as binding as if called for by both. Where conflicts occur, secure clarification from Engineer in advance of bidding; otherwise provide the more expensive quality or quantity. Follow figures in preference to scale dimensions; verify all dimensions and existing conditions.

1.5 CONFLICTS, COORDINATION AND CHANGES

- A. In the event that interferences or conflicts develop, the Engineer shall decide which equipment shall be relocated regardless of which was first installed. In the interest of avoiding such conflicts, the electrical sub-contractor who is using common space such as mechanical rooms, chases, ceiling space, etc., shall coordinate his work with all other trades and other parts of his own work. If, during this coordination, it is discovered that necessary or desirable changes should be made, advise the Engineer and secure his decision in writing.

1.6 SUBMITTALS

- A. The Electrical Contractor shall submit five copies of a list of items proposed for use. The Electrical Contractor shall also submit five copies of catalog data and shop drawings on proposed substitutions and on panelboards, exhaust fans, transformers, motor control centers, switchboards, light fixtures, electric heaters, safety switches, surge suppressors, lightning arrestors, etc. Where substitutions alter the design or space requirements, the Electrical Contractor shall defray all items of cost for the revised design and construction including costs of all allied trades involved.
- B. The Electrical Contractor shall include in his submittals layout drawings of all electrical rooms, layout drawings of all common space rooms, and/or layout drawings of all backboards or any other space where electrical equipment is mounted showing that he has taken into account other trades that may share this space.
- C. Record Drawings: Provide, and in such detail as required.
- D. Operations and Maintenance Manuals: Provide, and in such detail as required.

1.7 WARRANTY

- A. Warrant the entire electrical system in proper working order. Replace, without additional charge, all work or material which may develop defects (ordinary wear and tear or damage resulting from improper handling excepted) within a period of one year from date of final acceptance.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall be new and shall be listed as approved by the Underwriter's Laboratories, Inc. in every case where a standard has been established for the particular type of material in question. All work shall be executed in workmanlike manner and shall present a neat and mechanical appearance when completed.

2.2 ELECTRICAL SERVICE

- A. General: Coordinate with Utility Company and the owner. Provide all material and labor not supplied by Utility Company so as to produce a complete installation meeting the Utility regulations. The Electrical Contractor shall be responsible for all secondary conduit/wiring and shall include this cost in the bid. The utility company will bill the owner directly for bringing power to this site, but the electrical contractor shall assist in the generation of the service application in addition to anything that is not provided by the utility company or the owner.
- B. Characteristics of Service:
 - 1. Existing 120/240 volt, 60 cycle, 1 phase, 3 wire, with a ground.
- C. Metering: Obtain from Utility Company.

- D. Main Service Equipment: Install as per the Riser Diagram and per the Utility Company's regulations. Coordinate any increase or decrease in transformer size with utility.
- E. Existing Service Feeder/Transformer: Coordinate any increase or decrease in service/transformer size with utility.

PART 3 - EXECUTION

3.1 VISIT TO SITE

- A. Before submitting a bid, visit the site and ascertain all existing conditions. Make such adjustments in work as are required by the actual conditions encountered.

3.2 CUTTING AND CHASING

- A. Where possible all work shall be built in as the job progresses. Where this is not possible, secure approval and do necessary cutting, chasing, etc. required. Do not cut through any structural members without securing approval in advance; such holes shall be neatly cut or drilled – not chipped.

3.3 TRENCHING AND BACKFILLING

- A. Do all excavating necessary for installation of work; backfill trenches and excavations after work has been installed and inspected. Backfill within the building and under paved areas shall meet compaction requirements and fill material shall be pit run gravel or similar granular material.

3.4 ELECTRICAL SERVICE INSTALLATION

- A. Project Conditions: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated.
- B. Notify Project Manager and Owner no fewer than seven days in advance of proposed interruption of electrical service.
- C. Indicate method of providing temporary electrical service.
- D. Do not proceed with interruption of electrical service without Project Manager's written permission.

3.5 SALVAGE MATERIAL

- A. All metals and devices removed from the project that can be returned for scrap shall be the property of the owner. Owner shall have first right of refusal on all items that are to be demolished, removed or scrapped from the project. Contractor shall provide a list of such items

in written form to the owner. Prior to the contractor salvaging any material for his own gain, the contractor shall obtain written approval from the owner.

END OF SECTION 26 0000

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Copper building wire rated 600 V or less.
- 2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

- 1. Section 26 0523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

1.3 DEFINITIONS

- A. PV: Photovoltaic.
- B. RoHS: Restriction of Hazardous Substances.
- C. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer's authorized service representative.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Belden Inc.
 2. General Cable Technologies Corporation.
 3. Okonite Company (The).
 4. Southwire Company.
 5. Or Approved Equal.
- C. Standards:
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. RoHS compliant.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- E. Conductor Insulation:
 1. Type NM: Comply with UL 83 and UL 719.
 2. Type RHW-2: Comply with UL 44.
 3. Type SE: Comply with UL 854.
 4. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
 5. Type THHN and Type THWN-2: Comply with UL 83.
 6. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 7. Type UF: Comply with UL 83 and UL 493.
 8. Type XHHW-2: Comply with UL 44.
- F. Shield:
 1. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation, dual spirally wrapped copper tape shields and three bare symmetrically applied ground wires, and sunlight- and oil-resistant outer PVC jacket.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Electrical Products.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 4. TE Connectivity Ltd.
 - 5. Thomas & Betts Corporation; A Member of the ABB Group.
 - 6. Or Approved Equal.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- D. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.
- E. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.
- F. PV Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.
- F. Feeders in Cable Tray: Type THHN/THWN-2, single conductors in raceway.

- G. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- J. Branch Circuits Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.
- K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, and strain relief device at terminations to suit application.
- L. VFC Output Circuits: Type XHHW-2 in metal conduit.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, which will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 26 0536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- D. All wire terminations at motor leads and at motor starters shall be made with insulated ring or fork type terminals and insulated for 600 volts with heat shrink sleeves.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 8413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors feeding the following critical equipment and services for compliance with requirements:
 - 3. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.

- 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
 4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
 5. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
- E. Cables will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports to record the following:
1. Procedures used.
 2. Results that comply with requirements.
 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 0526 - 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. Ground bonding common with lightning protection system.
 - 3. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding arrangements and connections for separately derived systems.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:

- a. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1) Test wells.
 - 2) Ground rods.
 - 3) Ground rings.
 - 4) Grounding arrangements and connections for separately derived systems.
- b. Instructions for periodic testing and inspection of grounding features at ground rings and test well based on NFPA 70B.
 - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - 2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 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.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. ERICO International Corporation.
 - 3. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 4. Thomas & Betts Corporation; A Member of the ABB Group.
 - 5. Or Approved Equal.

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 Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 7. 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. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- G. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- H. Conduit Hubs: Mechanical type, terminal with threaded hub.
- I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with socket set screw.
- J. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- K. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- L. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- M. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- N. Straps: Solid copper, copper lugs. Rated for 600 A.
- O. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one-piece clamp.

- P. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- Q. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with stainless-steel bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
 - 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet.
- B. Ground Plates: 1/4 inch thick, hot-dip galvanized.

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. 3/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. 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 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.5 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- H. Metallic Fences: Comply with requirements of IEEE C2.
1. Grounding Conductor: Bare copper, not less than No. 8 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.

3.6 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 Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical

service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

- C. 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 one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. 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.
- E. 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 gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Grounding and Bonding for Fences & Gates
 - 1. Ground fence on each side of gates and other non-continuous sections of fence.
 - 2. Protection at Crossings of Overhead Electrical Power Lines
 - a. Ground fence at location of crossing
 - 3. Maximum Interval between any two fence grounding connections shall be 150'.
- H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

- I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
 - 1. Install tinned-copper conductor not less than No. 3/0 AWG for ground ring and for taps to building steel.
 - 2. Bury ground ring not less than 24 inches from building's foundation.
- J. 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. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 - 2. 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.
- K. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level shall be no more than ten (10) OHMS at all locations covered by these specifications, 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.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- F. Grounding system will be considered defective if resistance is more than ten (10) OHMS and it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Report measured ground resistances that exceed values as listed on the plans.
- I. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

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SECTION 26 0533 - 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 and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. CGRC: PVC Coated Galvanized Rigid Conduit.
- C. PVC: Schedule 40 Poly Vinyl Chloride Conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 3. Perma-Cote.
 - 4. Plasti-Bond.
 - 5. Southwire Company.
 - 6. Thomas & Betts Corporation; A Member of the ABB Group.
 - 7. Wheatland Tube Company.
 - 8. 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. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch, minimum.
- E. FMC: Comply with UL 1; zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

2. 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.
 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- H. Joint Compound for 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 AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CANTEX INC.
 2. RACO; Hubbell.
 3. Thomas & Betts Corporation; A Member of the ABB Group.
 4. 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. Fiberglass:
1. Comply with NEMA TC 14.
 2. Comply with UL 2515 for aboveground raceways.
 3. Comply with UL 2420 for belowground raceways.
- D. ENT: Comply with NEMA TC 13 and UL 1653.
- E. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- F. LFNC: Comply with UL 1660.
- G. Rigid HDPE: Comply with UL 651A.
- H. Continuous HDPE: Comply with UL 651A.
- I. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- J. RTRC: Comply with UL 2515A and NEMA TC 14.
- K. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- L. Fittings for LFNC: Comply with UL 514B.
- M. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hoffman; a brand of Pentair Equipment Protection.
 - 2. Square D.
 - 3. Rittal
 - 4. Or Approved Equal.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 12 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:
 - 1. Allied Moulded Products, Inc.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. 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. Solvents and Adhesives: As recommended by conduit manufacturer.

2.5 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.
 - d. Or Approved Equal.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.
 - d. Or Approved Equal.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Crouse-Hinds, an Eaton business.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. Hubbell Incorporated; Wiring Device-Kellems.
 - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 5. Plasti-Bond.
 - 6. Thomas & Betts Corporation; A Member of the ABB Group.
 - 7. Wiremold / Legrand.
 - 8. 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, aluminum, Type FD, with gasketed cover.

- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Metal Floor Boxes:
 - 1. Material: Cast metal or sheet metal.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Nonmetallic Floor Boxes: Nonadjustable, rectangular.
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- I. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
 - 1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- J. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- K. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- L. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- M. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.
- N. Gangable boxes are allowed.
- O. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 12 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: Fiberglass.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- P. Cabinets:
 - 1. NEMA 250, Type 12 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.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Oldcastle Precast, Inc.
 - b. Quazite: Hubbell Power Systems, Inc.
 - c. Or Approved Equal.
2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Conduit: RNC, Type EPC-40-PVC,.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R, unless otherwise noted.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: GRC.
 2. Exposed, Not Subject to Severe Physical Damage: GRC.
 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
 4. Concealed in Ceilings and Interior Walls and Partitions: GRC.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. 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.
 3. EMT: Use setscrew, cast-metal fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.

- H. 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 NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. 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.
- G. Conceal conduit and within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. All vertical turnups from underground raceways shall utilize GRC sweep 90-degree radius bends and GRC vertical conduit. The Vertical portion of the conduit shall be coated or wrapped in a bitumastic coating system from below grade to 6 inches above grade.
- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use GRC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. 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.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. 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.

- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. 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.
- Q. 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.
- R. 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.
- S. 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.
- T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- W. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.

- b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
 - X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for 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.
 - Y. 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 top of box unless otherwise indicated.
 - Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
 - AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
 - BB. Locate boxes so that cover or plate will not span different building finishes.
 - CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
 - DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
 - EE. Set metal floor boxes level and flush with finished floor surface.
 - FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 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 31 20 00 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 31 20 00 "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 31 20 00 "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 26 05 53 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.7 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 26 05 33

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SECTION 26 05 53 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
- 2. Labels.
- 3. Bands and tubes.
- 4. Tapes and stencils.
- 5. Tags.
- 6. Signs.
- 7. Cable ties.
- 8. Paint for identification.
- 9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.

- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E and Section 26 05 74 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on a white field.
 - 2. Legend: Indicate voltage.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 240-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 4. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 5. Color for Neutral: White or gray.
 - 6. Color for Equipment Grounds: Green.
 - 7. Colors for Isolated Grounds: Green with white stripe.
- C. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

D. Warning Label Colors:

1. Identify system voltage with black letters on a white background.

E. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 LABELS

A. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Brother International Corporation.
 - c. Panduit Corp.
 - d. Or Approved Equal.
2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
3. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
4. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.4 BANDS AND TUBES

A. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Panduit Corp.
 - c. Or Approved Equal.
 - d. All wires and cables shall have heat-shrink identification at all terminations and splices.

2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. Panduit Corp.
 - c. Or Approved Equal.
- B. Underground-Line Warning Tape:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Seton Identification Products.
 - c. Or Approved Equal.
 - 2. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 3. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
 - 4. Tag: Type I:
 - a. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches.
 - c. Thickness: 4 mils.
 - d. Weight: 18.5 lb/1000 sq. ft..
 - e. Tensile according to ASTM D 882: 30 lbf and 2500 psi.
 - 5. Tag: Type II:
 - a. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.

- b. Width: 3 inches.
 - c. Thickness: 12 mils.
 - d. Weight: 36.1 lb/1000 sq. ft.
 - e. Tensile according to ASTM D 882: 400 lbf and 11,500 psi.
- 6. Tag: Type ID:
 - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches.
 - c. Overall Thickness: 5 mils.
 - d. Foil Core Thickness: 0.35 mil.
 - e. Weight: 28 lb/1000 sq. ft..
 - f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.
- 7. Tag: Type IID:
 - a. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches.
 - c. Overall Thickness: 8 mils.
 - d. Foil Core Thickness: 0.35 mil.
 - e. Weight: 34 lb/1000 sq. ft.
 - f. Tensile according to ASTM D 882: 300 lbf and 12,500 psi.
- C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. Seton Identification Products.
 - d. Or Approved Equal.

2.7 SIGNS

- A. Metal-Backed Butyrate Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Marking Services, Inc.
 - c. Or Approved Equal.
2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4-inch grommets in corners for mounting.
4. Nominal Size: 10 by 14 inches.

2.8 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Marking Services, Inc.
 2. Panduit Corp.
 3. Or Approved Equal.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- M. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- P. Self-Adhesive Labels:
1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- W. Underground Line Warning Tape:
1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
 2. Limit use of underground-line warning tape to direct-buried cables.
 3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- X. Metal Tags:
1. Place in a location with high visibility and accessibility.
 2. Secure using UV-stabilized cable ties.
- Y. Nonmetallic Preprinted Tags:
1. Place in a location with high visibility and accessibility.

2. Secure using UV-stabilized cable ties.

Z. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

AA. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.

BB. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

CC. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

DD. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch-high, black letters on 20-inch centers.
 1. Locate identification at changes in direction, at penetrations of walls and floors, and at 30-foot maximum intervals.

- D. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- E. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- F. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.
- H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- I. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.
- J. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- K. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- L. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- M. Concealed Raceways and Duct Banks, More Than 600 V, within Buildings: Apply floor marking tape to the following finished surfaces:
 - 1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to raceways concealed within wall.
 - 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

- N. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- O. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- P. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- Q. Arc Flash Warning Labeling: Self-adhesive labels.
- R. Operating Instruction Signs: Metal-backed, butyrate warning signs.
- S. Emergency Operating Instruction Signs: Metal-backed, butyrate warning signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- T. Equipment Identification Labels:
 - 1. Indoor Equipment: Metal-backed butyrate signs.
 - 2. Outdoor Equipment: Laminated acrylic or melamine sign.
 - 3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchgear.
 - e. Switchboards.
 - f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - g. Substations.
 - h. Emergency system boxes and enclosures.
 - i. Motor-control centers.
 - j. Enclosed switches.
 - k. Enclosed circuit breakers.
 - l. Enclosed controllers.
 - m. Variable-speed controllers.
 - n. Push-button stations.
 - o. Power-transfer equipment.
 - p. Contactors.

- q. Remote-controlled switches, dimmer modules, and control devices.
- r. Battery-inverter units.
- s. Battery racks.
- t. Power-generating units.
- u. Monitoring and control equipment.
- v. UPS equipment.

END OF SECTION 26 05 53

SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Molded-case switches.
 - 7. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, 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. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 6. Include 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. Provide in PDF electronic format.

- B. Shop Drawings: For enclosed switches and circuit breakers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - b. 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. Provide in PDF electronic format.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.9 FIELD 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.

1.10 WARRANTY

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; by Schneider Electric.
 - 2. Siemens
 - 3. Or Approved Equal.
- B. Type HD, Heavy Duty:
 - 1. Single or Double throw.
 - 2. Three pole.
 - 3. 600-V ac.
 - 4. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
 - 5. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
 - 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 6. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 7. Service-Rated Switches: Labeled for use as service equipment.

2.4 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; by Schneider Electric.
 - 2. Siemens
 - 3. Or Approved Equal.
- B. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Three Pole, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.
7. Service-Rated Switches: Labeled for use as service equipment.

2.5 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12), unless otherwise indicated on plans.
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.
- E. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

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.
 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager 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 Construction Manager's written permission.
4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Wash-Down Areas/Corrosive Environment: NEMA 250, Type 4X, stainless steel.
 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7.

3.4 INSTALLATION

- 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.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - i. Verify correct phase barrier installation.
 - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
- 2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

- c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

F. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

- a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
- b. Inspect physical and mechanical condition.
- c. Inspect anchorage, alignment, grounding, and clearances.
- d. Verify that the unit is clean.
- e. Operate the circuit breaker to ensure smooth operation.
- f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- g. Inspect operating mechanism, contacts, and chutes in unsealed units.
- h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:

- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate

- values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
 - e. Determine the following by primary current injection:
 - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
 - f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
 - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
 - h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
 - i. Verify operation of charging mechanism. Investigate units that do not function as designed.
- 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 4. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- G. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- H. Prepare test and inspection reports.
 1. Test procedures used.
 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

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

END OF SECTION 26 2816

SECTION 31 05 16 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Coarse aggregate materials.
2. Fine aggregate materials.
3. Rip rap materials.

B. Related Sections:

1. Section 31 20 00 - Earth Moving.
2. Section 31 25 00 - Erosion and Sedimentation Controls
3. Section 31 50 00 - Excavation Support and Protection.
4. Section 32 91 13 - Soil Preparation

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

C. Alabama Department of Transportation. *Standard Specifications for Highway Construction*, latest edition.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.
- C. Materials Source: Submit name of imported materials suppliers.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work according to State of Alabama Highway Standards, latest edition.

PART 2 - PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

- A. Aggregate Designation: Macadam Base Course/Recycled Portland Cement Concrete (RPCC) Base Course
 - 1. Conform to the Alabama Department of Transportation. *Standard Specifications for Highway Construction*, latest edition, Section 800.
 - 2. Aggregate Designation: Macadam Base Course/Recycled Portland Cement Concrete (RPCC) Base Course
 - a. Macadam Base Course: Use coarse aggregate for Macadam Base Course consisting of hard, durable particles of crushed slag or stone, excluding marine limestone. Ensure that the aggregate is free from vegetable matter, sand, lumps or balls of clay, or other deleterious matter. Ensure minimum weight for crushed slag used in Macadam Base Course, when dry and rodded, is 70 pounds per cubic foot. Use crushed slag that consists of angular fragments, reasonably uniform in density and quality, and reasonably free from glassy, thin or elongated pieces, dirt, or other objectionable material.
 - b. Recycled Portland Cement Concrete (RPCC) Base Course: Use coarse aggregate for Recycled Portland Cement Concrete Base Course consisting of sound, durable particles of recycled Portland cement concrete aggregate, excluding crushed concrete block or pipe.
 - 3. Percent Passing per Sieve Size:
 - a. 2 inches: 100.
 - b. 1 1/2 inches: 95 to 100.
 - c. 1 inch: 70 to 100.
 - d. 3/4 inch: n/a.
 - e. 1/2 inch: 48 to 75.
 - f. 3/8 inches: n/a.
 - g. No. 4: 30 to 50.
 - h. No. 8: n/a.
 - i. No. 16: n/a.

- j. No. 30: 11-30.
- k. No. 100: n/a.
- l. No. 200: 0 to 12

B. Aggregate Designation: 57

1. Conform to the Alabama Department of Transportation. *Standard Specifications for Highway Construction*, latest edition, Section 800.
2. Percent Passing per Sieve Size:
 - a. 2 inches: n/a.
 - b. 1 1/2 inches: 100.
 - c. 1 inch: 95 to 100.
 - d. 3/4 inch: n/a.
 - e. 1/2 inch: 25 to 60.
 - f. 3/8 inches: n/a.
 - g. No. 4: 0 to 10.
 - h. No. 8: 0 to 5.
 - i. No. 16: n/a.
 - j. No. 100: n/a.

C. Aggregate Designation: 67

1. Conform to the Alabama Department of Transportation. *Standard Specifications for Highway Construction*, latest edition, Section 800.
2. Percent Passing per Sieve Size:
 - a. 2 inches: n/a.
 - b. 1 1/2 inches: n/a.
 - c. 1 inch: 100.
 - d. 3/4 inch: 90 to 100.
 - e. 1/2 inch: n/a.
 - f. 3/8 inches: 20 to 55.
 - g. No. 4: 0 to 10.
 - h. No. 8: 0 to 5.
 - i. No. 16: n/a.
 - j. No. 100: n/a.

D. Aggregate Designation: Riprap Class A

1. Conform to the Alabama Department of Transportation. *Standard Specifications for Highway Construction*, latest edition, Section 800.
2. Provide riprap conforming to the gradation classes in the following:
 - a. Rock Size (ft): 0.75, Rock Size (lbs): 37, Percent of Riprap Smaller Than: 100.
 - b. Rock Size (ft): 0.50, Rock Size (lbs): 11, Percent of Riprap Smaller Than: 50.
 - c. Rock Size (ft): 0.20, Rock Size (lbs): 0.7, Percent of Riprap Smaller Than: 15.

E. Aggregate Designation: Riprap Class B

1. Conform to the Alabama Department of Transportation. *Standard Specifications for Highway Construction*, latest edition, Section 800.
2. Provide riprap conforming to the gradation classes in the following:
 - a. Rock Size (ft): 1.33, Rock Size (lbs): 200, Percent of Riprap Smaller Than: 100.
 - b. Rock Size (ft): 1.0, Rock Size (lbs): 75, Percent of Riprap Smaller Than: 85.
 - c. Rock Size (ft): 0.75, Rock Size (lbs): 37, Percent of Riprap Smaller Than: 50.
 - d. Rock Size (ft): 0.42, Rock Size (lbs): 5, Percent of Riprap Smaller Than: 10.

F. Aggregate Designation: Riprap Class C

1. Conform to the Alabama Department of Transportation. *Standard Specifications for Highway Construction*, latest edition, Section 800.
2. Provide riprap conforming to the gradation classes in the following:
 - a. Rock Size (ft): 1.80, Rock Size (lbs): 500, Percent of Riprap Smaller Than: 100.
 - b. Rock Size (ft): 1.300, Rock Size (lbs): 200, Percent of Riprap Smaller Than: 50.
 - c. Rock Size (ft): 0.40, Rock Size (lbs): 5, Percent of Riprap Smaller Than: 10.

G. Aggregate Designation: Riprap Class D

1. Conform to the Alabama Department of Transportation. *Standard Specifications for Highway Construction*, latest edition, Section 800.
2. Provide riprap conforming to the gradation classes in the following:
 - a. Rock Size (ft): 2.25, Rock Size (lbs): 1000, Percent of Riprap Smaller Than: 100.
 - b. Rock Size (ft): 1.80, Rock Size (lbs): 500, Percent of Riprap Smaller Than: 50.
 - c. Rock Size (ft): 0.95, Rock Size (lbs): 75, Percent of Riprap Smaller Than: 10.

H. Aggregate Designation: Riprap Class E

1. Conform to the Alabama Department of Transportation. *Standard Specifications for Highway Construction*, latest edition, Section 800.
2. Provide riprap conforming to the gradation classes in the following:
 - a. Rock Size (ft): 2.85, Rock Size (lbs): 2000, Percent of Riprap Smaller Than: 100.
 - b. Rock Size (ft): 2.25, Rock Size (lbs): 1000, Percent of Riprap Smaller Than: 50.
 - c. Rock Size (ft): 1.80, Rock Size (lbs): 500, Percent of Riprap Smaller Than: 5.

I. Aggregate Designation: Riprap Class F

1. Conform to the Alabama Department of Transportation. *Standard Specifications for Highway Construction*, latest edition, Section 800.
2. Provide riprap conforming to the gradation classes in the following:
 - a. Rock Size (ft): 3.60, Rock Size (lbs): 4000, Percent of Riprap Smaller Than: 100.
 - b. Rock Size (ft): 2.85, Rock Size (lbs): 2000, Percent of Riprap Smaller Than: 50.
 - c. Rock Size (ft): 2.25, Rock Size (lbs): 1000, Percent of Riprap Smaller Than: 5.

2.2 FINE AGGREGATE MATERIALS

A. Fine Aggregate

1. Conform to State of Alabama Highways Standard
2. Aggregate No.: FA-10M.
3. Percent Passing per Sieve Size:

a.	1/2 inch:	n/a.
b.	3/8 inches:	100.
c.	No. 4:	95 to 100.
d.	No. 8:	84 to 100.
e.	No. 16:	45 to 95.
f.	No. 30:	25 to 75.
g.	No. 50:	8 to 35.
h.	No. 100:	0.5 to 20.
i.	No. 200:	0 to 10*.

*Dust of fracture essentially free from clay or shale, final job site testing only.

2.3 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Coarse Aggregate Material - Testing and Analysis: Perform according to AASHTO T96 or ASTM C131 and AASHTO T11.
- C. Fine Aggregate Material - Testing and Analysis: Perform according to ASTM D1557 or AASHTO T180.
- D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 INSTALLATION OF RIP RAP

- A. All rip-rap shall be embedded in place so that the top surfaces are at the grade established for the surface of rip-rap. The inclusion of objectionable quantities of overburden and rock dust will not be permitted. The rock fragments in rip-rap need not be compacted, but shall be dumped and graded off in a manner to ensure that the larger rock fragments are uniformly distributed and that the small rock fragments serve to fill the spaces between the layer of rip-rap of the specified thickness. Hand placing will be required only to the extent necessary to secure the results specified herein.
- B. Unless otherwise specified or shown, rip-rap shall have a minimum thickness of 12”.
- C. The Contractor shall maintain the rip-rap until accepted and any material displaced by any cause shall be replaced to the lines and grades shown on the plans.
- D. All rip-rap shall be underlain by an approved geotextile fabric to prevent erosion.

3.2 INSTALLATION OF CRUSHED STONE

- A. Crushed stone shall be placed in areas shown on the drawings. Stone shall be consolidated by mechanical means.
- B. Unless otherwise specified or shown, crushed stone shall have a minimum thickness of 6”.
- C. All crushed stone shall be underlain by an approved geotextile fabric to prevent erosion

3.3 STOCKPILING

- A. Stockpile materials on site at locations designated by Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- E. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.4 STOCKPILE CLEANUP

- A. Leave unused materials in neat, compact stockpile.
- B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 31 05 16

SECTION 31 10 00 - 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. Stripping and stockpiling rock.
 - 6. Removing above- and below-grade site improvements.
 - 7. Disconnecting, capping or sealing, and removing site utilities or abandoning site utilities in place.
 - 8. Initial erosion and sedimentation control.

1.3 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "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; 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; 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 larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other non-soil 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 as indicated on Drawings. Defined by a circle concentric with each tree with a radius 105 times the diameter of the drip line unless otherwise indicated.

- G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct Conference at Project Site

1.5 MATERIAL OWNERSHIP

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

1.6 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 video recordings.
- B. Topsoil stripping and stockpiling program.
- C. Rock stockpiling program.
- D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.
- E. Burning: Not allowed.

1.7 QUALITY ASSURANCE

- A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.
- B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD 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 Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's property offsite.
- C. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant protection measures are in place.
- E. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 – Earth Moving.
 1. Obtain approved borrow soil material on-site for construction area as indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed.
- C. Protect existing site improvements to remain from damage during construction.
 1. Restore damaged improvements to their original condition, as acceptable to Owner.

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 EXISTING UTILITIES

- A. Contractor will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing.
 - 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.
 - 1. Arrange with utility companies to shut off indicated utilities, if required.
 - 2. Contractor will arrange to shut off indicated utilities that cannot be cut off by contractor (gas, electric, communication).
- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner 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 2 days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Engineer's written permission.
- E. Excavate for and remove underground utilities indicated to be removed.
- F. Arrange for temporary pumping if necessary for sewer main work.

3.4 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. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 3. Use only hand methods or air spade for grubbing within protection zones.
 - 4. Chip removed tree branches and stockpile in areas approved by Engineer.
- 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, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 4 inches, or per Geotechnical Report, 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 larger than 1 inch in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. 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.
 - 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 resspreading deeper topsoil.

3.6 STOCKPILING ROCK

- A. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.
 - 1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- B. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.
 - 1. Limit height of rock stockpiles to 72 inches.
 - 2. Do not stockpile rock within protection zones.
 - 3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.
 - 4. Stockpile Topsoil and reuse on lawn areas.

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 Owner's property.
- B. Burning: Not allowed.
- C. 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 31 10 00

SECTION 31 20 00 - 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. Excavating and filling for rough grading the Site.
2. Preparing subgrades for process structures.
3. Excavating and backfilling for buildings and structures.
4. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Section 01 32 00 – Construction Progress Documentation
2. Section 01 32 33 – Photographic Documentation for recording pre-excavation and earth-moving progress.
3. Section 03 30 00 – Cast-in-Place Concrete for granular course if placed over vapor retarder and beneath the slab-on-grade.
4. Section 31 10 00 – Site Clearing
5. Section 32 92 00 – 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 **Engineer**. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, 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. for bulk excavation or 3/4 cu. yd. 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. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch (1065-mm-) maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
 2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.
 3. Blasting may be required for foundation preparation.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches 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 PREINSTALLATION MEETINGS

A. Preinstallation Conference:

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
 - a. Personnel and equipment needed to make progress and avoid delays.
 - b. Coordination of Work with utility locator service.
 - c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
 - d. Extent of trenching by hand or with air spade.
 - e. Field quality control.

1.5 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. Geofoam.
4. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches.
2. Warning Tape: 12 inches long; of each color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and off-site 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 City of Milledgeville.

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.

1.7 QUALITY ASSURANCE

- A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," 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.

1.8 FIELD 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 Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Engineer.
- C. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth-moving operations.
- D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 31 10 00 – Site Clearing are in place.

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 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 sieve and not more than 12 percent passing a No. 200 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 sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered 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 sieve and not more than 12 percent passing a No. 200 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 sieve and not more than 8 percent passing a No. 200 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 sieve and zero to 5 percent passing a No. 8 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 sieve and zero to 5 percent passing a No. 4 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. Survivability: As follows:
 - a. Grab Tensile Strength: 157 lbf ; ASTM D 4632.
 - b. Sewn Seam Strength: 142 lbf ; ASTM D 4632.
 - c. Tear Strength: 56 lbf ; ASTM D 4533.
 - d. Puncture Strength: 56 lbf ; ASTM D 4833.
 3. Apparent Opening Size: No. 40, No. 60 sieve, maximum; ASTM D 4751.
 4. Permittivity: [0.5] [0.2] [0.1] per second, minimum; ASTM D 4491.
 5. 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. Survivability: As follows:
 - a. Grab Tensile Strength: 247 lbf ; ASTM D 4632.
 - b. Sewn Seam Strength: 222 lbf ; ASTM D 4632.
 - c. Tear Strength: 90 lbf ; ASTM D 4533.
 - d. Puncture Strength: 90 lbf ; ASTM D 4833.
 3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 4. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, low-density, 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, or 3/8-inch nominal maximum aggregate size.
 4. Foaming Agent: ASTM C 869.
 5. Water: ASTM C 94.
 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., or 36 to 42 lb/cu. ft. at point of placement, when tested according to ASTM C 138.
 2. Compressive Strength: 80 psi, or 140 psi, when tested according to ASTM C 495.

- C. Produce conventional-weight, controlled low-strength material with 80-psi 140-psi compressive strength when tested according to ASTM C 495.

2.4 GEOFOAM (NOT USED)

2.5 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils 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 wide and 4 mils 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 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 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 outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches 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 beneath bottom of concrete slabs-on-grade.
 - f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches.
- 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 Engineer. 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; and 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 outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches 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 beneath bottom of concrete slabs-on-grade.
- f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

3.4 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. 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 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. Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 - 1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, 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.

3.5 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 minimum 12 inches higher than top of pipe or conduit unless otherwise indicated.
 - 1. Clearance: 12 inches 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 in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

2. For pipes and conduit 6 inches 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 deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches 4 inches 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 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.

3.6 SUBGRADE INSPECTION

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer 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, plant structures and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons 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.
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, 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 unit prices.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.7 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, may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.8 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.

3.9 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, 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.

3.10 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 of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 - Cast-in-Place Concrete.
- D. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 03 30 00 - Cast-in-Place Concrete.
- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
 - a. 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.
 2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.
- G. Final Backfill:
1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
 2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- H. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 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 engineered fill.
 4. Under building slabs, use engineered fill.
 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 GEOFOAM FILL (NOT USED)

3.13 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.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches 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 of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches 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 below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 95

3.15 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 elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1/2 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Section 33 46 00 - Subdrainage.
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

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 of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 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 thick compacted layers to final subgrade.

3.17 FIELD QUALITY CONTROL

- A. Special Inspections: Owner 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 classification and maximum lift thickness comply with requirements.
 3. Determine, during placement and compaction that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering 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 Engineer.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, 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. 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 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 150 feet 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.

3.18 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 Engineer; 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.

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

END OF SECTION 31 20 00

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SECTION 31 23 16.13 – TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating trenches for utilities
 - 2. Compacted fill from top of utility bedding
 - 3. Backfilling and compaction
- B. Related Requirements
 - 1. 31 10 00 – Site Clearing
 - 2. 33 31 00 – Sanitary Utility Sewerage Piping

1.2 REFERENCE STANDARDS

- A. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- B. ASTM D2487 – Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- C. ASTM D488 – Standard Sizes of Coarse Aggregate
- D. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400-ft-lbf/ft³ (600 kN-m/m³))
- E. AASHTO T 99 – Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in) Drop
- F. AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances
- G. 29 CFR PART 1926 (OSHA) – Safety and Health Regulations for Construction

1.3 SUBMITTALS

- A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan. The plan shall be stamped by a qualified professional engineer registered in the state where the project is located.
- B. Method of dewatering including type of systems, equipment, material, and other pertinent data of dewatering system. The system shall be designed by a qualified professional engineer registered in the state where project is located.

- C. Product Data
 - 1. Geotextile fabric
 - 2. Bedding materials
 - 3. Restoration materials
- D. Materials Source: Name and location of imported fill materials suppliers.
- E. Classification of imported materials by Laboratory analysis or other certification.
- F. Submit information found from test boring and pits.

1.4 QUALITY ASSURANCE

- A. Perform Work according latest requirements of OSHA excavation safety standards and all applicable state and local requirements.
- B. Design of excavation support and stabilization systems shall be performed by a professional engineer, registered in the State where the project is located, with at least five (5) years of experience in design of similar excavation support systems.
- C. Design of the dewatering system shall be performed by a professional engineer, registered in the State where the project is located with at least five (5) years of experience in design of similar dewatering systems.

1.5 FIELD MEASUREMENTS

- A. Prior to construction, the Contractor shall be responsible for taking sufficient measurements, horizontal and vertical, to ensure that all existing facilities, which includes but is not limited to; pavements, curbs, gutters, drainage facilities, fences, gates, mailboxes, signs, guardrails, markers, and monuments are restored to their original lines and grades.

1.6 COORDINATION

- A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.
- B. The Contractor shall comply with the requirements of all encroachment permits obtained for the work. If the Contractor wishes to deviate from the permit requirements he shall obtain a revision to the permit at no additional cost to the Owner.
- C. Any additional Permit applications from State or County Highway Departments, Municipal Street Departments, Railroads, and Utility Companies shall be prepared by the Contractor. Permit applications shall be prepared by the Contractor even though the permanent contract agreement is made between the Controlling Authority and the Owner.
- D. The Contractor will be required under the terms of this contract to furnish the performance bond, insurance coverage, and any other security required by the Controlling Authority, either directly from him or indirectly from the Owner.

- E. The Contractor shall include in the amount bid for this item all costs related to field staking, measurements and surveys, sketches and drawings, and permit application form completion, bonds and insurance as required by the Controlling Authority. The Contractor shall also pay the cost of any supervision by an Inspector of the Controlling Authority if such is stipulated in the permit.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All excavation shall be “unclassified” unless it can be classified as “rock” excavation as specified in Section 31 23 16.26 of these specifications.
- B. Soils type shall be based upon ASTM D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- C. Stone or Coarse Aggregate type shall be based upon ASTM D488, Standard Sizes for Coarse Aggregates.
- D. Rip rap type shall be based upon State Department of Transportation Standards.

2.2 MATERIALS

- A. Structural backfill shall be imported or excavated trench material meeting the following requirements:
 - 1. Class I through III per ASTM D2321
 - 2. Free of clay lumps, roots, debris, rubbish, frozen material, and stones larger than one inch in diameter, have < 35% fines, and capable of being compacted to 95% density per AASHTO T-99.
- B. Common backfill material shall consist of excavated materials meeting the following requirements:
 - 1. Class I through III per ASTM D2321
 - 2. Highly organic silts, clays and Class IV and V materials shall not be used.
 - 3. Materials shall be free roots, stumps, debris, rubbish, frozen material, and stones larger than one inch in capable of being compacted to 85% density per AASHTO T-99.
 - 4. Contain no stone blocks, broken concrete, masonry rubble, or other similar materials.
 - 5. Physical properties such that it can be readily spread and compacted during filling.
 - 6. Snow, ice, and frozen soil will not be permitted.
- C. Crushed Stone:
 - 1. Crushed stone for pipe bedding, structure bases, and other used indicated on the Drawings shall be angular, clean-washed, crushed stone graded in accordance with size #5 or #5 in ASTM D488.
- D. Foundation Conditioning Material: Crusher-run rock, conforming to ASTM D448.

- E. Geotextile Fabric shall be used as directed by the Engineer or as indicated on the Drawings and shall conform to the following requirements:
 - 1. Geotextile fabric shall be non-woven Mirafi, Type HP570, Type 140N; Dupont, Type PAR, Style 3401; or approved equal.
- F. Trench Plugs:
 - 1. Trench plugs shall be concrete filled sacks, Bentonite Clay or material having a "GC" soil rating per ASTM D2487 and shall have a coefficient of permeability no greater than 0.001 CM/SEC per ASTM D2434.
 - 2. If excavated material is to be used the contractor shall submit verification and test results from a qualified laboratory that the material meets the classification and permeability specification above.

PART 3 - EXECUTION

3.1 LINES AND GRADES

- A. Excavate trench as necessary to install pipes at indicated lines and grades at the depths specified on the drawings.
 - 1. The Engineer may make changes in lines, grades, and depths of utilities when changes are required for Project conditions
- B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

- A. Ensure sediment and erosion control measures are installed per the Drawings and Section 31 25 00 prior to performing any disturbing activity.
- B. Complete site clearing operations per the Drawings and Section 31 10 00.
- C. Contact local utility line information service not less than three (3) working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- D. Identify required lines, levels, contours, and datum locations.
- E. All trees, telephone and power line poles along the line of the work must be protected, and at night a sufficient number of barricades and lights to prevent accidents shall be provided. Where sewers are laid between the curb and the sidewalk or in other places where shrubbery and grass lawns are encountered, the Contractor shall carefully remove and replace the shrubbery and cut the grass sod in sections, laying it to the side and replacing it after the trench has been backfilled and allowed to settle.

- F. Unless otherwise indicated on the Drawings, protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- G. Maintain and protect above and below grade utilities indicated to remain.
- H. Establish temporary traffic control and detours when trenching is performed in public rights-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 SHEETING AND SHORING

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. All sheeting and shoring shall be furnished and placed in accordance with the requirements of OSHA Standards, Subpart P, Part 1926, of the Code of Federal Regulations.
- C. Design sheeting and shoring to be left in place as part of completed Work, cut off minimum of 6" above the top of pipe and 18 inches below finished grade.
- D. No sheeting installed closer than one (1) pipe diameter or two (2) feet (whichever is greater) from the outside edge of the pipe shall be withdrawn if driven below mid-diameter of any pipe. Any sheeting beyond these limits which is withdrawn shall be done in a manner in which the sheeting slides smoothly out of position without any disturbance of adjacent bedding. The remaining hole shall immediately be filled by hand with sand.
- E. If trench sloping is substituted for shoring, the slope shall be in accordance with all OSHA requirements. Sloping of the pipe trench shall only be allowed at depths of ten (10) feet or less below existing grade. The sloping of the trench wall shall terminate twelve inches above the top of the pipe and, from that point to the trench bottom, the trench wall shall be vertical.
- F. All excavations deeper than ten (10) feet below grade shall have appropriate excavation support systems from the bottom of the excavation to within a minimum of ten (10) feet from the top of the excavation.
- G. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing at no additional cost to the Owner.
- H. The Contractor may, at his option, use movable earth retaining devices (trench boxes) to stabilize excavations for pipes where these devices can be effectively used. Trench boxes shall not be considered as a substitute for sheeting systems specifically called out on the drawings. Trench boxes shall not be used for tunnel launch and exit shafts.
- I. Where movable earth retaining devices such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and backfill.

- J. Trench box systems shall be designed by a professional engineer registered in the State of South Carolina. Design drawings and computations for non-commercial trench boxes shall be submitted to the Engineer for information prior to construction.

3.4 DEWATERING

- A. The Contractor shall, at all times during construction, provide and maintain ample means and devices with which to promptly remove and properly dispose of all water entering the excavation or other parts of the work and shall keep said excavation and work dry until the structures to be built therein are completed, or until the Engineers direct the Contractor to discontinue dewatering operations. Wherever judged necessary by the Engineer, the Contractor shall employ well points to insure a dry excavation. No claims for an amount of money in excess of the bid price for the work will be entertained or allowed on account of the character of the ground in which the trench or other excavations are made.
- B. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the sub-grade soils at the proposed bottom of the excavation. Groundwater shall be lowered to at least two (2) feet below the excavation level at all times.
- C. The Contractor shall provide for the disposal of the water removed from the excavation in such a manner as not to cause erosion, siltation, or turbidity increases in any water course; injury to public health; degradation or damage to private or public property, to any portion of the work completed or in progress, or to roads or streets; or cause any impediment to the reasonable use of the site by others.

3.5 EXCAVATION & TRENCHING

- A. Underpin adjacent structures which may be damaged by excavation work.
- B. Trenches and excavations shall be open cut to proper depth and alignment for the installation of pipe, structures, and appurtenances as shown on the plans.
- C. The minimum trench width shall be at least the nominal pipe diameter plus twenty-four (24) inches.
- D. Remove lumped subsoil, boulders, and rock up of six (6) feet in diameter.
- E. Slope banks with machine to angle of repose or less until shored.
- F. Grade top perimeter of excavations to prevent surface water from draining into excavation.
- G. Excavated material shall be stockpiled within the construction easement of the work.
 - 1. The excavated material shall be piled on the side of the trench at least four (4) feet (horizontally) extending away from the top of the excavated trench so that a clear walkway will be maintained at the edge. Excavated material shall be kept clear of the sidewalks except where unusual conditions prevent this being done. All driveways shall be backfilled as soon as the pipe is laid and no driveway shall remain inaccessible at the end of the day's work.

2. Excavated material which has suitable characteristics for backfill shall be stockpiled in such a manner that it will not collect either surface water or rainwater. The stockpile top surface shall be sloped to drain away from the excavation site and graded smooth and compacted to drain rainwater rapidly. It shall be the Contractor's responsibility to control or adjust the moisture content of excavated materials to the requirements for common fill before such materials may be used for backfill at no additional cost to the Owner.
- H. Excess excavation shall be disposed of offsite by the Contractor. All handling, hauling, and disposal costs shall be considered incidental to the work. Disposal shall be in compliance with all applicable regulations. Excess excavation shall be as described below:
 1. All rocks, stumps, roots, and organic muck, clay, or silt lenses removed in the preparation of the excavation for common fill.
 2. Soils which cannot qualify as common fill after preparation such as muck soils, high organic soil, or non-granular soil high in silt and clay content.
 3. Excavated material remaining at the end of the work after all stockpiles, and prepared backfill has been utilized as needed.
- I. Do not advance open trench more than fifty (**50**) feet ahead of the pipe laying unless prior approval is given by the Engineer
- J. Excavate trenches to the bottom elevation of the bedding for structures and pipes. The width shall be at least two (2) feet beyond the neat lines of structure footings and as shown on the Drawings for pipelines. Over-excavation that is not directed in writing by the Engineer shall be backfilled with structural fill at no additional cost to the Owner.
- K. Do not interfere with 45-degree bearing splay of foundations.
- L. When subsurface materials at bottom of trench are loose or soft, excavate to; a depth of no more than one (1) foot below the trench bottom, unless additional depth is authorized by Architect/Engineer, or until suitable material is encountered. Backfill with foundation conditioning material to the original trench bottom compacted to 95% maximum density. Underlay foundation conditioning material with geotextile overlapping each seam by a minimum eighteen (18) inches.

3.6 FOUNDATION, BEDDING AND EMBEDMENT

- A. Foundation stone for structures and pipe shall be #5 or #57 stone placed to the minimum excavation widths as shown on the Drawings, and shall be at least 6 inches deep below the bottom of footings, base slabs, and to a depth as shown on the drawings below the bottoms of pipe.
- B. Foundation stone shall be placed only on dry, stable, compacted subgrade or on rock.
- C. Loose earth in the sub-grade shall not be acceptable. Where required, sub-grade compaction shall be with a vibratory type mechanical compactor.
- D. Trim excavation. Hand trim for bell and spigot pipe joints.

- E. No foundation contamination with earth shall be allowed. Immediately remove any earth mat that falls into the foundation during placement or compaction.

3.7 TRENCH PLUGS

- A. An impervious clay ditch check or trench plug shall be required on the downstream side of all stream crossings, on both sides of all wetland crossings, where shown on the Drawings or as directed by the Engineer.
- B. The trench plug shall be constructed for a length of three (3) feet as measured along the centerlines of the pipe and the full width of the trench excavation from the trench bottom to six (6) inches above the top of the pipe.

3.8 BACKFILLING

- A. All trenches and excavations shall be backfilled immediately after the pipe has been laid and inspected. Backfill material shall be approved in all cases by the Engineer and shall be free of objectionable debris. Backfilling shall include the refilling and compacting the fills in the trenches or excavation to the existing ground surface or to the existing road subgrade.
- B. Following the laying of the pipe, the pipe shall be centered in the trench, adjusted to line and grade and the initial bedding material shall be carefully placed on both sides of the pipe so as not to disturb the alignment and grade of the pipeline. The bedding material shall be sliced under the haunches of the pipe and compacted to fill all voids.
- C. Backfill structures carefully, bringing the fill up evenly on all sides.
- D. Bedding material shall consist of #5 or #57 to the depths shown on the plans.
- E. Backfill material shall consist of crushed stone, structural, or common backfill depending upon location as detailed on the Drawings.
- F. Cut out soft areas of subgrade not capable of compaction in place. Backfill with common backfill and compact to density equal to or greater than requirements for subsequent backfill material.
- G. Maintain optimum moisture content of fill materials to attain required compaction density.
- H. Do not leave trench or excavation open at end of working day.

3.9 COMPACTION

- A. Foundation and bedding stone shall be installed in maximum 6-inch lifts, as placed, and compacted with suitable compaction equipment to at least 90% of maximum dry density or as required by pipe manufacturers. Lift thickness shall be reduced to 4 inches in confined areas accessible only to hand-guided compaction equipment.
- B. Structural backfill shall be placed in maximum 6-inch level layers and compacted to at least 95% of maximum dry density as determined by ASTM D698.

- C. Common backfill shall be placed in maximum 12-inch layers and compacted to at least 90% of maximum dry density or as shown on the Drawings.
- D. Trench Plugs shall be placed in maximum 6 inch lifts and compacted to 95% density per ASTM D698.
- E. Compaction shall be by a vibratory-type mechanical compactor adjacent to structures and including between the pipe and trench sides, sheeting or trench box. Larger compaction equipment may be used as desired after backfill has reached at least two feet above the top of the pipe. For structures, the mechanical compactor shall be used between the structures and sheeting until the elevation at which sheeting is withdrawn, at which elevation the entire excavated area may be compacted with larger equipment if desired.

3.10 PROTECTION OF UTILITIES

- A. The Contractor shall locate and protect all utilities which could be affected by the Work including but not limited to; overhead cables, poles, buried cables, duct banks, wastewater pipes, gas pipes, water pipes, and drainage pipes and appurtenances. Before working in any area, the Contractor shall contact the local utility locating service to mark the locations of underground utilities. Any underground utilities that could interfere with the work shall be staked and flagged.
- B. Underground pipes and cables which cross the excavations shall be carefully exposed and temporarily supported by the Contractor to the satisfaction of the utility owner. The utility shall be carefully incorporated in the backfill with full support and protection. Length of utility support shall be based on actual field conditions.
- C. Utility relocation shall be discussed at a meeting with the Engineer and utility owner.
- D. Before operating any equipment near a buried or overhead electric cable, the contractor shall contact the owner of the cable to arrange for protection of the cable and the Contractor's personnel and equipment.
- E. At least 48 hours prior to operating any equipment near a buried gas pipe line that Contractor shall contact the owner of the line and inform them of the work.
- F. Compliance with the conditions of the Owner of an electric or gas utility shall be considered a subsidiary obligation under the Contract.
- G. The Engineer shall be invited to attend all meetings between the Contractor and utility owner for information only.

3.11 FIELD QUALITY CONTROL

- A. The Contractor shall retain and pay for compaction tests performed by an independent testing firm acceptable to the Owner on the compacted backfill to verify compliance with these specifications.
- B. Perform laboratory material tests according to ASTM D698, or AASHTO T 99 Method A.

- C. Perform in place compaction tests according ASTM D2167 for density and ASTM D3017 for moisture content.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.
- E. Frequency of Tests:
 - 1. Trenches: One location every 500 feet.
 - 2. Structures (Manholes): Two locations around each manhole in separate lifts.
 - 3. Structures: At least two-density test shall be made beneath each structure, or as directed by the Engineer.

3.12 MAINTENANCE

- A. The Contractor shall maintain all project areas during the specified warranty period. Maintenance shall include the following:
 - 1. Immediately filling and reseeding any eroded areas.
 - 2. Reseeding any areas where a full stand of grass does not develop.
 - 3. Removal and replacement of any trees which die or show distress.
 - 4. Refilling and reseeding any backfilled areas which settle and develop depressions.

END OF SECTION 31 23 16.13

SECTION 31 25 00 - EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Construction Entrance/Exits
2. Diversion Channels
3. PAM
4. Rock Energy Dissipator
5. Rock Barriers
6. Sediment Control: including silt fences, inlet protection, etc.
7. Sediment Traps
8. Site Stabilization

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete
2. Section 05 50 00 - Metal Fabrications
3. Section 31 05 16 - Aggregates for Earthwork
4. Section 31 20 00 - Earth Moving
5. Section 32 91 13 - Soil Preparation
6. Section 32 92 00 - Turf and Grasses

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.

C. ASTM International:

1. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. Precast/Prestressed Concrete Institute:

1. PCI MNL-116S - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

E. Alabama Department of Transportation Standard Specifications for Highway Construction.

F. Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas

1.3 QUALITY ASSURANCE

- A. Perform Work according to State of Alabama Highways standards.

PART 2 - PRODUCTS

A. Silt Fence

1. The height of a silt fence shall not exceed 36 inches. Storage height and ponding height shall never exceed 18 inches.
2. The standard-strength filter fabric shall be stapled or wired to the fence, and 12 inches of the fabric shall extend into the trench.
3. Type A Silt Fence
 - a. A wire mesh support fence shall be fastened securely to the upslope side of the posts (between the posts and fabric) using heavy duty wire staples at least ½" long and ¾" wide, tie wires or hog rings. The wire shall extend into the trench a minimum of 6 inches and shall not extend more than 36 inches above the original ground surface.
 - b. Posts shall be 4' long steel that each weigh at least 5.2 lbs.
4. Type B Silt Fence
 - a. The spacing between posts shall be a maximum of 6', and the filter fabric shall be stapled or wired directly to the posts.
 - b. Posts may be soft wood 2x4, oak 2x2, or steel as indicated for Type A Silt Fence

2.2 PIPE MATERIALS

- A. Pipe: Corrugated steel, as specified in the State Highways standards.

2.3 ACCESSORIES

- A. Trash Rack: Bars welded to angles and at each intersection of bars.

2.4 SOURCE QUALITY CONTROL (AND TESTS)

- A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Perform tests on cement, aggregates, and mixes to ensure conformance with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify compacted stabilized soil is acceptable and ready to support devices and imposed loads.
- B. Verify gradients and elevations of base or foundation for other work are correct.

3.2 CONSTRUCTION ENTRANCE/EXIT

- A. The entrance/exit shall be excavated to a depth of 3" and cleared of all vegetation and roots.
- B. The entrance/exit course aggregate should be ALDOT coarse aggregate gradation No. 1 and be a minimum of 6" thick and a minimum 50' long and 20' wide.
- C. If the action of the vehicle travelling over the gravel pad does not sufficiently remove the mud, the tires should be washed prior to entrance onto public rights-of-way. When washing is necessary, it should be done on an area stabilized with crushed stone.
- D. A geotextile fabric underliner should be placed the full length and width of the entrance.

3.3 SITE STABILIZATION

- A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.
- B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.
- C. Stockpile and waste pile heights shall not exceed 35 feet. Slope stockpile sides at 2:1 or flatter.
- D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 14 days.
- E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.4 FIELD QUALITY CONTROL & INSPECTIONS

- A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

- B. Inspect erosion and sediment control devices after each storm event greater than or equal to 3/4" or at a minimum of once per month. Make necessary repairs to ensure erosion and sediment controls are in good working order.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- D. The Contractor may contact Amy Ingram at Goodwyn, Mills, & Cawood (334-271-3200) in Montgomery, Alabama for assistance with stormwater permitting, inspection, and BMP plan.
- E. Contractor is responsible for continually maintaining all temporary erosion control measures until permanent measures are properly installed and performing as required.

3.5 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.
- C. Do not damage structure or device during cleaning operations.
- D. Do not permit sediment to erode into construction or site areas or natural waterways.
- E. Clean channels when depth of sediment reaches approximately one half channel depth.

3.6 PROTECTION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Protect paving from elements, flowing water, or other disturbance until curing is completed.

END OF SECTION 31 25 00

SECTION 31 50 00 - 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 31 20 00 Earthmoving

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. 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.

- C. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Engineer no fewer than two days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Engineer's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements.
 - 2. The geotechnical report is included elsewhere in Project Manual.
- 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, ASTM A 690, or ASTM A 992.
- C. Steel Sheet Piling: ASTM A 328, ASTM A 572, or ASTM A 690; with continuous interlocks.
 - 1. Corners: Site-fabricated mechanical interlock or Roll-formed corner shape with continuous interlock.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.
- E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- F. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- G. Tiebacks: Steel bars, ASTM A 722.
- H. Tiebacks: Steel strand, ASTM A 416.

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 Owner 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 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. Accurately align exposed faces of sheet piling to vary not more than 2 inches 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 Engineer.
 - 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. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
- B. 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 below overlying construction and abandon remainder.
 - 2. Fill voids immediately with approved backfill compacted to density specified in Division 31 and as required by the geotechnical engineer.
 - 3. Repair or replace, as approved by Engineer, 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 31 50 00

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SECTION 32 31 13 - 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. Swing gates.
 - 3. Horizontal gates.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete.

1.3 PRE-INSTALLATION MEETINGS

- A. Pre-installation 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Accessories: Barbed wire.
 - d. Gates and hardware.
 - e. Gate operators, including operating instructions and motor characteristics.
- B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.
3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
4. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of chain-link fence, operator, and gate.
- B. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

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: Certified by NETA to supervise on-site testing.
- B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

1.8 FIELD 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: Installer 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. Failure to comply with performance requirements.

- b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Faulty operation of gate operators and controls.
- 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Products from qualified manufacturers having a minimum of five (5) years-experience manufacturing galvanized coated chain link fencing will be acceptable by the Engineer as equal, if approved in writing, ten days prior to bidding, and if they meet the following specifications for design, size gauge of metal parts and fabrication.
- B. Obtain chain link fences and gates, including accessories, fittings, and fastenings, from a single source.

2.2 CHAIN-LINK FENCE FABRIC

- A. Galvanized Wire: Zinc coated Wire, ASTM A 392 – 1.2 oz/sf. Wire Spec-A817-83, Class 1.
- B. Size: Helically wound and woven to height as indicated on drawings with 2” diamond mesh, 9 gauge, with a wire diameter of 0.148 inch and a breakload of 1,290 lbf.
- C. Selvage of fabric twisted at top and knuckled at bottom.

2.3 STEEL FENCE FRAMING

- A. Steel pipe – Type 1: ASTM F 1083, standard weight schedule 40; minimum yield strength of 30,000 psi (205 MPa); sizes as indicated. Hot-dipped galvanized with minimum average 1.8 oz/ft² (550 g/m²) of coated surface area.
- B. Member Sizes
 - 1. End and Corner Post 2.375” od, 3.65 lbs/ft
 - 2. Line (intermediate) Post 1.9” od, 2.72 lbs/ft
 - 3. Rail and Braces 1.66” od, 2.27 lbs/ft

2.4 ACCESSORIES

- A. Chain link fence accessories: [ASTM F 626] Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.
- B. Post caps: Formed steel or cast malleable iron weather tight closure cap for tubular posts. Provide one cap for each post. Cap to have provision for barbed wire when necessary. “C” shaped line post without top rail or barbed wire supporting arms do not require post caps. (Where top rail is used, provide tops to permit passage of top rail.)

- C. Top rail and rail ends: Pressed steel per ASTM F 626, for connection of rail and brace to terminal posts.
- D. Top rail sleeves: 7" (178 mm) expansion sleeve with a minimum .137" wire diameter and 1.80" length spring, allowing for expansion and contraction of top rail.
- E. Wire ties: 9 gauge, 0.148", galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge, 0.092", for rails and braces. Hog ring ties of 12-1/2 gauge, 0.0985", for attachment.
- F. Brace and tension (stretcher bar) bands: Pressed steel, minimum 300 degree profile curvature for secure fence post attachment. At square post provide tension bar clips.
- G. Tension (stretcher) bars: One piece lengths equal to 2 inches (50 mm) less than full height of fabric with a minimum cross-section of 3/16" x 3/4" (4.76 mm x 19 mm). Provide tension (stretcher) bars where chain link fabric meets terminal posts.
- H. Tension wire: Galvanized coated steel wire, 6 gauge, 0.192", and diameter wire with tensile strength of 75,000 psi.
- I. Truss rods & tightener: Steel rods with minimum diameter of 5/16" (7.9 mm). Capable of withstanding a tension of minimum 2,000 lbs.
- J. Barbed wire: (ASTM A 121] Class 3, zinc coated steel wire double-strand, 12-1/2 gauge ,0.099" (2.51 mm)] twisted line with galvanized steel, 4 point barbs spaced approximately 5" (127 mm) on center.
- K. Barbed wire supporting arms: Pressed steel arms with provisions for attaching 3 row or barbed wire. Arms shall withstand 250 lb. (113.5 kg) downward pull at the outermost end of arm without failure.
 - 1. Provide 45° sloped outward, 3 strands, single arm.
 - 2. Provide intermediate arms with hole for passage of top rail.
- L. Nuts and bolts are galvanized.

2.5 SETTING MATERIALS

- A. Concrete: Minimum 28 day compressive strength of 3,500 psi.

2.6 SWING GATES

- A. General: ASTM F 900 for gate posts and single and double swing gate types.
 - 1. Gate Leaf Width: 36 inches or As indicated Insert width.
 - 2. Framework Member Sizes and Strength: Based on gate fabric height as indicated in the details.
- B. Pipe and Tubing:

1. Zinc-Coated Steel: ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framework.
 2. Gate Posts: Round tubular steel.
 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Extended Gate Posts and Frame Members: Fabricate gate posts and frame end members to extend as indicated above top of chain-link fabric at both ends of gate frame to attach barbed wire assemblies.
- E. Hardware:
1. Hinges: 180-degree swing.
 2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 3. Lock: Provided by owner
 4. Closer: Manufacturer's standard.

2.7 HORIZONTAL-SLIDE GATES

- A. General: ASTM F 1184 for gate posts and single and double sliding gate types.
1. 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 framework.
 2. Gate Posts: ASTM F 1184. Provide round tubular steel posts.
 3. 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 as indicated as required to attach barbed wire assemblies.
- E. Overhead Track Assembly: Manufacturer's standard track, with overhead framework supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
- F. Hardware:
1. Hangers, Roller Assemblies, and Stops: Fabricated from galvanized steel.
 2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 3. Lock: Manufacturer's standard internal device.
 4. Padlock and Chain: By Owner.

2.8 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with 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.

2.9 GROUNDING MATERIALS

- A. Comply with requirements Division 26 and the grounding details.
- B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
 - 1. Connectors for Below-Grade Use: Exothermic welded type.
 - 2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for 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 Engineer.
- 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 or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
 - 1. Install fencing on established boundary lines inside property line.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

- C. 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 above grade; shape and smooth to shed water.
 - b. Concealed Concrete: Place top of concrete 2 inches below grade to allow covering with surface material.
 - c. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
 - d. Posts Set into Holes in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
- D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
- E. Line Posts: Space line posts uniformly at 10 feet o.c.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. 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 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.
- G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches 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 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 or extended posts and top of fence fabric to support barbed wire or tape.
- H. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. 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.

- I. Intermediate and Bottom Rails: Secure to posts with fittings.
- J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance 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.
- K. 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 o.c.
- L. 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 according to 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 o.c. and to braces at 24 inches o.c.
- M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side.
- N. Barbed Wire: Install barbed wire uniformly spaced, angled toward security side of fence or as indicated on Drawings. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.
- O. Barbed Tape: Install according to ASTM F 1911. Install barbed tape uniformly in configurations indicated and fasten securely to prevent movement or displacement.

3.4 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.

3.5 GATE-OPERATOR INSTALLATION

- A. Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation: Hand-excavate holes for posts, pedestals, and equipment bases/pads, in firm, undisturbed soil to dimensions and depths and at locations according to gate-operator component manufacturer's written instructions and as indicated.

3.6 GROUNDING AND BONDING

- A. Comply with requirements in the details and as required in Division 26 Electrical.

B. Fence and Gate Grounding:

1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
2. Install ground rods and connections at maximum intervals of 1500 feet.
3. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 500 feet.
4. Ground fence on each side of gates and other fence openings.
 - a. Bond metal gates to gate posts.
 - b. 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 below finished grade.

C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.

D. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.

E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

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.

F. Connections:

1. Make connections with clean, bare metal at points of contact.
2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
4. Make above-grade ground connections with mechanical fasteners.
5. Make below-grade ground connections with exothermic welds.
6. 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: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

3.7 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. Lubricate hardware and other moving parts.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 32 31 13

SECTION 32 91 13 - SOIL PREPARATION

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 planting soils and layered soil assemblies specified by composition of the mixes.
- B. Related Requirements:
 - 1. Division 31 - Earthwork
 - 2. Section 32 92 00 "Turf and Grasses" for placing planting soil for turf and grasses.

1.3 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. Layered Soil Assembly: A designed series of planting soils, layered on each other that together produce an environment for plant growth.
- H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

- J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- M. SSSA: Soil Science Society of America.
- N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- Q. USCC: U.S. Composting Council.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for application and use.
 - 2. Include test data substantiating that products comply with requirements.
 - 3. Include sieve analyses for aggregate materials.
 - 4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
 - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SU1P #25.
 - c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

1.6 INFORMATIONAL SUBMITTALS

- A. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

- B. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil.
 - 1. Notify Engineer seven days in advance of the dates and times when the contractor requests samples will be taken.
- B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
 - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.9 SOIL-SAMPLING REQUIREMENTS

- A. General: Extract soil samples according to requirements in this article.
- B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Engineer under the direction of the testing agency.
 - 1. Number and Location of Samples: Minimum of three representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.
 - 2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
 - 3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
 - 4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.10 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
 - a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.
 2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).
- C. Chemical Testing:
1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
 2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
- D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAFT SERA-6, including the following:
1. Percentage of organic matter.
 2. CEC, calcium percent of CEC, and magnesium percent of CEC.
 3. Soil reaction (acidity/alkalinity pH value).
 4. Buffered acidity or alkalinity.
 5. Nitrogen ppm.
 6. Phosphorous ppm.
 7. Potassium ppm.
 8. Manganese ppm.
 9. Manganese-availability ppm.
 10. Zinc ppm.
 11. Zinc availability ppm.
 12. Copper ppm.
 13. Sodium ppm.
 14. Soluble-salts ppm.
 15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
 16. Other deleterious materials, including their characteristics and content of each.
- E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

- F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.
 2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Do not move or handle materials when they are wet or frozen.
 4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOILS SPECIFIED BY COMPOSITION

- A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.
- B. Planting-Soil Type: Provide offsite topsoil or amend existing, on-site surface soil, with the duff layer, if any, retained; modified to produce viable planting soil. Blend existing, on-site surface soil with the soil amendments and fertilizers required for the topsoil to have the following qualities or provide from offsite as follows:
1. Fertile, friable, naturally occurring. Free of stones, clay, lumps, hardpan, roots, stumps, branches, sticks and other debris larger than one inches in any dimension; free of noxious weeds, grasses, seeds, plants, extraneous matter and any substance harmful to plant growth. Topsoil from open fields will not be accepted.
 2. Ph: 5.0 to 7.0
 3. Organic Matter: 5% to 10%
 4. Sand: 50% to 70%

5. Silt: less than 30%
6. Clay: 10% to 25%
7. Permeability Rate of 5 x 10 ⁻³ centimeters or greater at 85% compaction.
8. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and brome grass.
9. Unacceptable Properties: Clean soil of the following:
 - a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
 2. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
 3. Form: Provide lime in form of ground dolomitic limestone or calcitic limestone.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Perlite: Horticultural perlite, soil amendment grade.
- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.
- F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33.

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
 1. Feedstock: May include sewage sludge.
 2. Reaction: pH of 5.5 to 8.
 3. Moisture Content: 35 to 55 percent by weight.

4. Particle Size: Minimum of 98 percent passing through a 1-inch sieve.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 5 dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.
- 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, debris, and material harmful to plant growth.

2.4 FERTILIZERS

- A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- B. 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 testing agency.
- C. 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.
 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.
- D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

PART 3 - EXECUTION

3.1 GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

- C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

- A. Excavation: Excavate soil from designated area(s) to a depth of 6 inches and stockpile until amended.
- B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
- C. Unsuitable Materials: Clean soil to contain a maximum of 5 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.
- D. Screening: Pass unamended soil through a 2-inch sieve to remove large materials.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of 6. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.
- C. Mixing: Spread unamended soil to total depth of 4 inches, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
 - 1. Amendments: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.
 - a. Mix lime with dry soil before mixing fertilizer.
 - b. Mix fertilizer with planting soil no more than seven days before planting.
 - 2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place except where a different compaction value is required due to use or as directed by the Engineer.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply manufactured soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply approximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.
- C. Application: Spread planting soil to total depth of 4 inches, but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
 - 1. Lifts: Apply planting soil in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place except where a different compaction value is required due to use or as directed by the Engineer.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.5 APPLYING COMPOST TO SURFACE OF PLANTING SOIL

- A. Application: Apply compost component of planting-soil mix 4 inches of compost to surface of in-place planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Finish Grading: Grade surface to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
 - 1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 2000 sq. ft. of in-place soil or part thereof.
- C. Soil will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

- E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.7 PROTECTION

- A. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Vehicle traffic.
 - 4. Foot traffic.
 - 5. Erection of sheds or structures.
 - 6. Impoundment of water.
 - 7. Excavation or other digging unless otherwise indicated.
- B. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Engineer and replace contaminated planting soil with new planting soil.

3.8 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
 - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 32 91 13

SECTION 32 92 00 - TURF AND GRASSES

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. Seeding.
 - 2. Hydroseeding.
 - 3. Sodding.
 - 4. Erosion-control material(s).
- B. Related Requirements:
 - 1. Section 32 91 13 "Soil Preparation"

1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 32 91 13 "Soil Preparation."
- E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, 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 grass and seeds. Include identification of source and name and telephone number of supplier.
- C. Product Certificates: For fertilizers, from manufacturer.
- D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
 - 1. Experience: Three years' experience in turf installation in addition to requirements in Section 01 40 00 "Quality Requirements."
 - 2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 3. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.
- C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 FIELD CONDITIONS

- A. Planting Restrictions: Plant during one of the periods indicated in the seeding and grassing chart or as advised by the turf provider. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species:
 1. Quality: State-certified seed of grass species as listed on the drawings.
- C. 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 laboratory.

2.2 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Compost Mulch: 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 sieve; soluble salt content of 2 to 5 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.

2.3 PESTICIDES

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.4 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.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.
- C. Erosion-Control Mats: Cellular, nonbiodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.
 1. 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:
 - a. Invisible Structures, Inc.
 - b. Presto Products Company.
 - c. Tenax Corporation - USA.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint

- thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
- 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
- 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Engineer and replace with new planting soil.

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 and hydromulching overspray.
 - 2. Protect grade stakes set by others until directed to remove them.
- B. Install 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 TURF AREA PREPARATION

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 91 13 "Soil Preparation."
- B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.
 - 1. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- D. Before planting, obtain Engineer's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Turf Area Preparation" Article.
- B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.

- D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
 - 1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 2. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 3 to 4 lb/1000 sq. ft. or as indicated by the GDOT guidelines.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with erosion-control mats where indicated on Drawings; install and anchor according to manufacturer's written instructions.
- F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
- G. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.6 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, commercial 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 fiber-mulch manufacturer's recommended tackifier.
 - 2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.7 SODDING

- A. Lay sod within 24 hours of harvesting unless a suitable preservation method is accepted by Engineer prior to delivery time. 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 soil or sod during installation. Tamp and roll lightly to ensure contact with soil, 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. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.8 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - 2. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf 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 turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Owner shall mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third 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.
- D. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.9 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Engineer:
 1. Satisfactory Seeded Turf: 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. and bare spots not exceeding 5 by 5 inches.
 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.10 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove non-degradable erosion-control measures after grass establishment period.

END OF SECTION 32 92 00

SECTION 32 92 19 – SEEDING AND RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Work described in this section includes site restoration material and general installation.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related work specified elsewhere includes:
 - 1. Section 31 23 16.13 – Excavation & Trenching
 - 2. Section 31 25 00 – Erosion and Sedimentation Controls
 - 3. Section 33 31 00 – Sanitary Utility Sewerage Piping

1.3 SUBMITTALS

- A. Submit the following items in accordance with Section 01 33 00
 - 1. Product Data for fertilizer and seeds.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. This Contractor shall furnish topsoil in sufficient quantity, to complete grading and planting operations as specified.
- B. Characteristics of topsoil to be furnished
 - 1. Fertile, friable, naturally occurring. Free of stones, clay, lumps, hardpan, roots, stumps, branches, sticks and other debris larger than two (2) inches in any dimension; free of noxious weeds, grasses, seeds, plants, extraneous matter and any substance harmful to plant growth.
 - 2. pH: 5.0 to 7.0
 - 3. Organic Matter: 5% to 10%
 - 4. Permeability Rate of 5 x 10 ⁻³ centimeters or greater at 85% compaction.
 - 5. Topsoil from project site may stockpiled and used if it meets the above criteria. Stockpiled topsoil must be protected from weather and construction traffic until it is placed.

2.2 SEEDING MIXES

- A. All seed shall meet the requirements of these specifications and comply with applicable state law. The type of grass seed to be planted shall meet the approval of the Owner. Seed shall be delivered in sealed bags, properly labeled. Seeds of legumes shall be inoculated just before use with the appropriate culture. Seed mixtures shall be applied at the rate in pounds per acre and with the seasonal limitations shown in the Drawings.
- B. Where turf grass is present before construction, turf grass of like species shall be replaced.

2.3 FERTILIZER AND LIME

- A. After ground preparation is complete, the area to be seeded shall have commercial fertilizer (800 lbs./acre: 13-13-13) and lime (1.5 ton/acre: dolomitic or calcitic lime) applied at the applicable rate.

2.4 MULCHING

- A. Straw Mulch
 - 1. Mulching shall consist of covering areas that have been grassed or as otherwise specified with straw. **Hay is not an acceptable mulching material and will not be allowed.** Straw shall be threshed oats, pine, wheat, or rye, and shall be applied at the rate of 1-1/2 tons per acre. Mulch materials shall be free of seeds detrimental to the project.
 - 2. Mulch shall be free from leaves, twigs, insects, grasses, weeds, plants and their seeds, other foreign material and any substances harmful to plant growth.
- B. Compost Mulch: 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 sieve; soluble salt content of 2 to 5 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.

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. Bring the planting area to final grade and install the necessary erosion control practices.
- B. Divert concentrated flows away from the seeded area.
- C. Conduct soil test to determine pH and nutrient content. Roughen the soil by harrowing, tracking, grooving or furrowing.

- D. Apply amendments as needed to adjust pH to 6.0-7.5. Incorporate these amendments into the soil.
- E. Prepare a 3-5 inch (76-127 mm) deep seedbed, with the top 3-4 inches (76-102 mm) consisting of topsoil.
- F. The seedbed should be firm but not compact. The top three inches of soil should be loose, moist and free of large clods and stones.
- G. The topsoil surface should be in reasonably close conformity to the lines, grades and cross sections shown on the grading plans.

3.2 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
 - 1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 2. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 3 to 4 lb/1000 sq. ft. or as indicated by the DOT guidelines.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions..
- E. Protect seeded areas with erosion-control mats where indicated on Drawings; install and anchor according to manufacturer's written instructions.
- F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
- G. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.
- H. Furnish, sow, establish and maintain an acceptable growth of specified grass over all disturbed areas not otherwise designated to receive planting, mulch or sod.
- I. Care shall be exercised during covering operations to preserve the line, grade and cross-section of the seeded areas and to see that areas adjacent to pavement, curbs, etc., are not left higher than the paved surface.

3.3 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, commercial 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 fiber-mulch manufacturer's recommended tackifier.
 - 2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.4 SODDING

- A. Lay sod within twenty-four (24) hours of harvesting unless a suitable preservation method is accepted by Engineer prior to delivery time. 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 soil or sod during installation. Tamp and roll lightly to ensure contact with soil, 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. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.5 MULCHING

- A. Apply mulch to seeded areas at specified rate within twenty-four (24) hours after the area has been seeded.

3.6 INSPECTION AND MAINTENANCE

- A. Newly seeded areas need to be inspected frequently to ensure the grass is growing.
 - 1. Repair damage caused by pedestrian and/or vehicular traffic, or other causes.
 - 2. If the seeded area is damaged due to runoff, additional stormwater measures may be needed.
- B. Satisfactory Stand
 - 1. The acceptance of areas designated to be seeded under this Section will be based on verification of a satisfactory stand of grass as determined by an on-site observation by the Engineer.

2. A satisfactory stand is defined as a cover of living grass of specified species, after true leaves are formed in which no gaps larger than five (5) inches square occur. Areas viewed by the Engineer to be solid rock will be exempt from this requirement.
 3. If a satisfactory stand is not established in any area, the area shall be reseeded until a satisfactory stand is established, without additional compensation.
 4. The Contractor shall water, fill washes, and otherwise protect and maintain the seeded areas until the contract is accepted. It shall be the responsibility of the Contractor to establish and maintain a satisfactory stand of grass, a satisfactory stand being defined as a complete cover of living grass (limited to species expected to germinate in the current season).
 5. Should the site be ready for seeding during a season when, in the opinion of the Engineer, the specified grass will not form a satisfactory cover, establish a cover of Winter Rye and reseed specified grass at earliest time when acceptable growth can be established at no additional cost to the Owner.
- C. Spot seeding can be done on small areas to fill in bare spots where grass did not grow properly.

END OF SECTION 32 92 19

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SECTION 33 01 30.51 – PUMPING AND BYPASSING

PART 1 - GENERAL

1.1 SUMMARY

- A. Under this item, the Contractor is required to furnish all materials, labor, equipment, power, maintenance, fuel, etc. to implement a temporary pumping system for the purpose of diverting flow around the work area throughout the required duration.
- B. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.
- C. Schedule and perform work in manner that does not cause or contribute to incidence of overflows, releases or spills of sewage from sanitary sewer system or bypass operation.

1.2 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.
- B. 33 31 00 – Sanitary Utility Sewerage Piping

1.3 QUALITY ASSURANCE

- A. Follow national standards and as specified herein.
- B. Perform leakage and pressure tests on discharge piping using clean water, before operation.
- C. Keep and maintain spare parts for piping on site, as required.
- D. Maintain adequate hoisting equipment and accessories for the pump on-site.

1.4 SUBMITTALS

- A. The Contractor shall submit to the Engineer a detailed plan and description outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows in all locations requiring bypass pumping. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to ensure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract Documents. No construction shall begin until all provisions and requirements have been reviewed by the Engineer.

B. The plan shall include but not be limited to details of the following:

1. Staging areas for pumps;
2. Sewer plugging method and types of plugs;
3. Number, size, material, location and method of installation of suction piping;
4. Number, size, material, location and method of installation of discharge piping;
5. Bypass pump sizes, capacity, number of each size to be on site and power requirements;
6. Calculations of static lift, friction losses, flow velocity (pump curves showing pump operating range shall be submitted), and bypass pump pipe size;
7. Downstream discharge plan;
8. Thrust and restraint block sizes and locations;
9. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill;
10. Method of noise control for each pump and/or generator;
11. Any temporary pipe supports and anchoring required;
12. Design plans and computation for access to bypass pumping locations indicated on the drawings;
13. Schedule for installation of and maintenance of bypass pumping lines; and
14. Plan indicating selection location of bypass pumping line locations.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Transport, deliver, handle, and store pipe, fittings, pumps, ancillary equipment and materials to prevent damage and following manufacturer's recommendations.
1. Inspect all material and equipment for proper operation before initiating work.
- B. Material found to be defective or damaged due to manufacturer or shipment shall be repair as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Bypass Pumping System

1. The Contractor shall provide all pipeline plugs and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be repaired.
2. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.
3. Bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full available flow into the work area as necessary for satisfactory performances of work.
4. The Contractor shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. System must overcome any existing force main pressure on discharge.

5. Provide pipeline plugs of adequate size to handle peak flow/head.

B. Performance Requirements

1. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with his work, carry it past his work and return it to the existing sewer downstream of his work.
2. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.
3. The Contractor shall provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the main flows under any circumstances.
4. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers and that will protect public and private property from damage and flooding.
5. The Contractor shall protect water resources, wetlands and other natural resources.
6. Pumps shall be capable of meeting noise requirements imposed by Owner or governing agency.

2.2 MATERIALS

A. Discharge and Suction Pipes

1. To prevent the accidental spillage of flows, all suction/discharge systems shall be temporarily constructed of rigid pipe with positive, restrained joints. Under no circumstances will aluminum "irrigation" type piping or glued PVC pipe be allowed. Discharge hose will only be allowed in short sections and by specific permission from the Engineer.

B. Polyethylene Plastic Pipe

1. High density solid wall and following ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-DR) based on Outside Diameter, ASTM D1248 and ASTM D3550.
2. Homogenous throughout, free of visible crack, discoloration, pitting, varying wall thickness, holes, foreign materials, blisters, or other deleterious faults.

C. High-Density Polyethylene (HDPE)

1. Homogenous throughout, free of visible crack, discoloration, pitting, varying wall thickness, holes, foreign materials, blisters, or other deleterious faults.
2. Assembled and joined at site using couplings, flanges or butt-fusion method to provide leak proof joint. Following manufacturer's instructions and ASTM D 2657.
 - a. Threaded or solvent joints and connections are not permitted.

3. Fusing shall be conducted by personnel certified as fusion technicians by manufacturer of HDPE pipe and/or fusing equipment.
4. Butt-fused joint shall be truly aligned and contain uniform roll-back beads resulting from use of proper temperature and pressure.
 - a. Allow adequate cooling before removal of pressure.
 - b. Watertight and have tensile strength equal to that of pipe.

D. Flexible Hoses and Associated Couplings and Connectors

1. Abrasion resistant.
2. Suitable for intended service.
3. Rated for external and internal loads anticipated, including test pressure.
 - a. External loading shall incorporate anticipated traffic loadings.
4. When subjected to traffic loading, compose system, such as traffic ramps or covers.
 - a. Install system and maintain H-20 loading requirements while in use.

E. Valves and Fittings

1. Determined according to flow calculations, pump sizes previously determined, and system operating pressures.

F. Plugs

1. Plugs shall be selected and installed according to size of line to be plugged, pipe, and manhole configurations, and based on specific site.

2.3 EQUIPMENT

A. Pumps

1. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps may be electric or diesel powered. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows.

B. Controls

1. The Contractor shall provide the necessary stop/start controls for each pump.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the Owner and the Engineer. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.
- B. During all bypass pumping operation, the Contractor shall protect the main and all local sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the Pumping Station and main and all local sewer lines caused by human or mechanical failure.

3.2 INSTALLATION AND REMOVAL

- A. The Contractor shall remove manhole sections or make connections to the existing sewer and construct temporary bypass pumping structures only at the access location indicated on the Drawings and as may be required to provide adequate suction conduit.
- B. Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.
- C. When working inside manhole or force main, the Contractor shall exercise caution and comply with OSHA requirements when working in the presence of sewer gases, combustible or oxygen-deficient atmospheres, and confined spaces.
- D. The installation of the bypass pipelines is prohibited in all saltmarsh/wetland areas. The pipeline must be located off streets and sidewalks and on shoulders of the roads. When the bypass pipeline crosses local streets and private driveways, the contractor must place the bypass pipelines in trenches and cover with temporary pavement. Upon completion of the bypass pumping operations, and after the receipt of written permission from the Engineer, the Contractor shall remove all the piping, restore all property to preconstruction condition and restore all pavement. The Contractor is responsible for obtaining any approvals for placement of the temporary pipeline within public ways from the County.

END OF SECTION 33 01 30.51

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SECTION 33 01 30.61 - SEWER AND PIPE JOINT SEALING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe cleaning and flushing.
2. Plugging.
3. Bypassing sewage.
4. Joint testing.
5. Joint sealing.

B. Related Requirements:

1. Division 5 – Concrete
2. Division 33 – Utilities

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C33 - Standard Specification for Concrete Aggregates.
2. ASTM C150 - Standard Specification for Portland Cement.

1.3 SCHEDULING

- A. Furnish Work schedule seven (7) days in advance of when sewer piping section is out of service for joint sealing.

1.4 SEQUENCING

- A. Sequence for cleaning of sanitary sewer lines shall be as specified on the plans or as directed by Owner/Engineer prior to televising sanitary sewer lines.

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Product Data: Submit sealant and root growth inhibitor data.

- C. Reports:

1. Submit weekly report with daily entries showing:

- a. Location of joints sealed and successfully tested.
 - b. Results of air or liquid joint tests before and after sealing joints.
 - c. Volume of joint sealant or joint sealant/root treatment additive pumped.
 - d. Pounds of acrylamide and N,N'-methylenebisacrylamide mixture used.
 - e. Pounds of ammonium persulfate used.
 - f. Gallons of root treatment additive material used each day, including gallons of triethanolamine.
 - g. Elevation of ground water.
 - h. Location of pipe fractures and misalignment.
 - i. Location of leaking joints, including non-leaking joints failing air test.
 - j. Location of connections discharging continuous flow or incorrectly connected to sewer main.
 2. Submit weekly reports on form approved by Architect/Engineer prior to start of testing and sealing.
 - D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - E. Prior to starting Work, submit certifications attesting to:
 1. Composition and manufacturer of joint sealing material and root treatment additive.
 2. Chemical compatibility of sealant material and root treatment additive material.
 3. Calibration of meters used to measure joint sealant and root treatment additive and pressure gages are accurate to within 10 gpm and 5 psi respectively.
 - F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
 - G. Qualifications Statements:
 1. Submit qualifications for manufacturer and applicator.
 2. Submit manufacturer's approval of applicator.
 3. Submit qualifications for Contractor
- 1.6 CLOSEOUT SUBMITTALS
- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for closeout procedures.
 - B. Project Record Documents: Record actual locations of repaired joints.
- 1.7 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 5 years' documented experience.
 - B. Applicator: Company specializing in performing Work of this Section with minimum 5 years' documented experience and approved by manufacturer.

- C. Contractor: Shall have a minimum 3 year's continuous experience in performing the work described in these specifications.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Protect materials from damage by storing in secure location.

PART 2 - PRODUCTS

2.1 GROUT SEALANT

- A. Chemical Grout:
 - 1. Mixture of dry acrylamide and dry N,N'-methylenebisacrylamide in proportions capable of diluting aqueous solutions and, when properly catalyzed, forming stiff gels.
 - 2. Chemical grout capable of tolerating ground water dilution and reacting in moving water.
 - 3. Viscosity of less than 0.0000418 lbf-s/sq. ft., remaining constant until gelation concurs.
 - 4. Reaction time controllable from 10 seconds to 1 hour.
- B. Catalyst:
 - 1. Ammonium persulfate.
 - 2. Use in combination with activator.
 - 3. Use of catalyst containing (dimethylamino)propionitrile is prohibited.
- C. Activator: Triethanolamine or other compounds of equivalent properties.
- D. Inhibitor: Potassium ferricyanide.
- E. Root Growth Inhibitor:
 - 1. Dichlorobenzonitrile meeting recommendations of grout manufacturer.
 - 2. Root treatment additive capable of remaining active for minimum of two years.
 - 3. Active ingredient for destroying root intrusions: Sodium methyldithiocarbamate.
 - 4. Root Cell Inhibiting Agent:
 - a. 2,6-dichlorobenzonitrile (dichlobenil).
 - b. For each application, disperse root control agent into clear, cool water free of acid, alkali, oxidizing agents, or large amounts of oil or other organic compounds or materials.
 - c. Use tanks for transportation or storage of makeup water free of material listed above.
 - d. The Contractor at no additional cost to the Owner shall replace any damaged vegetation so designated by the Engineer. All safety precautions as recommended

by the manufacturer shall be strictly adhered to concerning handling and application of the herbicide.

- F. Portland Cement: ASTM C150, Type II.
- G. Fine Aggregate: ASTM C33 gradation.
- H. Packer for Joint Sealing:
 - 1. Bladder:
 - a. Provide air-impervious, pneumatically inflatable bladder on each end of mounting cylinder.
 - b. Seal ends of each bladder to cylinder by broad, confining bands.
 - 2. Connect at each end by winch-powered cables.
 - 3. Form positive seal between inflated bladders and interior periphery of sewer pipe and form annular void between inflated end bladders.
 - 4. Design to allow restricted quantity of sewage flow through packer at designated times.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application examination.
- B. Verify which sewer pipes require joint sealing.

3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application preparation.
- B. Pipe Cleaning and Flushing:
 - 1. Perform cleaning of pipe interior to extent necessary to pass equipment and materials required for joint sealing. The Contractor shall clean all sewer segments designated for inspection and/or rehabilitation prior to performing any work. The Contractor shall be solely responsible for his means and methods of sewer cleaning. Cleaning of the sewers shall consist of the dewatering, by-pass pumping, removal of all grease, sand, silt, solids, tuberculation, rags, roots, cut protruding laterals and other debris from each sewer segment, including sags within any sewer segment and including manholes. Selection of cleaning equipment and the method for cleaning shall be based on the condition and/or pipe material of the sewer segment at the time work commences, and shall comply with this specification.
 - 2. The Contractor shall be solely responsible for safety during the performance of all work. The Contractor shall take satisfactory precautions to protect the sewer segments and

appurtenances from damage that might be inflicted upon them by the use of cleaning equipment. Any damage inflicted upon a sewer segment or other public or private property as a result of the Contractor's cleaning operations, regardless of the cleaning method used and regardless of any other circumstance which may contribute to the damage, shall be repaired by Contractor at his sole expense.

3. The Contractor shall not enter into any sewer segment where hazardous conditions may exist until such time as the source of those conditions is identified and eliminated by Contractor and/or Owner. The Contractor shall perform all work in accordance with the latest OSHA confined space entry regulations. The Contractor shall coordinate his work with local fire, police and emergency rescue units.
4. Dumping of raw sewage on private property, in city streets, or into surface or groundwater is not permitted.
5. Passing material from sewer segment to sewer segment shall not be permitted. In the event that sludge, dirt, sand, rocks, grease, roots and other solid or semisolid material or debris resulting from the cleaning operations are observed and/or detected by the Owner/Engineer as passing to downstream sewer segment(s), The Contractor shall be responsible for cleaning such downstream sewer segment(s) at no additional cost to the Owner.
6. The Contractor shall be responsible for the handling, hauling and disposal of all debris, silt, and accumulated solids removed from the sewer. All debris, silt and solids removed by the Contractor shall be disposed of at a facility licensed for the handling and disposal of such materials in accordance with all appropriate codes, rules and regulations for the handling and disposal of such materials. Under no circumstances shall the removed sewage or solids be dumped onto streets or into ditches, catch basins, storm drains, sanitary or combined sewer manholes, or otherwise improperly disposed. If sewage is unintentionally spilled, discharged, leaked or otherwise deposited in the open environment, The Contractor shall be responsible for any clean-up and disinfection of the affected area(s). The Contractor shall comply with all Local, State and Federal regulatory requirements regarding spills. Improper disposal of sewage or solids removed from the sewers may subject the Contractor to fines imposed by the OWNER or other regulatory entities. In addition, the Contractor may be subject to civil and/or criminal penalties for improper disposal of removed materials under the law.
7. If the cleaning of an entire sewer pipe section cannot be successfully performed from one manhole, the equipment shall be re-setup on the other manhole and cleaning again attempted. If successful cleaning still cannot be performed or the equipment fails to traverse the entire manhole section, the cleaning effort will be abandoned at the Owner's and/or Engineer's approval. Sewer line repairs shall then be made at the discretion of the Engineer.

C. Plugging:

1. Conditions Requiring Plugging of Pipes:
 - a. Depth of flow within sewer pipe is greater than 20 % of inside diameter of sewer pipe.
 - b. Exposing complete inside periphery of sewer pipe is required to conduct inspection, sealing, or testing.
2. Repair damage resulting from plugging sewer piping.

D. Bypassing Sewage:

1. Bypass sewage when plugging cannot control flows.
2. Install and operate pump to manage bypassing of peak sewage flow rate.
3. Provide standby pump of equal or greater capacity at bypass location.
4. Provide safety precautions including barricades, lights, and flaggers as specified in Section 01 50 00 - Temporary Facilities and Controls.

3.3 APPLICATION

A. Root Control:

1. Roots shall be removed in the sections where root intrusion is a problem. Special precautions should be exercised during the cleaning operation to assure complete removal of visible roots from the joint area. All roots shall be removed.
2. Apply chemical root control agent by foaming or soaking according to conditions in piping under treatment.
3. Foam Application:
 - a. Agent: Solution containing not less than 24 % by weight of anhydrous vapam (sodium methyldithiocarbamate) and not less than 1.7 % by weight of dichlobenil (2,6-dichlorobenzonitrile); containing surfactant capable of producing foam able to transmit pressure of 30 psig and yielding 20 gal. of foam for each gallon of solution.
 - b. Foam Concentration: Deliver foam to pipe to yield approximately 20 gal. of foam for each gallon of 5 % solution.
4. Soaking Application:
 - a. Agent: Aqueous solution containing 28 % by weight or more of anhydrous vapam (sodium methyldithiocarbamate) and 1 % by weight or more of dichlobenil (2,6-dichlorobenzonitrile) active layer of foam on contacted surfaces.
 - b. Application:
 - 1) Fill entire pipe with freshly prepared and well-mixed solution containing not less than 1 percent by volume of chemical agent specified above.
 - 2) Fully charge for soaking period of 1 hour or not less than 30 minutes and replenish solution to maintain its level above upper end of section under treatment and concentration at 1 % by volume of root control agent.
 - 3) Following specified soaking period, pass solution downstream to treat additional segments of piping, add additional root control agent to maintain concentration of solution at 1 %, and charge each segment for designated soaking period by addition of solution.

B. Joint Sealing:

1. Seal joints that fail pre-sealing test.
2. Monitor and record actual maintenance pressures when grouting and testing joints.
3. Pass sealing materials from dual independent pumping system through instantaneously controlled system and read flow meter to annular void in packer through dual hose systems.
4. When sealant material injected into joint exceeds 15 gal. in 8 inch pipe, stop injection. Do not resume sealing of joint until other joints in manhole run are sealed.
5. Reclean and repeat sealing process until positive seal is achieved.

6. Clean joint after sealant material has set.
7. Examine joint repair for visible defects using TV camera and fix defects prior to testing of post-joint seal.

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.
- B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- C. Pre-Sealing Joint Test: Air test each joint between manholes as follows:
 1. Conduct pre-sealing test as specified for post-sealing test.
 2. Record failure of pre-sealing test in weekly report.
 3. Notify Architect/Engineer when pre-sealing test passes. Record passing tests in weekly report and discontinue joint sealing and post-sealing test sequence for passed joint.
 4. Use pressure meters accurate to within 5 psi.
 5. Use flow meters accurate to within 10 gpm.
- D. Post-Sealing Joint Test:
 1. Perform visual inspection of joint.
 2. Apply positive air pressure in void area to raise void pressure 150% psig above maximum ground water pressure and allow to stabilize due to temperature effect.
 3. Complete air pressure stabilization.
 - a. Test Pressure: Not less than maximum ground water pressure nor more than 7.5 psig above maximum ground water pressure at initiation of test procedure.
 4. Record initial test pressure, stabilized test pressure, and period of time required to have 1.0 psig pressure drop from stabilized test pressure.
 5. Minimum Test Duration:
 - a. Pipe Diameter 8 inches: Zero minutes, 18 seconds.
 - b. Pipe Diameter 10 inches: Zero minutes, 28 seconds.
 - c. Pipe Diameter 12 inches: Zero minutes, 40 seconds.
 - d. Pipe Diameter 15 inches: 1 minute, 3 seconds.
 - e. Pipe Diameter 18 inches: 1 minute, 31 seconds.
 - f. Pipe Diameter 21 inches: 2 minutes, 4 seconds.
 - g. Pipe Diameter 24 inches: 2 minutes, 16 seconds.
 - h. Pipe Diameter 27 inches: 2 minutes, 42 seconds.
 6. When pressure drop exceeds 1.0 psi from stabilized test pressure during minimum time specified above, joint has failed.
 7. Discontinue test when minimum time has been completed and 1.0 psi pressure drop has not occurred from stabilized test pressure; in this circumstance, joint has satisfactorily passed test.
 8. Use the following procedure for sealed joint failing air test:

- a. Visually inspect.
- b. Reseal.
- c. Visually inspect.
- d. Retest until successful test is obtained or sealant limit is attained.

E. Final Acceptance:

1. Acceptance of this portion of the work shall be made upon the successful completion of the television inspection and shall be to the satisfaction of the Engineer's representative.
2. If cleaning is deemed unsatisfactory, the Contractor shall re-clean and re-inspect the sewer line until cleaning is shown to be satisfactory.

END OF SECTION 33 01 30.61

SECTION 33 05 05.31 - HYDROSTATIC TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Hydrostatic testing of pressure piping.
- B. Related Requirements:
 - 1. Section 33 31 23 - Sanitary Sewerage Force Main Piping: Pipe materials and accessories normally encountered with municipal sanitary sewage force mains.

1.2 REFERENCE STANDARDS

- A. American Water Works Association:
 - 1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Submit following items prior to start of testing:
 - 1. Testing procedures.
 - 2. List of test equipment.
 - 3. Testing sequence schedule.
 - 4. Provisions for disposal of flushing and test water.
 - 5. Certification of test gage calibration.
- C. Test and Evaluation Reports: Indicate results of piping tests.
- D. Qualifications Statement:
 - 1. Submit qualifications for applicator.

1.4 QUALITY ASSURANCE

- A. Perform Work according to applicable standards.

1.5 QUALIFICATIONS

- A. Applicator: Company specializing in performing Work of this Section with minimum three years' experience.

PART 2 - PRODUCTS

2.1 HYDROSTATIC TESTING

A. Equipment:

1. Pressure pump.
2. Pressure hose.
3. Water meter.
4. Test connections.
5. Pressure relief valve.
6. Pressure Gage: Calibrated to 0.1 psi.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that piping is ready for testing.
- C. Verify that trenches are backfilled.
- D. Verify that pressure piping thrust restraints have been installed.

3.2 FIELD QUALITY CONTROL

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. Testing of Pressure Piping:
 1. Test system according to AWWA C600 and following:
 - a. Hydrostatically test each portion of pressure piping, including valved section, at 1.5 times working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage.
 - b. Conduct hydrostatic testing for at least two hours.
 - c. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
 - d. Install corporation cocks at high points.
 - e. Close air vents and corporation cocks after air is expelled.
 - f. Raise pressure to specified test pressure.
 - g. Observe joints, fittings, and valves undergoing testing.
 - h. Remove and renew cracked pipes, joints, fittings, and valves that show visible leakage.
 - i. Retest.

- j. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
 - k. Maintain pressure within plus or minus 5.0 psi of test pressure.
 - l. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of testing.
 - m. Compute maximum allowable leakage using following formula:
 - 1) $L = [SD \times \sqrt{P}]/C$.
 - 2) L = testing allowance, gph.
 - 3) S = length of pipe tested, feet.
 - 4) D = nominal diameter of pipe, inches.
 - 5) P = average test pressure during hydrostatic testing, psig.
 - 6) C = 148,000.
 - 7) If pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.
- 2. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
 - 3. Correct visible leaks regardless of quantity of leakage.

END OF SECTION 33 05 05.31

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SECTION 33 05 26 - UTILITY IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipeline marker posts.
2. Ribbon tape for placement above direct-buried utility.
3. Trace wire for placement above direct-buried utility.

B. Related Requirements:

1. Section 33 31 11 – Public Sanitary Utility Sewerage Gravity Piping
2. Section 33 31 23 - Sanitary Sewerage Force Main Piping

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's catalog information for each product required.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged valves.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance materials.

1.5 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

PART 2 - PRODUCTS

2.1 PIPELINE MARKER POSTS

A. Description:

1. Material: High-density polypropylene.
2. Diameter: 3-1/2 inches.
3. Length: 72 inches.
4. Color: White.
5. Embedment: T-anchor.

B. Visibility Enhancer:

1. Material: Polyethylene.
2. Length: 24 inches.
3. Diameter: 3-3/4 inches.
4. Color: As required by utility.
5. Text: As required by utility.

2.2 RIBBON TAPE

A. Description:

1. Reef Industries Terra Tape Standard
2. Material: 100% virgin pigmented polyolefin film, brightly colored, continuously printed.
3. Minimum Size: 6 inches wide by 4 mils thick.
4. Manufactured for direct burial service.
5. Imprint: In large letters with message printed at least every 30 inches; Sanitary Sewer Gravity **“CAUTION SEWER LINE BURIED BELOW”**; Reuse Water Lines **“CAUTION REUSE WATER LINE BURIED BELOW”**; Sewer Force Main Lines **“CAUTION SEWER FORCE MAIN BURIED BELOW”**

2.3 TRACE WIRE

1. Description:

- a. Conductor: No.12 AWG HS-CCS high strength copper clad steel tracer wire.
- b. Covering: 30 mils of Green HMWPE insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipeline Marker Posts: As recommended by manufacturer.

B. Ribbon Tape:

1. Tape shall be installed a minimum of 24 inches above the top of the pipe for its full length.
 2. If multiple pipes occur in common trench, locate ribbon tape above centerline of trench.
- C. Trace Wire:
1. Attach locator wire to the top of pipe every 5 feet with duct tape.
 2. All wire splices shall be made using copper wire “U” bolt assemblies and then wrapping with electrical tape.

END OF SECTION 33 05 26

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SECTION 33 31 00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. PVC Pipe
2. Ductile Iron Pipe
3. Ductile Iron Fittings
4. Concrete Pipe
5. HDPE Pipe
6. HDPE Fittings
7. Plug Valves
8. Gate Valves
9. Accessories

B. Standards

1. Standards: Supply all products and perform all work in accordance with applicable American Society of Testing and Material (ASTM), American Water Works Associations (AWWA), American National Standards Institute (ANSI), or other recognized standards.
2. Latest revisions of all standards are applicable.

C. Related Sections

1. Division 01 Specifications
2. 31 23 16.13 Excavation & Trenching

1.2 SUBMITTALS

- A. Product Data: Manufacturer information indicating pipe material to be used, and pipe accessories.
- B. Manufacturer's Certificate: Products meet or exceed specified requirements.
- C. Certified mill certificate showing conformance to all requirements specified herein.
- D. Manufacturer Instructions: Special procedures required to install specified products.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- F. General arrangement and dimensional drawings.
- G. Laboratory Approval – Ductile Iron Pipe shall be tested by an independent laboratory, approved by the Engineer, in accordance with AWWA C151.

1.3 QUALITY ASSURANCE

- A. Perform Work according to applicable SCDHEC, OSHA, AWWA, and ASTM standards.
- B. All pipes shall be first quality, with smooth interior and exterior surfaces, free from cracks, blisters, “honeycombs,” and other imperfections, and true theoretical shapes and forms throughout the full length.
- C. All pipes shall be subject to the inspection of the Engineer at the pipe plant, trench, or other points of delivery, for the purpose of culling and rejecting pipe, independent of the laboratory test which does not conform to the requirements of these specifications. Such pipe shall be marked by the Engineer, and the Contractor shall remove it from the project site upon notice of its rejection being received.

PART 2 - PRODUCTS

2.1 PVC PIPE

A. General

- 1. All PVC pipe and fittings shall be clearly marked as to size, ASTM, Company, SDR or DR, and date of manufacture. No pipe shall be accepted that is more than 120 days old when delivered to the job site.
- 2. Pipe shall be manufactured of PVC having a cell classification of 12454 for pressure service, 12454 or 12364 for gravity service as defined in ASTM D 1784. Additives and fillers including but not limited to stabilizers, antioxidants, lubricants, colorants, etc. shall not exceed 10 parts by weight per 100 parts of PVC resin in the compound.
- 3. A certified mill certificate showing conformance to all requirements specified above shall be provided to the Engineer with each shipment of pipe delivered to the job site.
- 4. All PVC pipe shall be green in color and stenciled “SANITARY SEWER.”
- 5. PVC pipe shall not be used in locations where the pipe has a cover less than four feet, where crossing creek or ravine bottoms where the pipe may be exposed, or where sewers are laid under railroads, powerline easements, or roadway rights of way unless noted in Drawings.

B. PVC Pipe for Gravity Sewers

- 1. PVC pipe for gravity sewers shall be manufactured in accordance with ASTM D 3034 for 4” through 15” SDR 35 minimum and F679 for 18” through 36” 46PS/115PS sewer pipe as indicated on the drawings.
- 2. Joints shall be of the rubber gasket slip on type conforming to ASTM D 3212 under both pressure and vacuum. The bell shall be an integral part of the pipe with the same strength. Spigot ends shall be beveled.
- 3. Elastomeric gaskets shall meet the requirements of ASTM F477. Gaskets shall be locked in, NAPCO, HARCO, or approved equal.
- 4. PVC pipe material at different depth of burial, as defined from the final ground surface to the bottom of the pipe, shall conform to the following schedule:
 - a. 4’ to 15’ SDR 35 with a minimum pipe stiffness of 46 PSI

- b. 15' to 20' SDR 26 with a minimum pipe stiffness of 115PSI
 - c. > 20' use Ductile Iron or other alternate material, as directed by the Engineer.
- 5. Transitions from PVC pipe to Ductile Iron pipe shall be made only at manholes unless noted on Drawings.
- C. PVC pipe for Low Pressure Sewer (less than 4")
 - 1. PVC Pipe shall conform to ASTM D1785, Schedule 80, fitting to ASTM D2467, Schedule 80.
 - 2. Pipe and fittings shall be manufactured as a system and be the product of one manufacturer.
 - 3. Joints: will be solvent-welded per ASTM D2855 or threaded or flanged if later removal is required.
- D. PVC Pipe for Low Pressure Sewer (4" through 60")
 - 1. PVC pipe for force mains shall conform to the requirements of AWWA C900 4" through 60". Pipe shall be green in color and marked with the nominal pipe size, PVC dimension ratio, AWWA pressure class, AWWA designation number (AWWA C900), manufacturer's name and labeled "Sewer Force Main".
 - 2. The pressure rating shall be selected based upon the design requirements of the system. The minimum wall thickness shall be DR 18, Class 150.
 - 3. Pipe shall be Type I, Grade I and shall be manufactured from virgin material.
 - 4. All gaskets shall meet ASTM F477 standards.
 - 5. PVC joints shall be restrained where specified on the drawings.
 - a. Restrained joints shall be provided by a clamping ring and an additional ring designed to seat on the bell end of the pipe. The rings shall be connected with T-Head bolts or rods.
 - b. Restraining devices shall provide full (360°) support around the circumference of the pipe. No point loading shall be permitted. Restraint of mechanical joint fittings shall be provided by a clamping ring installed on the PVC pipe and connected to the mechanical joint fitting with T-Head bolts or rods.
 - c. Restraining devices shall be EBAA Series 1600 or approved equal.
 - d. For PVC lines smaller than 4 inches, use thrust blocks or additional restraint as shown on Drawings.
 - e. The use of solvent weld PVC pipe and fittings in low pressure sewer mains 4" to 60" is prohibited.

2.2 DUCTILE-IRON PIPE

A. General

- 1. Pipe laying lengths shall be provided in 18 or 20 feet nominal lengths with allowable trim pipe lengths in accordance with AWWA C151 and special shorter lengths provided as required by the Drawings.
- 2. All ductile iron pipes and fittings, installed in a trench conditions shall receive a shop-applied bituminous coating 1-mil thick, minimum in accordance with AWWA C151/ANSI A21.51.

3. All exposed pipe and fittings shall be provided with a shop prime and painted as specified.
4. Where flexible joint iron pipe is called for on the plans, it shall conform to the same specifications as ductile iron. The joints shall be of the ball and socket type either bolted or keyed and, if of the bolted type, the bolts and nuts shall be made of stainless steel. The trench in which this pipe is installed shall be excavated to a depth that will provide a cover of not less than 3' over the top of the pipe when it is in place.
5. All ductile iron sewer main pipes shall be color coded green by painting a 3" green stripe along the crown of the pipe barrel.

B. Joints:

1. Provide ductile iron pipe with push-on joints conforming to ANSI A21.11/AWWA C111, latest revision.
2. Joints shall be restrained where indicated on the drawings. Use American Fast-Grip® Gaskets, or approved equal for restrained joints. Provide a boltless, integral restraining system rated for the design pressure in accordance with the performance requirements of ANSI/AWWA C111/A21.11, unless noted otherwise on the Drawings.
3. Gauge pipe ends (spigot end, bell, and socket) for all pipe with suitable gauges at sufficiently frequent intervals to ensure compliance to the standard dimensions of ANSI/AWWA C151/A1.5, latest addition. Manufacturer must have a recommended ovality tolerance for 18 inches and larger size pipe. Each end of each pipe 18 inches and larger shall be measured and approved by manufacturer's quality assurance inspector to meet such out of round tolerances. Provide manufacturer's certification that ovality has been measured and controlled in accordance with manufacturer's standard.

C. Flanged Joint Pipe

1. Provide flange fittings as required for above ground applications or exposed piping in vaults.
2. Flanges conforming to AWWA C110 can be joined with Class 125 B16.1 flanges shown in ANSI B16.1 but not with Class 250 B16.1 flanges.
3. Flange joints should be fitted so that the contact faces bear uniformly on the gasket. The joint should be made with relatively uniform bolt stress.
4. Bolts and nuts shall be type 316 stainless steel, conforming to ASTM A 193, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts.
5. Set flange bolts beyond finger tightness with an indicating torque wrench to insure equal tension in all bolts. Tighten bolts such that those 180 degrees apart or directly opposite are torqued in sequence.
6. Provide at minimum one (1) restrained dismantling joint or flange coupling adaptor for disassembly in each linear run of flanged piping.

2.3 DUCTILE-IRON FITTINGS

- A. Ductile iron fittings shall be provided in locations as shown on the plans or in locations deemed necessary by the Engineer. Ductile iron fittings 12" and smaller shall be rated for 350 psi working pressure and fittings larger than 12" shall be rated for 250 psi working pressure.
- B. Fittings shall be manufactured in accordance with AWWA C153 and provided with mechanical joints. All fittings shall be provided with a thin cement lining in accordance with AWWA C104

unless noted otherwise on plans. If DIP is to be epoxy lined, all fittings shall be epoxy lined in lieu of cement lining.

- C. Use Tee-head or non-hex head bolts and hex head nuts for joint makeup and gasket seating, bolts and nuts shall be carbon steel coated with corrosion inhibiting fluoropolymer composite material. Mechanical joint fittings shall be furnished with sufficient quantities of accessories as required for each joint. All mechanical joints shall be restrained.
- D. Ductile Iron fittings with retainer glands shall be provided.
- E. Concrete thrust block/restraints shall be 2500 psi concrete poured in place against undisturbed soil at each fitting location.
- F. Where 90 degree deflections occur along the route of the force main, two (2) 45 degree bends shall be used where possible.

2.4 POLYETHYLENE PIPE

- A. All polyethylene pipe and fittings shall be molded from Virgin PE4710 High Density Polyethylene Pipe (HDPE) resins in accordance with the requirements of ASTM D3035 and manufactured to comply with ASTM F714.
- B. Unless otherwise specified, the nominal size and DR shall be as shown on the Drawings. HDPE fittings shall be fully pressure rated.
- C. Gravity Sewer - Profile wall polyethylene pipe and fittings for gravity sewers shall be of the spiral wound type. The pipe shall be made of high density, high molecular weight polyethylene pipe material meeting the requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D-1248. The pipe shall be provided with rubber gasket joints that meet the non-pressure requirements of ASTM F477. Special heavy wall pipe sections having a smooth outside wall shall be supplied for all manholes and connections to other types of pipe.
- D. Pressure Mains – HDPE pipe and fittings shall have a nominal DIPS (ductile iron pipe size) outside diameter per ASTM F714. Pipe sections shall be joined on the job site above ground into continuous length by the butt-fusion method in accordance with ASTM F2620, and be performed in strict accordance with the manufacturer's recommendations. Butt-fusion fittings shall comply with ASTM D3261.
- E. HDPE pipe shall be joined to ductile iron valves and fitting with a DIPS size MJ adapter kit. Pipe stiffeners shall be used to maintain roundness of the pipe. MJ adapter and stiffeners shall be installed in strict accordance with the manufacturer's recommendations.
- F. Pipe shall be supplied in lengths not less than 40 feet long, of the size and wall thickness as shown on the plans. The combined soil pipe system shall be reviewed and approved by the pipe manufacturer to ensure an installation limiting maximum deflection of the pipe to less than five percent of base diameter, when both soil and maximum water loads are applied. The pipe shall be handled and installed in strict accordance with the recommendations of the manufacturer.

2.5 VALVES

A. Gate Valves

1. Manufacturers:
 - a. Mueller Co
 - b. American
 - c. Or Approved Equal
2. Description:
 - a. Comply with AWWA C509.
 - b. Body: Ductile iron.
 - c. Seats: Resilient.
 - d. Style:
 - 1) Buried service: Mechanical joint ends in accordance with AWWA C111.
 - 2) Above ground service: Flanged ends with 125 lb. flanged ends faced and drilled per ANSI B16.1 standard for cast iron flanges.
 - e. Stem:
 - 1) Type: Non-rising.
 - 2) Material: Bronze.
 - f. Operation:
 - 1) 2-inch operating nut for buried applications
 - 2) Handwheel for above ground applications
 - 3) Opening Direction: Counterclockwise.
3. Provide gate valves smaller than 3 inches in diameter that are all bronze, threaded, meeting the requirements of Federal Specification WW-V-54C, as manufactured by Crane, or Walworth, or equivalent, and suitable for the service required.

B. Plug Valves

1. Manufacturers:
 - a. Milliken
 - b. Henry Pratt Company
 - c. DeZurick
 - d. Val-Matic
 - e. Or Approved Equal
2. Description:
 - a. Type:
 - 1) Non-lubricated
 - 2) Eccentric
 - 3) 90 Degree Turn

- 4) Resilient faced Plug
- 3. Working Pressure: 175 psig for valves through 12" and 150 psig for valves for 14" through 72".
- 4. Ports:
 - a. Configuration: Rectangular.
 - b. Minimum Port Area: 100 percent of nominal pipe area for valves.
- 5. Stem Bearings: Self-lubricating.
- 6. Stem Seals:
 - a. Type: V-ring.
 - b. Material: Neoprene.
- 7. Packing and Gland: Accessible and externally adjustable.
- 8. End Connections:
 - a. Buried service: Mechanical joint ends in accordance with AWWA C111.
 - b. Above ground service: Flanged ends with 125 lb. flanged ends faced and drilled per ANSI B16.1 standard for cast iron flanges.
- 9. Operation:
 - a. 2-inch operating nut for buried applications.
 - b. Handwheel for above ground applications.
 - c. Opening Direction: Counterclockwise.
- 10. Materials:
 - a. Body:
 - 1) Cast iron, ASTM A126 Class B.
 - 2) Lining: As recommended by valve manufacturer for service conditions.
 - b. Plug:
 - 1) Ductile iron, ASTM A126 Class B.
 - 2) Lining: Synthetic viton compound of a minimum of 70 durometer hardness.
 - c. Seats: 1/8", welded, 90% pure Nickel.
 - d. Stem: Type 316 stainless steel.
 - e. Stem Bearings: Type 316L stainless steel.
 - f. Seals: Buna-N.
 - g. Connecting Hardware: Type 316 stainless steel.
 - h. Plugs shall be on top when open and on pressure side when closed.
- C. Check Valves
 - 1. Manufacturers:
 - a. GA Industries, Inc.

- b. Henry Pratt Company
 - c. Kennedy Valve Company
 - d. Or Approved Equal
 - 2. Description:
 - a. Comply with AWWA C508.
 - b. Minimum Working Pressure: 200 psig for 2" - 12" and 150 psig for 14" - 30".
 - c. Check valves 6 inches and larger: Furnish with adjustable air cushion chambers.
 - d. Type: Swing, resilient seated with outside lever and adjustable weight.
 - e. Mounting: Horizontal or vertical.
 - f. End Connections: Integral flange ends shall be ANSI B16.1 Class 125, suitable for horizontal or vertical installation.
 - 3. Materials:
 - a. Body and Cover: Ductile iron, ASTM A536.
 - b. Disc, Disc Arm: Ductile iron, ASTM A536
 - c. Body Seat: Replaceable, Type 316 ASTM A276 with Buna-N renewable seat ring
 - d. Shaft: Type 303 Stainless Steel ASTM A582
 - e. Disc Seat: Buna-N
 - f. Lever and Counterweight: Ductile Iron, ASTM A536
 - g. Hinge Pin and Key: Type 316 Stainless Steel
 - h. Rubber Components: Buna-N
 - i. Connecting Hardware: Type 304 stainless steel.
 - 4. Finishes: As specified in Section 09 96 00 High-Performance Coatings.
- D. Air Vacuum Valves
- 1. Manufacturers:
 - a. ARI Flow Control Accessories
 - b. Or Approved Equal
 - 2. All air release and vacuum valves shall be sized per the manufacturer and approved by the engineer prior to installation based on the owner's preferences and the anticipated line pressures.
 - 3. Wastewater air and vacuum valves shall permit unrestricted passage of air during filling of the distribution piping. The valve body shall be stainless steel with stainless steel screws, unless indicated (stainless steel) in the plan set. The float and all internal metal parts shall be stainless steel, and the valve shall be designed so that the venting mechanism does not come into contact with sewage. The air and vacuum combination valves for sewage shall be ARI Model D-020 or equal. The valve shall have a NPT inlet sized by the manufacturer and shall be fitted with a back flushing device.
 - 4. The air release valve shall be installed as shown in details.
 - 5. No galvanized nipples shall be used.
 - 6. Install Air Vacuum valves as shown on plans.

2.6 MATERIALS

A. Bedding and Cover:

1. Bedding:
 - a. Ductile Iron Pipe – Type 2 or Type 3 Trench per AWWA C151 as required.
 - b. PVC/HDPE – Type 2 Trench per AWWA C151
2. Cover: Provide a minimum of 4 feet of cover unless shown otherwise on Drawings.
3. Soil Backfill from Above Pipe to Finish Grade:
 - a. Subsoil with no rocks greater than 6 inches in diameter, frozen earth, or foreign matter.
 - b. Back-fill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe.

2.7 ACCESSORIES

A. Polyethylene Encasement

1. Where indicated on the drawings ductile iron pipe shall be wrapped in 6 mil polyethylene encasement in accordance with AWWA C105. All fittings shall be wrapped in 6 mil polyethylene encasement extending 6" beyond the connection.

B. Zinc Coating: Where indicated on the drawings, ductile iron pipe for buried service shall be coated with a layer of arc-sprayed zinc. The mass of the zinc applied shall be 200 g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils.

1. The zinc coating system shall conform to ISO 8179 standard.
2. All pipe shall be manufactured and zinc coated in the United States at the pipe manufacturer's facility.

C. Protective Lining: The Contractor shall provide interior protective lining where indicated on the drawings or specified below.

1. Ductile iron pipe and fittings shall receive an epoxy lining of the interior surface where indicated on the drawings. The interior protective liner shall be an amine cured novalac epoxy applied to a dry film thickness of 40 mils minimum, and shall be Protecto 401™ Ceramic Epoxy or approved equal. Ductile iron pipe to be lined shall not be cement mortar lined.

D. Pipe Weights

1. Unless otherwise noted in the Specifications, all gravity sewer pipe installed with less than three diameters of cover over the top of the pipe barrel shall be provided with concrete weights to prevent flotation.

2. The weights shall be spaced at ten feet centers, with each weight weighing not less than 800 pounds. The weights may be constructed of a cast iron bolt on design, or they may be of the concrete cast in place type for below ground installations. Cast in place weights shall each contain two No. 3 rebars bent over and around the pipe barrel to provide adequate tensile strength to the upper part of the weight. Above ground portions of concrete weights shall be neatly formed and rubbed upon completion of the work.

E. Trench Plugs

1. Provide trench plugs where shown on drawings and at all creek crossings.
2. Trench plug consists of an impervious clay or concrete ditch check installed on the downstream side of all stream crossings. Ditch check shall be constructed for a length of 3 feet as measured along the centerline of the pipe and the full width of the trench excavation.
3. Backfill shall exhibit the characteristics of a "GC" soil rating as classified by the unified soil classification system (ASTM D2487) and shall have a coefficient of permeability no greater than .001 cm/sec.
4. The material utilized may vary from the above requirements if approved by Engineer; however, in any case the contractor shall furnish an approved independent testing facility utilizing the above methods.
5. The minimum percentage of compaction for the backfill shall be 95% proctor density (ASTM D1557).

F. Tracer Wire

1. Insulated copper wire shall be installed on all non-metallic pipe force mains. The wire shall be 10 gauge stranded type TW copper marker wire with electronically continuous joints with blue or purple thermoplastic insulation recommended for direct burial. The marker wire shall be brought up to all in-line valves and at 500' increments along the forcemain alignment to be readily available to system operators. All wire connections and splices shall be connected with underground wire nuts, tied, and tightly taped with insulated electrical tape. All costs associated with the installation of the marker wire shall be included in the price bid for the pipe.

G. Detection Tape

1. Green metallic detection tape shall be provided for all PVC pipes.
2. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tape shall be marked "CAUTION SEWER MAIN BURIED BELOW."
3. Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of 3-inches and have a minimum thickness of 5 mil.
4. Tape shall be marked "CAUTION SEWER MAIN BURIED BELOW."
5. All tracer wire termination points will use a test station. Test stations shall be Lite Duty Snakepit test station (LD14*TP) green in color, as manufactured by Copperhead industries LLC, Rhino TracerPed Triview Green (P692TGI), or equal.

H. Valve Boxes

1. Manufacturers:
 - a. Mueller Co

- b. Ford Meter Box Company, Inc.
 - c. Sigma
 - d. Or Approved Equal
 - 2. Description
 - a. Material: Cast iron
 - b. Type: One Piece
 - 1) Material: Cast iron.
 - 2) Provide 6-inch Class 200 PVC riser
 - c. Installation: Support valve box and PVC riser on minimum of 2 cement bricks. Install tracer wire on outside of riser pipe and loop inside of valve box.
 - 3. Lid Inscription: SEWER
- I. Pressure Gauges
- 1. Gauges shall be furnished as shown on the drawings. Gauges shall be bourdon tube type, with bronze movement, plexiglass covers and shall be 4½ inches in diameter with not less than 90 percent glycerin filled cast phenolic cases. Each gauge shall have a range such that the normal operating pressure shall be approximately at half the range. The gauges shall be provided with diaphragm protectors and ¼ inch NPT liquid flushing connection with brass lever handle blow-off pet cock. The diaphragm and surfaces exposed to the liquid shall be of stainless steel. Gauges shall be calibrated in pounds per square inch.

PART 3 - EXECUTION

3.1 GENERAL

- A. Watertight Construction – It is imperative that all sewers and manholes be built watertight and that the Contractor rigidly adheres to the specifications for material and workmanship. After completion, the sewers or section thereof will be tested and gauged; and if infiltration is observed, the sewer will be rejected.
- B. Inspection – All work done and materials furnished shall be subject to the inspection of the Engineer and the Inspector, and all improper work shall be reconstructed. All materials which do not conform to the requirements of the specifications shall be removed from the worksite upon notice being received from the Engineer of the rejection of such materials. The Engineer shall have the right to mark rejected materials and to distinguish them as such.

3.2 EXAMINATION

- A. Verify that trench cut is ready to receive Work.
- B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.3 PREPARATION

- A. Perform trenching operations per Section 31 23 16.13
- B. Protect and support existing sewer lines, utilities, and appurtenances in accordance with Section 31 23 16.13 and the Occupational safety and health act (OSHA) of 1970 (PL 91-596), as amended.
- C. Utilities:
 - 1. Coordinate with other utilities and the Engineer to eliminate interference.
 - 2. Notify Engineer if crossing conflicts occur.

3.4 INSTALLATION

- A. The Contractor shall assume responsibility for all materials and equipment stored, protection of his product and compliance with all federal, state and local safety regulations.
- B. Care shall be taken in loading, transporting, and unloading to prevent damage to pipe or fittings. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before laying, and the Engineer notified of any defect. No piece shall be installed which is defective. Only outside slings shall be used for lifting. Under no conditions shall lifting be from interior surfaces. The Contractor shall be responsible for all materials furnished by him and shall replace all such material found defective in manufacture or damaged in handling after delivery at no additional cost to the Owner.
- C. Gravity sewer pipes, structures and manholes shall be installed and tested as specified to the grades, elevations, alignments, and orientations shown on the drawings within the following tolerances:
 - 1. Pipe center line horizontal position at any point: ± 0.50 feet
 - 2. Pipe center line horizontal position difference between any two joints (maximum): 0.10 feet
 - 3. Elevations of bases, openings, appurtenances, and tops of any structure or manhole (except pipe invert elevations): ± 0.10 feet
 - 4. Horizontal orientation (rotation) of any structure or manhole or any pipe penetration face: ± 2.0 degrees
- D. Under no circumstances should installation of sewer pipes, structures, and manholes to the tolerances specified herein result in a reverse grade. Any pipe, structures, and manholes outside of these tolerances or at an inverse grade shall be removed and replaced with correct work. Materials may be reinstalled only as approved in writing by the Engineer. Otherwise, removed pipe and manholes shall be removed from the site and replaced at no additional cost to the Owner.
- E. All PVC gravity sewer pipe shall be laid in strict accordance with ASTM 2321, and only crushed stone bedding as described elsewhere in these specifications shall be used
- F. All HDPE Force mains shall be installed in accordance with the requirements of ASTM D2321. Class IV and Class V materials shall not be used in the pipe zone.

- G. All ductile iron pipe and fittings shall be installed in conformance with AWWA C600.
- H. A laser beam device shall be used to ensure correct horizontal and vertical alignment for all gravity sewer pipe. The laser beam shall be of a type approved by the Engineer. Each laser beam shall be calibrated at the factory before being used for this work. At 30 day intervals, each laser beam device shall be field checked and recalibrated if necessary by the manufacturer and a certificate authenticating its accuracy provided to the Engineer.
- I. Before the pipe is placed in position, the bottom of the trench shall be uniformly graded and bedding stone placed so that the pipe will have a bearing for its full length. As each section of pipe is set in place a small excavation shall be made to provide a place for the bell.
- J. All sewer pipe shall be laid upgrade with the spigots pointing downgrade. The pipe and specials shall be so laid in the trench that after the sewer is completed the interior surface shall conform on the bottom accurately to the grades and alignment fixed or given by the Engineer.
- K. All pipe shall be carefully examined for cracks or other defects, and no pipe shall be laid which is found defective. If any pipe is found to be defective after being laid, it shall be removed and replaced with sound pipe without further charge.
- L. The interior of the pipe shall be carefully freed of all dirt and superfluous material of every description as the work proceeds.
- M. No pipe shall be laid on blocking of any kind except by express permission of the Engineer, and then only at manholes or other structures where temporary blocking may facilitate installation of the pipe. After installation of the pipe, such blocking shall be carefully removed, and all voids left by the blocking shall be filled with selected materials and tamped.
- N. The bell of each joint shall be wiped clean before the gasket is inserted in it and the gasket covered with lubricant meeting the requirements of AWWA C111 before the pipe sections are jointed together.
 - 1. No joints shall be made where surfaces of pipe and bell to be joined have been soiled by earth in handling until such soiled surfaces are so thoroughly cleaned by brushing and wiping that all traces of the earth are removed.
 - 2. The surfaces of pipe to be joined, as well as the gaskets, shall be cleaned and lubricated. Whatever lubricating agent is used, it shall not be injurious or detrimental to the gasket.
- O. After each joint is installed, the gasket shall be checked for proper position prior to installation of the succeeding length of pipe.
- P. Where pipe laying is suspended at the lunch hour, at night, during inclement weather or at any other time, the open end of the pipe line shall be provided with a tight-fitting plug-in order to prevent the entrance of dirt, mud and animals.
- Q. The Contractor shall be responsible for removing and cleaning any foreign debris that enters the sewer system.
- R. Wye-branches shall be installed in the line opposite every house, and in other locations if so directed by the Engineer. Any omission of these appurtenances shall be corrected by the Contractor without additional cost to the Owner. The Contractor shall maintain a complete and

accurate record showing the location of each wye-branch installed. The locations will be given as a distance upgrade from each manhole. The written record may be kept on the cut sheet provided by the Engineer and shall be given to him on completion of each line. The record shall state whether the wye-branch is facing right or left when looking up grade and if riser pipe is installed, the amount shall be recorded. In each instance the Contractor will make every effort to install the wye-branch at the location requested by the property owner.

- S. Backfill trench as shown on the Drawings and in accordance with Section 31 23 16.13 of these specifications.
 - 1. Unless otherwise shown on the Drawings, ductile iron pipe shall be installed in a Type 4 standard laying condition per AWWA C151.
- T. All disturbed areas along the pipeline shall be grassed as soon as possible after backfilling operations have been completed.
 - 1. The maximum length of area disturbed before soil stabilization techniques will be required shall be 500 feet.
 - 2. Seeding and Restorations shall be per Section 32 92 19 of these specifications.

3.5 OBSTRUCTIONS

- A. Each building, wall, fence, pole, bridge, railroad, driveway or other property or improvement encountered is to be carefully protected from all injury, and in the event that any of the foregoing are damaged or removed during the progress of the work the same shall be repaired or replaced within a reasonable time, and before final acceptance of the work shall be returned to as good condition as before the work started. Special care must be exercised in trenching under or near railroads in order to avoid or minimize delays and the danger of injury resulting therefrom, and the Contractor must use care in all phases of the construction work, for he will be held liable for damages caused by carelessness.
- B. In excavating, backfilling and laying pipe care must be taken not to remove, disturb or injure any water or sewer pipes or other conduits or structures. If necessary, the Contractor, at his own expense, shall sling, shore up and maintain such structures in operation, and within a reasonable time shall repair any damage done to them. Before final acceptance of the work, he shall return all such structures to as good condition as before the work started.
- C. Unless otherwise specifically addressed on the drawings, sewers shall be laid at least ten (10) feet horizontally from any existing or proposed potable water main. The distance shall be measured edge to edge.
- D. Sewers crossing potable water mains shall be laid to provide a minimum vertical separation of eighteen (18) inches between the outside of the potable water main and the outside of the sewer. This shall be the case where the potable water main is either above or below the sewer. Whenever possible, the potable water main shall be located above the sewer main. Where a new sewer line crosses a new potable water main, a full length of pipe shall be used for both the sewer line and potable water main and the crossing shall be arranged so that the joints of each line shall be as far as possible from the point of crossing and each other. Where a potable water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the potable water main while maintaining line and grade.

- E. When necessary, the Contractor shall give sufficient notice to the interested utility of his intention to remove or disturb any pipes, conduits, etc., and shall abide by their regulations governing such work. In the event that any subsurface structure becomes broken or damaged in the prosecution of the work, the Contractor shall immediately notify the proper authorities, and shall be responsible for all damage to persons or property caused by such breaks. Failure of the Contractor to promptly notify the affected authorities shall make him liable for any needless loss or for interference with the normal operation of the utility.
- F. When pipes or conduits providing service to adjoining buildings are broken during the progress of the work, the Contractor shall repair them at once at his own expense, or if required by the utility involved, shall pay the utility the proper charges for having such repairs made by the utility's own forces. Delays, such as would result in buildings being without service overnight or for a needlessly long period during the day, will not be tolerated, and the Owner reserves the right to make repairs at the Contractor's expense without prior notice. Should it become necessary to move the position of a pipe, conduit or structure it will be done by the Contractor in strict accordance with the instructions given by the Engineer or utility involved.
- G. The Contractor shall notify all utilities involved of his intention to excavate in the locations specified and request that any underground utilities be located in advance of the construction work. Where ordered by the Engineer, the Contractor shall uncover subsurface obstructions in advance of construction so that the method of avoiding them may be determined before pipe laying reaches the obstruction.

3.6 CONNECTIONS TO EXISTING SANITARY SEWERS OR MANHOLES

- A. Connections to gravity sewers shall be made by core drilling a hole (no sledge hammer) in the wall of the existing structure of the proper size to insert the required rubber boot, and a length of sewer pipe into the hole, filling around pipe and boot with non-shrink vinyl-based grout or water plug, and troweling the inside and outside surfaces of the joint to a smooth finish. The bottom of the manhole shall be rebuilt and formed as necessary to fit the invert of the sewer as shown on the drawings for new manholes. High-early strength cement mortar mixed with an approved non-shrink epoxy grout shall be used to minimize interruptions in sewer service. The Contractor shall perform any work needed to temporarily block or divert waste flows to complete the connection without spillage of the waste.
- B. All existing connections to shall be tightly plugged and blocked to prevent the entrance of construction debris (cement, rocks, mud, silt, flushing water, etc.). The discharge of these materials to the Sanitary Sewer System during construction is prohibited. It is the Contractor's responsibility to secure and plug the system during the construction period to prevent entrance of unexpected rainwater, mud, and silt.

3.7 PIPELINES UNDER PAVEMENT

- A. Where sewers are to be laid under pavement, and the installation of casing pipe or the use of cast iron pipe inserted in a bored hole is not required or specified, the Contractor will be permitted to cut and replace this pavement. In the event that subsurface operations result in injury or damage to the pavement, the necessary repairs shall be made by the Contractor at no additional cost to the Owner. In the event of the pavement on either side of the pipe line

cracking or otherwise becoming disturbed or broken due to Contractor's operations, he shall repair or replace same at his own expense and without additional compensation.

- B. In the event of the State Highway Department requiring a bond or certified check to guarantee the replacement of highway paving, the Contractor shall furnish this security at his own expense.
- C. Where pipelines are to be laid underneath paved sidewalks, the Contractor will be required to install them by; means of tunneling, and where it becomes necessary to cut and replace the sidewalk it shall be replaced as soon as practicable after the trench has been backfilled and tamped. The replaced surface shall be 12 inches wider than the width of the trench; the excess width being equally distributed on both sides.
- D. The Contractor will receive no additional compensation for laying sewers under pavement unless this item of work is set up as a separate item in the Proposal.

3.8 TRAFFIC CONTROL

- A. It shall be the responsibility of the Contractor for all traffic control along any portion of the job. Where required, all necessary flagmen, traffic cones and traffic control plans shall be in place on both County roads and State highways to meet road department specifications.
- B. Traffic control plan shall be in conformance with the Manual on Uniform Traffic Control Devices. In the event actual physical conditions warrant additional traffic control devices, they shall be installed in conformance with the M.U.T.C.D. as directed by the South Carolina Department of Transportation District Engineer.
- C. It should be noted that work for this project takes place along a very busy section of four-lane highway. The contractor shall be familiar with the project area prior to bid and implement an effective traffic control plan in accordance with the M.U.T.C.D.

3.9 FIELD QUALITY CONTROL

- A. Test Pipe per Section 33 01 30.13
- B. Compaction Testing per Section 31 23 16.13
- C. As each section of the work is completed it shall be thoroughly cleaned and all excess mortar, earth, brick or other foreign matter removed. Before acceptance of the work the system as a whole shall be cleaned and inspected and a full circle of light shall show in all sewer between manholes.
- D. The Contractor will be responsible for supplying the Engineer with accurate record drawings per Section 01 78 39 at the conclusion of the project. The Contractor will be responsible for keeping "asbuilt" drawings current throughout the duration of the project. Pay requests will not be approved unless "asbuilt" drawings are accurate and are kept current with the work that has been performed.

- E. Final CCTV Inspection: The Contractor shall perform a detailed closed-circuit television inspection in accordance with ASTM standards, in the presence of the Owner after installation of all new sewer pipes. A digital copy of the final inspection shall be provided to the owner and to the engineer. All costs associated with the final CCTV Inspection shall be included in the price bid for pipe.

3.10 PROTECTION

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
- B. Wherever possible, topsoil shall be removed from all areas to be disturbed by construction, and stockpiled. Land exposure shall be minimized in terms of area and time. All exposed areas subject to erosion shall be covered as quickly as possible by the grassing and seeding specified elsewhere or by mulching or vegetation. Natural vegetation shall be retained whenever possible.
- C. Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

END OF SECTION 33 31 00

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SECTION 40 05 13 - COMMON REQUIREMENTS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements common to pipe and tube of all material types used on the Project.
2. Accessories.

B. Related Requirements:

1. Division 31 – Earthwork.
2. Division 40 – Process Interconnections

1.2 COORDINATION

A. Section 01 31 00 – Project Management and Coordination.

B. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's catalog information on pipe materials and fittings.

C. Shop Drawings: Indicate layout of piping systems, including equipment, fittings, critical dimensions, sizes, and material lists.

D. Submit manufacturer's certification and certified test reports that the pipe and linings and coatings were manufactured and tested in accordance with the ASTM and ANSI/AWWA Standards specified. Submittal shall be at least 7 days prior to each shipment of pipe.

E. Material Certificates

F. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for pipe sizing methods and calculations used.

G. Qualifications Statements:

1. Submit qualifications for manufacturer, installer, and licensed professional.
2. Submit manufacturer's approval of installer.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, invert and centerline elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Perform Work according to all applicable Federal, State and Local standards and these specifications.
- B. Permanently mark each length of pipe with manufacturer's name or trademark and indicate conformance to standards.
- C. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

1.6 QUALIFICATIONS

- A. Manufacturer: For each pipe material type, a company specializing in manufacturing products of the material shall be used. The manufacturer shall have successfully manufactured and delivered products of the diameters used in this project for a minimum of 15 projects over the past 5 years.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver materials in manufacturer's packaging; include handling instructions.
- C. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe or coatings. Under no circumstances shall the pipe be dropped or skidded against each other. Slings, hooks, or pipe tongs shall be padded and used in a manner as to prevent damage to the exterior surface or internal coating or lining of the pipe. If any part of the coating or lining is damaged, the repair shall be made by the Contractor.
- D. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- E. Store piping and appurtenances according to manufacturer instructions.
- F. Protect piping and appurtenances from oxidation by storing off ground.

- G. Stored pipe shall be kept safe from damage and away from traveled ways. The interior of all pipe, fittings and other appurtenances shall be kept free from water, dirt, or foreign matter at all times.

1.8 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 ACCESSORIES

1. Couplings, Adapters, Specials for Process Piping: As specified in Section 40 05 06 - Couplings, Adapters, Specials for Process Piping
2. Hangers and Supports for Process Piping: As specified in Section 40 05 07 - Hangers and Supports for Process Piping.
3. Process Piping Insulation: As specified in Section 40 42 13 - Process Piping Insulation.

2.2 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.
- B. All pipe and fittings to be installed under this Contract shall be of new manufacture.
- C. The manufacturer is responsible for the performance of all inspection requirements as specified.
- D. Owner Inspection:
 1. The manufacturer is responsible for performance of all inspection requirements as specified. All pipe and fittings to be installed under this Contract may be inspected at the plant for compliance with these Specifications by the Owner, by an independent testing laboratory selected by the Owner, or by other representative of the Owner.
- E. Certificate of Compliance:
 1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
 2. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that field dimensions are as indicated on the Drawings.
- C. Inspect existing flanges for nonstandard bolt hole configurations or design, and verify that new pipe and flange mate properly.

3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Ream ends of threaded pipes and file smooth.
- C. Cleaning: Thoroughly clean pipe and fittings before installation.
- D. Surface Preparation:
 - 1. Touch up shop-primed surfaces with primer as specified in Section 09 96 00 - High-Performance Coatings.
 - 2. Solvent-clean surfaces that are not shop primed.
 - 3. Clean surfaces of metallic pipe to remove loose rust, mill scale, and other foreign substances by power wire brushing or commercial sand blasting; SSPC SP 6/NACE No. 3. Do not sand blast or power wire brush thermoplastic pipe.
 - 4. Prime surface as specified in Section 09 96 00 – High-Performance Coating.

3.3 INSTALLATION

- A. Buried Service: Install pipe as specified in the Section appropriate to the pipe material.
- B. Exposed Service - Install according to ASME B31.3.
- C. Provide required upstream and downstream clearances from devices as indicated.
- D. Install piping with sufficient slopes for venting or drainage of liquids and condensate to low points.
- E. Support piping as specified in Section 40 05 07 - Hangers and Supports for Process Piping.
- F. Provide expansion joints as specified in Section 40 05 06 - Couplings, Adapters, and Specials for Process Piping and pipe guides as specified in Section 40 05 07 - Hangers and Supports for Process Piping to compensate for pipe expansion due to temperature differences.
- G. Dielectric Fittings: Provide between dissimilar metals.

- H. Field Cuts: According to pipe manufacturer's recommendations.
- I. Finish primed surfaces according to Section 09 96 00 – High-Performance Coating.
- J. Run pipelines straight and true, parallel to building lines with a minimum use of offsets and couplings. Provide only such offsets as may be required to provide necessary headroom or clearance and to provide necessary flexibility in pipe lines.
- K. Changes in direction of pipelines shall be made only with fittings or pipe bends. Changes in size shall be made only with fittings. Miter fittings, face or flush bushings, or street elbows shall not be used. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.
- L. Provide flanges or unions at all final connections to equipment, traps and valves to facilitate dismantling. Arrange piping and piping connections so that equipment being served may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.
- M. Use full and double lengths of pipe wherever possible.
- N. Unless otherwise indicated, install all supply piping, including shut off valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at inlet to control valve or pump. Install supply piping from outlet of control valve at full size to connection of equipment served.
- O. All pipe shall be cut to exact measurement and installed without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings. Particular care shall be taken to avoid creating, even temporarily, undue loads, forces or strains on valves, equipment, or building elements with piping connections or piping supports.

3.4 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.
- B. Laying Tolerances: Unless otherwise specified, laying tolerances will be within 5/8”.

3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.
- B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- C. Inspection:
 - 1. Inspect for damage to pipe lining or coating and for other defects that may be detrimental as determined by Engineer.
 - 2. Repair damaged piping or provide new, undamaged pipe.
 - 3. After installation, inspect for proper supports and interferences.

D. Damage:

1. Inspect for damage to pipe lining or coating, or other defects that may be detrimental as determined by Engineer.
2. Repair damaged piping or provide new undamaged pipe.

E. Pressure Testing:

1. Unless otherwise specified or indicated on the drawings, all pipe shall be pressure tested prior to acceptance.
2. Conduct pressure testing in according to AWWA C600 and following:
 - a. Hydrostatically test each portion of pressure piping, including valved section, at 1.5 times working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage or based on maximum pressure of pump in force mains.
 - b. Conduct hydrostatic test for at least two hours.
 - c. Slowly fill with water section to be tested; expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
 - d. Observe joints, fittings, and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.
 - e. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate. Maintain pressure within plus or minus 5 psi of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
 - f. Compute maximum allowable leakage by following formula:
 - 1) $L = SD \times \sqrt{P}/C$.
 - 2) L = testing allowance, in gph.
 - 3) S = length of pipe tested, in feet.
 - 4) D = nominal diameter of pipe, in inches.
 - 5) P = average test pressure during hydrostatic test, in psig.
 - 6) C = 148,000.
 - 7) When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.
 - g. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
 - h. Correct visible leaks regardless of quantity of leakage.

F. After installation, inspect for proper supports and interferences.

3.6 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Keep pipe interior clean as installation progresses.
- C. All piping shall be cleaned, flushed, and tested prior to use.

- D. All water lines shall be flushed out under full treated water pressure; potable water piping shall be flushed with potable water; air piping shall be thoroughly blown out with air. All filters, control valves and gages shall be removed from lines or bypassed during the blowout period.
- E. Following the blow through, all dirt legs and other low points in lines shall be disassembled and all residual material thoroughly removed. All stop valves shall be removed and cleaned.
- F. The Contractor shall provide all water required for cleaning, and flushing at no additional cost to the Owner.

END OF SECTION 40 05 13

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SECTION 40 05 23 - STAINLESS STEEL PROCESS PIPE AND TUBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless-steel pipe, tube, and fittings.
2. Stainless-steel cam and groove couplings.
3. Accessories.

B. Conform to the requirements of Section 40 05 13 – Common Requirements for Process Piping.

C. Related Requirements:

1. Section 09 96 00 - High-Performance Coatings: Finishes as specified by this Section.
2. Division 40 – Process Interconnections

1.2 REFERENCE STANDARDS

A. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

B. ASME International:

1. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).
2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
3. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings.
4. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.
5. ASME B16.20 - Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed.
6. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
7. ASME B31.3 - Process Piping.
8. ASME Boiler and Pressure Vessel Code (BPVC), Section IX - Welding and Brazing Qualifications.

C. ASTM International:

1. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
2. ASTM A194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
3. ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

4. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
5. ASTM A312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
6. ASTM A632 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small Diameter) for General Service.
7. ASTM A778 – Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
8. ASTM A789 - Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service.
9. ASTM D3308 - Standard Specification for PTFE Resin Skived Tape

D. AWWA

1. AWWA C220 – Stainless-Steel Pipe, ½ In. and Larger
2. AWWA C223 – Fabricated Steel and Stainless Steel Tapping Sleeves
3. AWWA C226 – Stainless-Steel Fittings for Waterworks Service, ½ In. Through 72 In.
4. AWWA C228 – Stainless-Steel Pipe Flanges for Water Service – Sizes 2 in. through 72 in.

E. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

F. The Society for Protective Coatings:

1. SSPC SP-6 - Commercial Blast Cleaning.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Felker Brothers.
- B. Brismet.
- C. TW Metals.
- D. Or Approved Equal.
- E. All cam and groove couplings shall be as manufactured by PT Coupling, USA.

2.2 STAINLESS-STEEL PIPE, TUBE AND FITTINGS

- A. All materials shall be new and unused.
- B. Unless otherwise indicated on the drawings, stainless steel pipe shall be Type 304 stainless steel, schedule 10 conforming to AWWA C220.
- C. Stainless steel tube shall be Seamless Type 304 stainless steel conforming to ASTM A269.
 1. In the event plans/schedule indicate Type 304, the requirements for Type 316 shall be interchangeable with Type 304.

- D. All welded pieces shall be shop fabricated.
- E. Pipe shall be field assembled using flanges and gaskets where necessary. Field welding will not be allowed without written approval from the Engineer.
- F. Fittings shall conform to AWWA C226. Shop-fabricated fittings made from flat-rolled stock, in accordance with ASTM A240 shall be in a solution-annealed condition. Shop fabricated fittings made from pipe shall be in accordance with AWWA C220, ASTM A312 and ASTM A778.
- G. Flanges shall conform to AWWA C228.
 - 1. Flanges shall be made from castings, seamless forgings, rolled and welded bar rings, segmented and welded plates, or cut from plate as a single piece.
 - 2. Flanged joints shall be made with bolts, bolt studs with nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same Standard as the flanges.
 - 3. Flanges shall be grade 316, Slip on type, minimum Class D. If service pressure is greater than 150 psi, class shall be rated for the same service pressure as the pipe.
 - 4. Flange faces shall be raised except when bolted to flat face cast iron flanges.
 - 5. Bolting:
 - a. Bolts and nuts shall be Type 316 stainless steel.
 - b. Bolts: Comply with ASTM A193, Grade B8M; square head.
 - c. Nuts: ASTM A194, Grade 8M; hex head.
 - d. Bolt studs and studs shall be of the same quality as machine bolts.
 - e. Washers on mating flanges or equipment connections: Same material as bolt

2.3 ACCESSORIES

- A. Pipe-Thread Tape:
 - 1. Material: PTFE.
 - 2. Comply with ASTM D3308.
- B. O-Ring Seals: EPDM.
- C. Flange Gaskets:
 - 1. Gaskets for flat face flanges shall be full face type. Gaskets for raised face flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Gaskets shall be 1/8 in. thick minimum and of following types:
 - a. Water, Sewage, Sludges (up to 175°F): Red rubber, heavy duty type, by John Crane Co., Morton Grove, IL, - Style 555.
 - b. Air: High temperature compressed gasketing consisting of organic fibers (Aramid) with SBR binder, Garlock "BLUE-GARD" Style 3200 or equal.
- D. Connections with Dissimilar Pipes

1. For stainless steel to ductile iron connections, a weld neck flange can be used on the stainless steel and a megaflange may be used on the ductile iron side. Sufficient gaskets should be used between the nuts or bolts and stainless steel in order to protect the stainless steel.
2. End welding of longitudinal seams shall be performed by manual welding in accordance with AWWA C220-12 Section 4.4.3.4 and 4.4.3.4.1.

2.4 CAM AND GROOVE COUPLING

- A. All cam and groove couplings shall be 316 stainless steel and designed for lightweight strength and long lasting durability.
- B. Cam and groove couplings shall allow for hose connection without the need for threading tools, lugs, twisting, springs or snaps.
- C. Locking arms shall be provided to prevent couplers from leaking or pulling apart during operation.
- D. Gaskets and materials shall be selected based on the manufacturer's recommendation and the material being conveyed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with ASME B31.3.
- B. Comply with Section 40 05 13 - Common Requirements for Process Piping.
- C. Field Cuts: According to pipe manufacturer instructions.
- D. Field welding of stainless steel is **not** permitted, without written permission from the Engineer.

3.2 TOLERANCES

- A. Piping tolerances shall be per AWWA C220.

3.3 TESTING

- A. Test installed components Per Section 40 05 13 – Common Requirements for Process Piping.

END OF SECTION 40 05 23

SECTION 40 05 31 - THERMOPLASTIC PROCESS PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. PVC pipe, tube, and fittings.
2. Chlorinated polyvinyl chloride (CPVC) pipe and fittings.
3. Acrylonitrile-butadiene-styrene (ABS) pipe and fittings.
4. High Density Polyethylene (HDPE) pipe, tube, and fittings.
5. Accessories for plastic piping and fittings.

B. Related Requirements:

1. Section 40 05 13 – Common Requirements for Process Piping
2. Section 40 05 51 – Common Requirements for Process Valves

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form).
2. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).
3. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800
4. ASME B16.5 - Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.
5. ASME B16.20 - Metallic Gaskets for Pipe Flanges.
6. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
7. ASME B31.3 - Process Piping Guide.

B. ASTM International:

1. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
2. ASTM A194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
3. ASTM D1527 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80.
4. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
5. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
6. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

7. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
8. ASTM D2321 – Standard Practice for Underground installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
9. ASTM D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
10. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
11. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
12. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
13. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
14. ASTM D2657 - Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
15. ASTM D2737 - Standard Specification for Polyethylene (PE) Plastic Tubing.
16. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
17. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
18. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
19. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
20. ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
21. ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
22. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
23. ASTM D3892 - Standard Practice for Packaging/Packing of Plastics.
24. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
25. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
26. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
27. ASTM F441 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
28. ASTM F442 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
29. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
30. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
31. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
32. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
33. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

34. ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing.
35. ASTM F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.
36. ASTM F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

C. American Water Works Association:

1. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
2. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
3. AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In.
4. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission.

D. NSF

1. NSF / ANSI 14 – Plastic Piping and Components and Related Materials
2. NSF/ANSI 61 – Drinking Water System Components – Health Effects.

E. PVC Pipe Association

1. UNI-B-06-Recommended Low-Pressure Air Testing of Installed Sewer Pipe.

1.3 AMBIENT CONDITIONS

- A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Temperature: Do not install pipe when temperature is below 40 degrees F (4.4 degrees C) or above 90 degrees F (32.2 degrees C) if pipe is exposed to direct sunlight.
- C. Ultraviolet (UV) Protection: Provide pipe installed above ground or outside with UV protection.

PART 2 - PRODUCTS

2.1 PVC PIPE, TUBE, AND FITTINGS

A. Manufacturers:

1. Eslon Thermoplastics; Charlotte, NC
2. R&G Sloane, Sun Valley, CA
3. Harvel Plastics, Easton, PA
4. LCP Chemicals & Plastics, Colfax, NC
5. Bristol Corp., Bristol, IN.

6. Or Approved Equal.

B. PVC Pipe and Fittings (for non-potable service):

1. PVC Pipe shall be ASTM D2241, SDR-21 for pressure service and SDR-26 for gravity service, calculated according to ASTM D2837.
2. Fittings: ASTM D2466, Schedule 40 for gravity service and ASTM D2467, Schedule 80 for pressure service.
3. Joints:
 - a. Above ground service will be solvent-welded per ASTM D2855 or threaded or flanged if later removal is required.
 - b. Below ground service will be gasketed joint per ASTM D-3139, and the gasket shall be per ASTM F477.
4. Materials: ASTM D1784, minimum cell classification 12454.

C. PVC Pipe and Fittings (for potable water service)

1. Pipe: AWWA C900 / AWWA C905, Class 235.
2. Fittings: AWWA C111, cast iron.
3. Joints: ASTM D3139, compression gasket ring.
4. Materials: ASTM D1784, minimum cell classification 12454-C per ASTM D1784.

D. PVC Tube and Fittings:

1. Tube:
 - a. Clear.
 - b. Size and Wall Thickness: schedule 80.
2. Fittings: Compression type; materials suitable for application.
3. Threads: Straight; ASME B1.1.

E. Pipe shall be colored based on applications as follows:

1. Purple – Reclaimed Water
2. Green – Sanitary Sewer Force Main and Gravity Lines
3. White – Non-potable Water
4. Blue – Potable Water

2.2 CPVC PIPE AND FITTINGS

A. Manufacturers:

1. Eslon Thermoplastics; Charlotte, NC
2. R&G Sloane, Sun Valley, CA
3. Harvel Plastics, Easton, PA
4. LCP Chemicals & Plastics, Colfax, NC
5. Bristol Corp., Bristol, IN.

6. Or Approved Equal.

B. CPVC Pipe and Fittings:

1. Pipe: ASTM F442, SDR 13.5 minimum.
2. Fittings:
 - a. Flanged: ASME B16.1, ASME B16.5, Class 125.
 - b. Socket Welded: ASTM F439, Schedule 80.
 - c. Threaded: ASTM F437, Schedule 80; ASME B1.20.1.
3. Joints: Flanged for above ground service, Push-on for below ground service; threaded or flanged if later removal is required.
4. Materials: ASTM D1784, minimum cell classification 23447.

2.3 ABS PIPE AND FITTINGS

A. Manufacturers:

1. Mueller Industries
2. NIBCO Inc.
3. Or Approved Equal.

B. ABS Pipe and Fittings:

1. Pipe: ASTM D1527, Schedule 40 for up to 4" and Schedule 80 for diameters greater than 4".
2. Fittings:
 - a. ASTM D2661; molded; solvent cemented.
 - b. Flanged Fittings: ASME B16.1, ASME B16.5, Class 125.
 - c. Threaded Fittings: ASME B1.1.
3. Joints: Solvent welded; flanged if later removal is required.
4. Materials: ASTM D3965, minimum cell classification 42222.

2.4 PE PIPE, TUBE, AND FITTINGS

A. Manufacturers:

1. Performance Pipe
2. United States Plastic Corporation
3. Or Approved Equal.

B. Polyethylene Pipe and Fittings (for non-potable service):

1. Pipe: ASTM D2447, SDR 9, calculated according to ASTM D3035.
2. Fittings: Molded; ASTM D3261, butt welded or ASTM D2683, F1056, socket welded.
3. Joints: Socket heat fusion or Butt fusion; threaded or flanged if later removal is required.

4. Materials: ASTM D3350, manufactured from virgin resins with minimum cell classification 324433-C. No recycled compound shall be used except that generated in the manufacturer's own plant from resin of the same specification from the same raw material supplier.

C. Polyethylene Pipe and Fittings (for Potable Water Service):

1. Pipe: AWWA C901 /AWWA C906, DR 13.5 for 160 psig pressure rating.
2. Fittings: AWWA C901, AWWA C906, molded or fabricated.
3. Joints: Butt fusion; threaded or flanged if later removal is required.
4. Materials: ASTM D3350, minimum cell classification 324433-C.

D. Polyethylene Tube and Fittings:

1. Tube:
 - a. AWWA C901.
 - b. Size and Wall Thickness: ASTM D2737 or; as indicated on piping schedule.
 - c. Pressure Rating: As indicated on Drawings or piping schedule.
2. Fittings: Compression type; materials suitable for application.
3. Threads: Straight; ASME B1.1.

2.5 HDPE PIPE, AND FITTINGS

A. Manufacturers:

1. ISCO.
2. JM Eagle.
3. Or Approved Equal.

B. HDPE Pipe and Fittings:

1. Pipe: ASTM F714 or ASTM D3035. DR as shown on the Drawings.
2. Fittings: ASTM D3261, butt welded and fully pressure rated for the same service condition as the pipe.
3. Joints: Butt fusion per ASTM F2620; threaded or flanged if later removal is required.
4. Materials: ASTM D3350, manufactured from virgin resins PE4710 cell classification PC445474C.
5. All HDPE pipe and fittings for potable water service shall be of nominal DIPS (ductile iron pipe size) outside diameter per AWWA C900/C905. The nominal size and DR shall be as shown on the Drawings.

2.6 ACCESSORIES

- A. Flange Bolting: Stainless steel, ASTM A193 Grade 8B hex head bolts and ASTM A194 Grade 8 hex head nuts.

- B. Flange Gaskets: Full faced, ethylene propylene diene monomer (EPDM), according to ASME B16.21.
- C. Push-On Joint Seals:
- D. Solvent Cement:
 - 1. PVC Piping: ASTM D2564.
 - 2. CPVC Piping: ASTM F493.
 - 3. ABS Piping: ASTM D2235
- E. Insert Fittings for PE Piping: ASTM D2609.
- F. Couplings for PE Piping: ASTM F1055.
- G. Tracer Wire: #12 AWG copper clad steel insulated wire, insulation color per pipe service.
- H. Detectable Underground Marking Tape: underground marking tape shall be a minimum 3" width, detectable marking tape, with a minimum 5.0 mil overall thickness. Tape shall be manufactured using a 0.8 mil clear virgin polypropylene film, reverse printed and laminated to a 0.35 mil solid aluminum foil core, and then laminated to a 3.75 mil clear virgin polyethylene film. Tape shall be printed using a diagonally striped design for maximum visibility, and meet the APWA Color-Code standard for identification of buried utilities. Detectable marking tape shall be Pro-Line Safety Products or approved equal and made in the USA.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install piping and components according to the following:
 - 1. Section 40 05 13 – Common Work Results For Process Piping
 - 2. ASME B31.3 for above ground service
 - 3. AWWA C605 for potable water service
 - 4. ASTM D2774 for non-potable underground pressure service
 - 5. ASTM D2321 for non-potable underground gravity service
- B. Joining:
 - 1. HDPE pipe sections shall be joined on the jobsite above ground into continuous lengths by the Butt-Fusion Method in accordance with ASTM F2620, and in strict accordance with the Manufacturer's Recommendations. Maximum joined drag length is 600-ft.
 - 2. HDPE pipe shall be joined to ductile iron valves and fittings with a DIPS size MJ Adapter Kit. Pipe Stiffeners shall be used to maintain roundness of the pipe. MJ adapter and stiffeners shall be installed in strict accordance with the manufacturer's instructions.
 - 3. Perform heat joining according to ASTM D2657.
 - 4. Perform electrofusion joining according to ASTM F 1290.
 - 5. Primers and Cleaners: ASTM F402.

6. PVC Solvent-Cemented Joints: ASTM D2855.
- C. Tracer Wire shall be installed on all non-metallic lines. The contractor shall perform a continuity test on all tracer wire in the presence of the engineer. Tracer wire shall be run along the top of the pipe and secured at intervals of 10' with wire or tape. The tracer wire shall be brought up into all valve and meter boxes so as to be readily accessible to system operators. All wire splices and connections shall be tied and tightly taped with insulated electrical tape.
- 3.2 A detectable marking tape shall be installed over all nonmetallic lines by the CONTRACTOR. Care will be taken to insure that the buried marking tape will bear the words "CAUTION-PIPE LINE BURIED BELOW." The detectable marking tape will be buried 4 to 6 in. below finish grade. The tape should be placed into backfill and allowed to settle into place in the backfill.
- 3.3 TESTING:
 - A. Clean lines by flushing or other means before testing begins.
 - B. Testing may be dangerous if a line is improperly prepared. The Contractor shall develop and put in place proper safety procedures when performing testing.
 - C. PE and HDPE pipe for pressure service will be tested in accordance with ASTM F2164-13.
 - D. PVC pipe for pressure service will be tested in accordance with AWWA C600.
 - E. Tests for Gravity Service shall include:
 1. Infiltration Test:
 - a. All lines below the water table shall be checked for infiltration
 - b. If at any time prior to expiration of the correction period stipulated in the General Condition, infiltration exists, that is any inflow, and the pipe fails.
 - c. The Contractor shall locate the leaks and make repairs as necessary to remove the infiltration.
 2. Deflection Testing
 - a. Conduct deflection test prior to low-pressure air test.
 - b. Perform deflection testing after the final backfill and compaction has been in place at least thirty (30) calendar days and prior to placing lines into operation.
 - c. Each reach of pipe shall be checked for excessive deflection by pulling a mandrel through the pipe. The mandrel shall be cylindrical in shape and constructed with 9 evenly spaced arms. The critical dimensions of the mandrel shall have a +/- 0.01 inch tolerance.
 - d. Deflection shall not exceed 5% of initial diameter
 - e. Pipe failing the deflection test shall be uncovered, and the bedding and backfill replaced to prevent excessive deflection. Repaired pipe shall be retested.
 3. Low Pressure Air Testing

- a. Test each reach with maximum 5 psi
 - b. The time elapsed for a 0.5 psi drop in air pressure shall be not less than 10 minutes or as specified in ASTM F1417 or UNI B-6-90 whichever is greater.
- 4. Joint Testing
 - a. For pipes large enough to enter (27" in diameter or larger), individual joints may be pressure tested with a portable tester to 5 psi maximum, with air or water in lieu of low pressure air testing.
 - b. Joint Testing shall be performed in accordance with ASTM C1103.

END OF SECTION 40 05 31

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40 05 51 - COMMON REQUIREMENTS FOR PROCESS VALVES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Valves.
 - 2. Valve actuators.
- B. Conform to the requirements of Section 40 05 51 - Common Requirements for Process Valves
- C. Related Requirements:
 - 1. Section 03 30 00 – Cast-in-Place Concrete
 - 2. Section 05 50 00 – Metal Fabrications
 - 3. Section 09 96 00 – High-Performance Coatings
 - 4. Division 40 – Process Interconnections

1.2 REFERENCE STANDARDS

- A. American Water Works Association:
 - 1. AWWA C541 - Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
 - 2. AWWA C542 - Electric Motor Actuators for Valves and Slide Gates.
 - 3. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
- B. ASTM International:
 - 1. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
 - 2. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
- C. Manufacturers Standardization Society:
 - 1. MSS SP-25 - Standard Marking System for Valves, Fittings, Flanges, and Unions.
- D. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. NFPA:
 - 1. NFPA 70 - National Electrical Code (NEC).
- F. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

G. UL:

1. Equipment Directory.

1.3 COORDINATION

- A. Section 01 31 00 – Project Management and Coordination.
- B. Coordinate Work of this Section with piping, equipment, and appurtenances.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 1. Submit manufacturer information for actuator with model number and size indicated.
 2. Submit valve cavitation limits.
- C. Shop Drawings: Indicate parts list, materials, sizes, position indicators, limit switches, control system, actuator mounting, wiring diagrams, and control system schematics.
- D. Valve Schedule: Indicating the service, size, and connections, make, model number and any special features such as chain wheel operators, etc.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Certification of Valves Larger than 12 Inches: Furnish certified copies of hydrostatic factory tests, indicating compliance with applicable standards.
- G. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for sizing of control valves.
- H. Manufacturer Instructions: Submit installation instructions and special requirements.
- I. Source Quality-Control Submittals: Indicate results of shop/factory tests and inspections.
- J. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections, including factory-applied coatings.
- K. Qualifications Statement:
 1. Submit qualifications for manufacturer and licensed professional.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of valves and actuators.

1.6 QUALITY ASSURANCE

- A. Maintain clearances as indicated on Drawings and Shop Drawings.
- B. Ensure that materials of construction of wetted parts are compatible with process liquid.
- C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.
- D. The manufacturer shall be required to furnish at the time of delivery an affidavit of compliance stating the valve and all materials used conform in every respect to the applicable performance of the appropriate AWWA Standard, and these supplementary specifications and that all tests have been performed with test requirements having been met. Test requirements shall be performed and test records furnished to the engineer prior to shipment.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum twenty years' documented experience

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Prepare valves and accessories for shipment according to latest edition of AWWA C500, Section 31 and:
 - 1. Seal valve ends to prevent entry of foreign matter into valve body.
 - 2. Box, crate, completely enclose, and protect valves and accessories from accumulations of foreign matter.
- D. Store materials according to manufacturer instructions.
- E. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.
 - 3. Provide additional protection according to manufacturer instructions.

1.9 TOOLS AND SPARE PARTS

- A. Provide to the OWNER, one operating wrench for every 10 valves of each type (but not less than 2 wrenches per type), not equipped with hand wheels or levers.
- B. The manufacturer shall furnish any special tools necessary to disassemble, service, repair, and adjust the equipment.

1.10 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.
- B. The Manufacturer and Contractor shall furnish a warranty extending twelve (12) months after substantial completion date.

PART 2 - PRODUCTS

2.1 VALVES

- A. Description: Valves, operator, actuator, handwheel, chainwheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and other accessories as required.
- B. General:
 - 1. All packing, gaskets, discs, seats, diaphragms, lubricants, etc., shall conform to recommendations of the valve manufacturer for the intended service.
 - 2. All valves shall be manufacturer's standard of the design which the manufacturer recommends for the service intended.
 - 3. Each valve shall bear the maker's name or trademark or reference symbol to indicate the service conditions for which it is guaranteed.
 - 4. All valves for use with copper tubing shall have solder type connections.
 - 5. All screw end valves shall be threaded according to the American Standard for Pipe Threads No. B2.1.
 - 6. Flange end valves shall have connecting end flanges in accordance with the B16.1, Class 125 Series of the American Standards Association for type valves covered in the Standard, and in accordance with the Manufacturer's Standardization Society Standard Practice for bronze valves corresponding to the maximum pressure and service for which the valve is to be used.
- C. Valve Ends: Compatible with adjacent piping system.

D. Operation:

1. Open by turning counterclockwise; close by turning clockwise.
2. Cast directional arrow on valve or actuator with OPEN and CLOSE cast on valve in appropriate location.

E. Valve Marking and Labeling:

1. Marking: Comply with MSS SP-25.
2. Labeling: As specified in Section 40 05 53 - Identification for Process Piping.

F. Valve Construction:

1. Bodies: Rated for maximum temperature and pressure to which valve will be subjected as specified in valve Sections.
2. Bonnets:
 - a. Flanged to body and of same material and pressure rating as body.
 - b. Furnish glands, packing nuts, or yokes as specified in valve Sections.
3. Stems and Stem Guides:
 - a. Materials and Seals: As specified in valve Sections.
 - b. Bronze Valve Stems: According to ASTM B584.
 - c. Space stem guides 10 feet o.c.
 - d. Submerged Stem Guides: Type 304 stainless steel.
4. Nuts and Bolts: As specified in Section 05 50 00 - Metal Fabrications.

G. Valve Type:

1. Plug Valves: As specified in Section 40 05 62 – Plug Valves.
2. Ball Valves: As specified in Section 40 05 63 – Ball Valves.
3. Butterfly Valves: As specified in Section 40 05 64 – Butterfly Valves.
4. Swing and Disc Check Valves: As specified in Section 40 05 65 – Swing Check Valves.
5. Pressure-Regulating Valves: As specified in Section 40 05 66 – Pressure-Regulating Valves.
6. Pressure-Relief Valves: As specified in Section 40 05 67 – Pressure-Relief Valves.
7. Telescoping Valves: As specified in Section 40 05 71 – Telescoping Valves.
8. Mud Valves: As specified in Section 40 05 72 – Mud Valves.
9. Combination Air Valves for Wastewater Service: As specified in Section 40 05 78 – Combination Air Valves for Wastewater Service.

2.2 VALVE ACTUATORS

- A. Description: Manual, pneumatic and electric motor actuators.
- B. Provide actuators per specification Section 40 05 57 – Actuators for Process Valves and Gates

2.3 INSULATION

- A. As specified in Section 40 42 13 - Process Piping Insulation or as indicated on Drawings.

2.4 FINISHES

- A. Valve lining and coating: Comply with AWWA C550.
- B. Exposed Valves: As specified in Section 09 96 00 – High-Performance Coatings.
- C. Do not coat flange faces of valves unless otherwise specified.

2.5 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.
- B. Testing: Test valves according to manufacturer's standard testing protocol, including hydrostatic, seal, and performance testing.
- C. Certificate of Compliance:
 - 1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
 - 2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 31 00 – Project Management and Coordination: Requirements for installation examination
- B. Verify that piping system is ready for valve installation.

3.2 INSTALLATION

- A. Install valves, actuators, extensions, valve boxes, and accessories according to manufacturer instructions.
- B. Firmly support valves to avoid undue stresses on piping.
- C. Valves shall be installed with the stems positioned in the horizontal or above the centerline of the pipe unless otherwise shown on the Drawings.
- D. Operators shall be positioned so that they do not interfere with pedestrian traffic.

- E. Valve operators which are 7 ft 0 in. or more above the operating floor or platform shall be chain wheel operated.
- F. Where necessary for operations as described above, valves shall be bevel or spur gear operated. Plug valve 6 in. and larger shall be gear operated.
- G. Coat studs, bolts and nuts with anti-seizing lubricant.
- H. Clean field welds of slag and splatter to provide a smooth surface.
- I. Install valves with stems upright or horizontal, not inverted.
- J. Install brass male adapters on each side of valves in copper-piped system and solder adapters to pipe.
- K. All buried valves shall have a 2" operating nut and handwheels for all exposed valves.
- L. Install 3/4-inch ball valves with cap for drains at main shutoff valves, low points of piping, bases of vertical risers, and equipment.
- M. Install valves with clearance for installation of insulation and to allow access.
- N. Provide access where valves and fittings are not accessible.
- O. Pipe Hangers and Supports: As specified in Section 40 05 07 - Hangers and Supports for Process Piping.
- P. Comply with Division 40 - Process Interconnections for piping materials applying to various system types.
- Q. Install insulation as specified in Section 40 42 13 - Process Piping Insulation and as indicated on Drawings.

3.3 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.
- B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- C. Valve Field Testing:
 - 1. Test for proper alignment.
 - 2. If specified by valve Section, field test equipment to demonstrate operation without undue noise, vibration, or overheating.
 - 3. Architect/Engineer will witness field testing.

END OF SECTION 40 05 51

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SECTION 40 05 53 - IDENTIFICATION FOR PROCESS PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.
7. Lockout devices.

B. Related Requirements:

1. Section 09 96 00 – High-Performance Coatings
2. Division 40 – Process Interconnections
3. Division 43- Process Gas and Liquid Handling, Purification and Storage Equipment
4. Division 46 – Water and Wastewater Equipment

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color-coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Samples: Submit one tag, label, and pipe markers for each size used on Project.

E. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirement.

G. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance materials.
- B. Extra Stock Materials: Furnish one container of spray-on adhesive.
- C. Tools: Furnish special tools and other devices required for Owner to reinstall tags.

1.6 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' documented experience.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Manufacturers:
 1. Craftmark Pipe Markers
 2. Kolbi Pipe Marker Co.
 3. Seton Identification Products
 4. Or Approved Equal
- B. Description: Equipment nameplates shall be engraved or stamped on stainless steel and fastened to the equipment in an accessible location with oval head stainless steel screws or drive pins. Nameplates shall at a minimum contain manufacturers name and address, year of manufacture, serial number, speed (if applicable) and other applicable information.

2.2 TAGS

A. Plastic Tags:

1. Manufacturers:
 - a. Brady ID
 - b. Craftmark Pipe Markers
 - c. Kolbi Pipe Marker Co.
 - d. Seton Identification Products
 - e. Or Approved Equal
2. Description:
 - a. Laminated three-layer plastic with engraved black letters on light, contrasting background color.
 - b. Minimum Tag Size and Configuration: 1-1/2 inches; diameter or square.

B. Metal Tags:

1. Manufacturers:
 - a. Brady ID
 - b. Craftmark Pipe Markers
 - c. Kolbi Pipe Marker Co.
 - d. Seton Identification Products
 - e. Or Approved Equal
2. Description:
 - a. Aluminum or Stainless-steel construction; stamped letters.
 - b. Minimum Tag Size and Configuration: 1-1/2 inches; diameter or square with finished edges.

C. Information Tags:

1. Manufacturers:
 - a. Brady ID
 - b. Craftmark Pipe Markers
 - c. Kolbi Pipe Marker Co.
 - d. Seton Identification Products
 - e. Or Approved Equal
2. Description:
 - a. Clear plastic with printed DANGER, CAUTION, WARNING, and message.
 - b. Minimum Tag Size: 3-1/4 by 5-5/8 inch.
 - c. Furnish grommet and self-locking nylon ties.
3. Tag Chart: Typewritten, letter-size list of applied tags and location, in anodized aluminum frame.

2.3 STENCILS

- A. Manufacturers:
 - a. Kolbi Pipe Marker Co.
 - b. Seton Identification Products
 - c. Or Approved Equal
- B. Description:
 - 1. Clean-cut symbols.
 - 2. Letters:
 - a. Up to 2-inch Outside Diameter of Insulation or Pipe: 1/2-inch-high letters.
 - b. 2-1/2- to 6-inch Outside Diameter of Insulation or Pipe: 1-inch-high letters.
 - c. Over 6-inch Outside Diameter of Insulation or Pipe: 1-3/4-inch-high letters
- C. Stencil Paint: As specified in 09 96 00 - High-Performance Coatings; semigloss enamel.
- D. Color-Coding and Lettering Size: Conform to ASME A13.1.

2.4 PIPE MARKERS

- A. Color-Coding and Lettering Size: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
 - 1. Manufacturers:
 - a. Brady ID
 - b. Craftmark Pipe Markers
 - c. Seton Identification Products
 - d. Or Approved Equal
 - 2. Description:
 - a. Factory-fabricated, flexible, semirigid plastic.
 - b. Preformed to fit around pipe or pipe covering.
 - c. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Pipe Markers:
 - 1. Manufacturers:
 - a. Brady ID
 - b. Craftmark Pipe Markers
 - c. Kolbi Pipe Marker Co.
 - d. Seton Identification Products
 - e. Or Approved Equal

2. Description: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

D. Plastic Underground Pipe Markers:

1. Manufacturers:
 - a. Kolbi Pipe Marker Co.
 - b. Seton Identification Products
 - c. Or Approved Equal
2. Description:
 - a. Brightly colored, continuously printed plastic ribbon tape.
 - b. Minimum 6 inches wide by 4 mil thick.
 - c. Manufactured for direct burial service.

2.5 LABELS

A. Manufacturers:

1. Brady ID
2. Seton Identification Products
3. Or Approved Equal

B. Description:

1. Aluminum or Laminated Mylar construction.
2. Minimum Size: 1.9 by 0.75 inches.
3. Adhesive backed, with printed identification and bar code.

2.6 LOCKOUT DEVICES

A. Lockout Hasps:

1. Manufacturers:
 - a. Brady ID
 - b. Master Lock Company, LLC
 - c. Or Approved Equal
2. Description:
 - a. Anodized aluminum or reinforced nylon construction.
 - b. Furnish hasp with erasable label surface.
 - c. Minimum Size: 7-1/4 by 3 inches.

B. Valve Lockout Devices:

1. Manufacturers:

- a. Brady ID
 - b. Master Lock Company, LLC
 - c. Or Approved Equal
2. Description:
 - a. Nylon or Steel construction.
 - b. Furnish device preventing access to valve operator and accepting lock shackle.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Prepare surfaces as specified in Section 09 96 00 – High-Performance Coatings for stencil painting.

3.2 INSTALLATION

- A. Apply stencil painting as specified in Section 09 96 00 - High-Performance Coatings.
- B. Install identifying devices after completion of coverings and painting.
- C. Identify equipment with nameplates.
- D. Identify inline pumps and other small devices with tags.
- E. Identify control panels and major control components outside panels with plastic nameplates.
- F. Install plastic nameplates with corrosion-resistant mechanical fasteners or adhesive.
- G. Labels:
 1. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.
 2. For unfinished covering, apply paint primer before applying labels.
- H. Tags:
 1. Install tags using corrosion-resistant chain.
 2. Number tags consecutively by location.
- I. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- J. Identify valves in main and branch piping with tags.

K. Piping:

1. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers and/or stenciled painting.
2. Use tags on piping 3/4-inch diameter and smaller.
3. Identify service, flow direction, and pressure.
4. Install in clear view and align with axis of piping.
5. Locate identification not to exceed 20 feet on straight runs, including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

L. Ceiling Tacks:

1. Provide ceiling tacks to locate valves above T-bar-type panel ceilings.
2. Locate in corner of ceiling panel closest to equipment.

END OF SECTION 40 05 53

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SECTION 40 71 13 – MAGNETIC FLOW METERS

PART 1 - GENERAL

The treatment system manufacturer shall supply electromagnetic flow meters to replace existing 2-inch and 4-inch flow meters. The manufacturer shall provide all necessary appurtenances, including potted cabling, grounding rings, signal converters, and other components required for complete system functionality. The specifications herein represent general requirements for electromagnetic flow meters. The manufacturer shall provide flow meters that ensure full system compatibility and performance, regardless of the general specification language.

1.1 SUMMARY

A. Section Includes:

1. Magnetic flow meters.
2. Integrators.

B. Related Requirements:

1. Division 26 - Electrical
2. Division 40 – Process Interconnections

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
2. AWWA M33 - Flowmeters in Water Supply.

B. ASME International:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

C. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. Section 01 31 00 – Project Management and Coordination.

B. Coordinate Work of this Section with piping work.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Furnish complete Product Data, Shop Drawings, Test Reports, Operating Manuals, Record Drawings, Manufacturer's certifications, Manufacturer's Field Reports.
- C. Product Data:
 - 1. Submit manufacturer information for system materials and component equipment, including connection requirements.
 - 2. Measurement accuracy.
 - 3. Flow range ability.
 - 4. Enclosure rating.
 - 5. Classification rating.
 - 6. Electrical characteristics.
 - 7. Output options.

1.5 QUALITY ASSURANCE

- A. Ensure that materials of construction of wetted parts are compatible with process liquid.
- B. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.
- C. Perform Work according to applicable standards.
- D. Manufacturer instruments in facilities certified to the quality standards of ISO Standard 9001.
- E. Non-intrinsically safe electrical equipment shall be approved by a Nationally Recognized Testing Laboratory (NRTL) such as cCSAus, FM, or UL for the specified electrical area classification.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five (5) years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store equipment according to manufacturer instructions.
- D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.8 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish one (1) year manufacturer's warranty for magnetic flow meters and appurtenant devices. If the meter is commissioned by a factory certified technician, the warranty shall be extended to three (3) years.

1.9 PROJECT AND SITE CONDITIONS

- A. Provide instruments suitable for the installed site conditions including but not limited to material compatibility, site altitude, process and ambient temperature, and humidity conditions.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Furnish sensors, field preamplifiers, signal conditioners, offset and span adjustments, amplifiers, transducers, transmitters, control devices, interconnecting cables, and unit conversions and algorithms as required for application.

2.2 MAGNETIC FLOW METERS

- A. Manufacturers:
 1. As Recommended by Treatment System Manufacturer.
 2. Endress+Hauser
 3. Approved Equal
- B. Description: Magnetic flow meters shall be supplied as a 1:1 replacement of existing flow meters per manufacturer recommendation. Meters shall be fully integrated with system controls and shall be provided with necessary cabling, grounding rings, and panel mount signal convertors to ensure full functionality with the treatment system.
- C. Performance and Design Criteria:
 1. Design: According to AWWA M33.
- D. Size: As indicated on Drawings.
- E. Flow Tubes:
 1. Material: Type 304 stainless steel with PTFE liner.

2. Length: As indicated on Drawings.
3. End Connections: Flanged, ASME B16.1, carbon steel.

F. Electrodes:

1. Type 316L stainless steel.
2. Self-cleaning.

G. Accuracy: Plus or minus 1 percent of actual flow rate over a 10:1 range.

H. Provide adjustment for zero and span.

I. Accessories:

1. Furnish cable between transmitter and receiver (if existing cable is not satisfactory for use).
2. Provide automatic, non-mechanical electrode cleaning system without taking meter out of service.

2.3 TRANSMITTERS

A. Transmitter Output:

1. 4- to 20-mA dc analog signal and pulse frequency output for totalization.
2. Accuracy: Plus or minus 0.25 percent of full scale.
3. External third-party signal converter is unacceptable.

B. Housing Material: Cast aluminum.

C. HMI:

1. Touch-screen programming.
2. Display:
 - a. Size: Four lines by 16 characters.
 - b. Type: Backlit digital display.
 - c. User-selectable engineering units.
 - d. Readout of diagnostic error messages.
 - e. Indicate simultaneous flow rate and total flow with three totalizers (forward, reverse, and net total).

D. Transmitter Communication Interface: Modbus RTU, Modbus TCP, or Ethernet/IP.

1. The installed mag flowmeter must be integrated with the existing panel-mounted transmitter.

E. Communication Firmware and Software: Obtain from the manufacturer as designated for the piece of equipment installed.

F. Accessories:

1. Current signal output simulation.

2. Empty pipe detection.
3. Self-diagnostics.
4. Automatic zero adjustment.
5. Stainless-steel sunshield.
6. Signal Cable: Provided by flow meter manufacturer.
7. Internally retain all setup parameters, calibration parameters and accumulated measurements in non-volatile memory in the event of power failure.
8. Protected against voltage spikes from the power source with internal transient protection.

2.4 OPERATION

A. Control Power:

1. 120-V ac, single phase, 60 Hz.
2. Furnish local transformers as required.

B. Enclosures: NEMA 4X

2.5 ACCESSORIES

- A. Stainless steel tag – labeled to match the contract documents
- B. Provide grounding rings, as per manufacturer's recommendations, if required.
- C. Provide sun shield for outdoor installations.

2.6 SOURCE QUALITY CONTROL

- A. Electromagnetic flow meters shall be factory calibrated on an ISO 17025 accredited test stand with certified accuracy traceable to NIST per "General Requirements for the Competence of Testing and Calibration Laboratories."
- B. Evidence of accreditation must originate from a national verification agency such as A2LA.
- C. Each meter shall ship with a certificate of a 2-point calibration report exceeding stated standard accuracy of 0.5% or 0.2% of rate as specified.
- D. A real-time computer generated printout of the actual calibration data points shall indicate apparent and actual flows. The flow calibration data shall be confirmed by the manufacturer and shipped with the meters to the project site.
- E. The manufacturer shall provide complete documentation covering the traceability of all calibration instruments.

2.7 SAFETY

- A. All electrical equipment shall meet the requirements of ANSI/NFPA 70, National Electric Code latest addition.

- B. All devices shall be certified for use in hazardous areas, independent of the output protocol selected.
- C. All devices shall be suitable for use as non-incendive devices when used with appropriate non-incendive associated equipment.
- D. Electrical equipment housing shall conform to NEMA 4X classification.
- E. Non-intrinsically safe electrical equipment shall be approved by a Nationally Recognized Testing Laboratory (NRTL) such as cCSAus, FM, or UL for the specified electrical area classification.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the complete set of plans, the process fluids, pressures, and temperatures and furnish instruments that are compatible with installed process conditions.
- B. Examine the installation location for the instrument and verify that the instrument will work properly when installed.

3.2 INSTALLATION

- A. As shown on installation details and mechanical Drawings.
- B. As recommended by the manufacturer's installation and operation manual.
- C. Specific attention should be given to the following technical requirements:
 - 1. Verify ground rings (if required) have been installed according to the manufacturer's recommendations.
 - 2. Reduced inlet installations must be accompanied by manufacturer's documented evidence of third party testing and data collection in comparison to a traceable standard.

3.3 FIELD QUALITY CONTROL

- A. Each instrument shall be tested before commissioning and the Engineer shall witness the interface capability in the PLC control system and associated registers.
 - 1. Each instrument shall provide direct programming capability through the PLC.
 - 2. Each instrument shall provide direct control of totalizer reset functions through the PLC
 - 3. Each instrument shall be supported with a device profile permitting direct integration in the PLC.
- B. The Engineer shall witness all instrument verifications in the field.

- C. Manufacturers Field Services are available for start-up and commissioning by a Factory field service representative or a manufacturer's authorized service provider (ASP) – the warranty against manufacturing defects is three years.
 - 1. Manufacturer representative shall verify installation of all installed flow tubes and transmitters.
 - 2. Manufacturer representative shall notify the Engineer in writing of any problems or discrepancies and proposed solutions.
 - 3. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested.
 - 4. Manufacturer representative shall generate a configuration report for each meter.

3.4 ADJUSTING

- A. Verify factory setup of all instruments in accordance with the Manufacturer's instructions.

3.5 DEMONSTRATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.
- B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 40 71 13

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SECTION 46 05 53 - IDENTIFICATION FOR WATER AND WASTEWATER EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Labels.
5. Lockout devices.

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturers catalog literature for each product required.
- C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for equipment identification and schedule, including equipment number, location, function, and manufacturer's name and model number.
- D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved black letters on light, contrasting background color.

2.2 TAGS

- A. Metal Tags:
 - a. Stainless steel construction; stamped letters.
 - b. Minimum Tag Size and Configuration: 1 inch x 2-inch (minimum) with finished edges.

2.3 STENCILS

A. Description:

1. Clean-cut symbols.
2. Letter Height: 1-3/4 inch.

B. Stencil Paint: As specified in Section 09 90 00 - Painting and Coating; semi-gloss enamel.

2.4 LABELS

A. Description:

1. Laminated Mylar construction.
2. Minimum Size: 1.9 by 0.75 inch.
3. Adhesive backed, with printed identification.

2.5 LOCKOUT DEVICES

A. Lockout Hasps:

- a. Anodized aluminum construction.
- b. Furnish hasp with erasable label surface.
- c. Minimum Size: 7-1/4 by 3 inches.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Prepare surfaces as specified in Section 09 90 00 - Painting and Coating for stencil painting.

3.2 INSTALLATION

- A. Identify equipment with nameplates.
- B. Identify inline pumps and other small devices with tags.
- C. Identify control panels and major control components outside panels with plastic nameplates.
- D. Apply stencil painting as specified in Section 09 90 00 - Painting and Coating.
- E. Install identifying devices after completion of coverings and painting.

- F. Install plastic nameplates with corrosion-resistant mechanical fasteners or adhesive.
- G. Labels:
 - 1. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.
 - 2. For unfinished covering, apply paint primer before applying labels.
- H. Install tags using corrosion-resistant chain.

END OF SECTION 46 05 53

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SECTION 46 07 53 – PACKAGE WASTEWATER TREATMENT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Package Wastewater Treatment Systems
 - 2. Equipment Required for Rehabilitation of Existing Package Wastewater Treatment Systems
- B. Related Requirements:
 - 1. Section 09 96 00 – High Performance Coatings
 - 2. Division 26 – Electrical
- C. General Description:
 - 1. The treatment package shall be an Orenco AX-Max Treatment System, installed in accordance with the design plans and these specifications. The Manufacturer or Manufacturer's Representative shall furnish a complete advanced treatment package including all necessary pumps, float switch assemblies, influent and discharge assemblies, valves, splice boxes, fans, and controls as required for full integration of a new treatment unit to work as part of a complete treatment system currently consisting of five (5) existing Ax-Max treatment units. (Proposed system shall consist of one (1) new treatment unit and five (5) existing units.)
 - 2. Existing Treatment Units shall be refurbished according to Project Drawings and this specification section to ensure complete integration with new treatment unit and adequate treatment of wastewater in all units.

1.2 DEFINITIONS

Wherever used in these specifications, capitalized and in bold text, the terms listed below will have the meanings indicated, which are applicable to both the singular and plural thereof.

- A. **Bid** – The offer or proposal of a **Bidder**, submitted on the prescribed form, setting forth the prices for the work to be performed.
- B. **Bidder** – An individual or entity who submits a **Bid** directly to the **Owner**.
- C. **Contractor** – The individual or entity with whom the **Owner** has entered into an agreement to install an AX-Max Treatment System.
- D. **Engineer** – The individual or entity responsible for preparation and certification of the construction plans and/or construction management.
- E. **Inspector** – The specific individual designated by the **Owner**, **Engineer**, **Contractor**, and **Manufacturer** to ensure quality control by inspecting and certifying that each AX-Max Treatment System complies with the **Manufacturer's** recommendations and requirements.

- F. **Manufacturer** – A supplier, fabricator, distributor, or vendor having a direct or indirect contract with **Contractor** or **Owner** to furnish materials or equipment to be incorporated in the work by **Contractor**.
- G. **Manufacturer’s Representative** – A firm under contract with the **Manufacturer** to sell or solicit sales and/or represent the **Manufacturer** as a limited agent for the **Manufacturer’s** products.
- H. **Owner** – The individual or entity that has entered into the direct or indirect contract and for whom the work is to be performed.

1.3 SUBMITTALS

Manufacturer or Manufacturer’s Representative shall submit an electronic set of shop drawings and technical data sheets. The submittals shall clearly specify the materials of construction and equipment compatibility, along with drawings for each unique package being supplied. There shall be no alternatives or substitutions considered.

1.4 OR-EQUAL EVALUATIONS

For this project, “approved equal” shall mean equal in the judgment of the Engineer, and the term “Engineer-approved equal” will therefore be used throughout this specification as defined in this section.

- A. Should the Bidder seek approval of a product other than the brand or brands named in the specifications, the Bidder 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 Engineer to research, review, or determine equality, nor the responsibility of the Manufacturer, 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 any Bidder 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. The Manufacturer’s standard data and catalog cut sheets will not be considered sufficient in themselves, and the Engineer 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 Engineer. Bidders seeking approval of “or-equal” products or systems shall provide, at minimum, the following information:
 - 1. Product and system submittals, including, but not limited to, the number of years the Manufacturer has been in the business of manufacturing relevant products/systems.
 - 2. Company size, including:
 - a. Number of employees related to relevant products/systems
 - b. Number of engineers on staff related to relevant products/systems

3. 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.
 - a. Equipment/system warranty along with exclusions
 - b. Performance claims, including, but not limited to:
 - 1) Treatment design
 - a) Surface area
 - b) Maintenance frequency
 - 2) Pump motor description
 - a) Manufacturer and origin
 - b) Length of service
 - c) Number of units in operation
 - d) Life-cycle cost (repair and replacement frequency)
 - e) Warranty
 - 3) Pump liquid-end description
 - a) Manufacturer and origin
 - b) Length of service
 - c) Number of units in operation
 - d) Life-cycle cost (repair and replacement frequency and cost). Note: liquid ends must be removeable, repairable, and cleanable.
 - e) Warranty
 - 4) Corrosion resistance
 - 5) Pump lead description
 - a) Lead must be extra-heavy-duty SOOW cord, 600V, CSA approved (PF7515 uses 14AWG, SJOOW, 300V cord).
 - 6) Control panel components
 - a) Manufacturer and origin
 - b) Length of service
 - c) Number of units in operation
 - d) Warranty
 - e) 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:
 - a) Project name, location, and application
 - b) Years in operation
 - c) Current average daily flows and design flows
 - d) Operator name and contact information
- C. Bidder shall specify and furnish documentation related to Manufacturer (or Manufacturer’s Representative) support services, including, but not limited to:
 1. Installation training program and support material
 2. Installation oversight program and support material
 3. Operator training program and support material
 4. Start-up services program and support material

- D. Engineer is eligible for reimbursement for the evaluation of any “or approved equal” or substitute, including, but not limited to:
 - 1. Installation training program and support material
 - 2. Installation oversight program and support material
 - 3. Operator training program and support material
 - 4. Start-up services program and support material

1.5 QUALITY ASSURANCE

- A. Experience Clause: The equipment furnished shall be manufactured and supplied by a company experienced in the design and manufacture of advanced treatment systems. Manufacturer shall have a minimum ten (10) years’ experience in the design and manufacture of advanced treatment systems of similar size and equipment specified. Manufacturer shall have at minimum of twenty-five (25) successful installations of advanced treatment systems.
- B. The Manufacturer shall furnish a complete, factory-built advanced treatment system. The Manufacturer shall supply detailed installation and O&M (operation and maintenance) instructions. The Manufacturer or Manufacturer’s Representative shall also provide the following support personnel:
 - 1. Experienced support staff dedicated to supporting the project through design, construction, and O&M.
 - 2. Asset management department dedicated to assisting operators with operational and maintenance activities.

1.6 PUMPS

- A. All pumps provided as a part of the project scope must be approved for use in the treatment unit as described in these specifications. Pumps shall be 1/2hp (0.37kW) to 2hp (1.49kW), 230VAC, single phase, 60Hz, two-wire motor, with 10-30ft (3-9m) long, extra-heavy-duty SOOW electrical cord with ground. The PF7515 pump shall use a 14AWG, SJOOW, 300V cord, suitable for Class I, Division 2 applications. The pumps must be submersible high-head effluent pumps. Pumps shall be UL and CSA listed for use with effluent. The pumps shall have a 1/8in (3.2mm) bypass orifice to ensure flow circulation for motor cooling and to prevent air bind. The pumps shall have a floating impeller or floating stack 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 ownership. The motor shall be rated for continuous use and frequent cycling, at least 100 cycles per day. The motor cable shall be suitable for Class I, Division 1 and 2 applications. The pumps shall be lightweight for easy removal and maintenance. The pumps’ intake screens must be 1/8in (3.2mm) mesh polypropylene. The pumps 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.

1.7 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, float switch assembly, discharge assembly, control panel, splice box, and ventilation fan. Warranty term shall ensue after Owner’s acceptance and system start-up 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.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Orenco (Advantex® Ax-Max® Treatment System)
- B. Pre-approved equal.

2.2 ADVANTEX AX-MAX TREATMENT SYSTEM

A. New Treatment Unit:

1. The treatment system shall be an Orenco® AdvanTex AX-Max facility. The facility shall be a complete, fully plumbed wastewater treatment system for receiving and processing wastewater. The facility shall be fully functional and shall include the following new units to be integrated with the five (5) existing AX-Max Units (numbered #3 through #7 in project drawings):
 - a. AX-Max 300–42 (AX-Max Unit #8)
 - 1) Unit shall have an overall length of 42 ft (12.8 m), a width of 7.5ft (2.3m), and a height of 7.7ft (2.3m). The structure shall be constructed of fiberglass-reinforced polymer with a thickness of 4in (102mm). The unit shall include a piping network that recirculates water from the recirculation tank onto the hanging textile media. The media shall be hanging textile media with a specific area of over 300 square feet (27.9 square meters).
 - b. AX-MAX Ventilation System
 - 1) Individual Fan Units
 - a) An Orenco ventilation system or shall be provided in the AX-Max treatment facility. The fan shall be UL recognized, 0.08hp (0.06kW), 115/230VAC, 1.4A/0.7A, 3400rpm, and provide up to 245cfm (7m3/min) at 0in (0mm) H2O. The exhaust from the ventilation fan shall be forced through an enclosure. This enclosure shall be capable of holding an adequate amount of activated carbon to remove odors for a period of over one (1) year.
 - 2) Combined Ventilation
 - a) Ventilation fan shall be Cincinnati Fan Model LMF-6 or Engineer-approved equal mounted to the AX-Max Unit. Housing shall be constructed of commercial grade 319-cast aluminum for increased strength and AMCA Type C spark resistance. Fan shall be rated for continuous duty with an rpm of 3400 and capable of delivering a minimum of 15cfm (0.4m3/min) per AX-Max unit.
 - c. Splice Box Conduit Seals And Sealants
 - 1) As part of the treatment package, all AX-Max units shall include pre-installed splice boxes and UL-listed waterproof 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 Engineer-approved equal with an R-5 (RSI 0.9) rating for each inch (25mm) of foam.
- b) UL-classified silicone sealant or Engineer-approved equal consisting of a neutral cure, non-acetic, non-corrosive silicone able to withstand temperatures to 450°F (232°C).

B. Rehabilitation/Replacement of Existing Treatment Unit Equipment: Existing Treatment Units #3 through #7 shall be rehabilitated according to manufacturer-recommendation to ensure adequate wastewater treatment. The units shall also be integrated with the proposed Unit #8 to ensure full functionality. Rehabilitation shall include work related to controls (mentioned in "Controls" section of this specification, and the following:

1. Manifolds
 - a. All existing manifolds shall be removed and replaced with 45-AX-MAX-M300 as shown in the project drawings. For units with compartments dedicated to pumps and floats, these manifolds shall be shortened as the unit requires.
2. Spin Nozzles
 - a. All existing spin nozzles shall be removed and replaced as one-to-one as shown in the project drawings.
3. Hanging Textile Media
 - a. All existing textile media shall be removed and replaced with AX-100FC as shown in the project drawings. For units with compartments dedicated to pumps and floats, the quantity of textile is 250 sqft. and all others consist of 300 sqft.
4. Lid Latch Clamps
 - a. All existing lid bolts shall be removed and replaced with lid latch clamp assemblies (45-AX-MAX-LL) as shown in the project drawings. These shall be accompanied by removing and replacing existing gas springs (AX-MAX-GAS-SPRING).
5. Gasket Repair
 - a. All existing gaskets shall be repaired with AX-MAX gasket repair kits (AX-MAX-GASKET42) as shown in the project drawings.

2.3 PUMPS

A. Pumps/Operating Conditions

1. PFG1802012-30
 - a. Orenco Model PFG1802012-30 series: 2hp (1.49kW), 230VAC, single phase, 60Hz, two-wire motor, with a 30ft (3-9m) long, extra-heavy-duty SOOW electrical cord with ground.
2. PF200512
 - a. Orenco Model PF200512 series: 1/2hp (0.37kW), 230VAC, single, 60Hz, two-wire motor, with a 10-30ft (3-9m) long, extra-heavy-duty SOOW electrical cord with ground. Pump shall be UL and CSA listed as an aerator pump.
 - b. All appurtenances (nozzle, etc.) shall be provided by system manufacturer to ensure adequate aeration.
3. PF751512
 - a. Orenco Model PF751512 series: 1.5hp, 230VAC, single phase, 60Hz, two-wire motor, with a 10-30ft (3-9m) long, SJOOW 300V electrical cord with ground. Pump shall be UL and CSA listed as an effluent pump.

2.4 MECHANICAL FLOAT ASSEMBLY

- A. Float switches are used to signal liquid level positions for alarm and pump control applications. Orenco float switch assemblies can be mounted in pump vaults, pump basins, and risers.
- B. New discharge float tree shall be provided for replacement of existing discharge float tree.
 - 1. Discharge float tree shall have four (4) floats. The floats shall have four outputs- High Level Alarm, Override Timer, Timer, and Redundant Off/ Low Level Alarm.
- C. New equalization float tree shall be provided for replacement of existing equalization float tree.
 - 1. Equalization float tree shall have five (5) floats. The floats shall have five outputs- High Water Alarm, Lag Pump Enable, Override Timer On/Off, Timer On/Off, and Low Water Alarm/ Redundant Off.
- D. New Aerator pump float tree shall be provided for replacement of existing aerator pump float tree.
 - 1. Aerator Pump float tree shall have one (1) float. The float shall have one output- Low Water Alarm/ Redundant Off/ Timer. When in the “down” position, aerator pumps will be disabled.

2.5 CONTROLS

- A. The existing treatment system control panel(s) shall be rehabilitated to ensure a fully functional treatment system integrating existing units #3 through #7 and proposed Ax-Max Unit #8.
 - 1. Programmed logic to meet the required functionality for a fully operational system and remote capable for changes and updates to firmware or programming.
 - 2. Program rules to be written based on several operands, including the following:
 - a. Input/output status
 - b. Point status
 - c. Date: mm/dd/yy format
 - d. Time of day: 24-hour clock
 - e. Timers
 - f. Historical data (allows for control optimization or detection of trends)
 - 3. Scheduling functions to control digital “points” based on date or day of week/time.
 - 4. Automatic daylight savings time adjustment.
 - 5. Email function with automatic call-out to at least 16 unique mailboxes.
 - 6. Collecting data and detecting trends that could lead to system failure.
- B. In addition to the above requirements, 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 must include at a minimum:
 - a. Remote telemetry unit: TCOM or TCOM-XL telemetry controller; required for system input/output (I/O) to be fully supported plus 10% spare; self, 24VDC power supply for all calculated needs plus 25%; 16 digital I/O expandable as necessary; minimum 16 analog inputs expandable as necessary. On-board Ethernet port (10 base T, RJ45jack) and Modbus port (RS422/485 terminals). Non-volatile memory

backup of programming, lithium battery backup of data and program settings for a minimum of 1 year without power.

- b. Local touchscreen display: must connect to the controller via Ethernet, bright 16-bit colors, high definition TFT analog resistance touchscreen, 32-bit RISC CPU, 400MHz with 128M Flash DRAM, 10.1in (257mm); or Engineer-approved equal.
- c. Industrial Ethernet switch: managed with at least 5 ports, 10/100 Base-T, 10-30VDC power input.

2.6 SPARE PARTS

A. Liquid End Replacement

- 1. Spare liquid end replacements (PGL18020) for the recirculation pumps (Model No. PFG1802012-30) shall be provided by manufacturer.
- 2. Spare impeller stacks for the recirculation pumps shall also be provided by manufacturer.

B. Rebuild Kit

- 1. Spare rebuild kits (PFR7515) for the equalization tank transfer pumps (Model No. PF751512) shall be provided by manufacturer.
- 2. Spare rebuild kits (PFR2005) for the aerator pumps (Model No. PF200512) shall be provided by manufacturer.

2.7 INSTALLATION

All treatment, pumping system, and electrical components shall be installed in accordance with the Manufacturer's recommendations and instructions, the Engineer's plans, and all state and local regulations.

PART 3 - EXECUTION

3.1 PRECONSTRUCTION CONFERENCE

Before any work at the site is started, a conference attended by the Owner, Contractor, Engineer, Manufacturer or Manufacturer's Representative, 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 Owner, Contractor, Engineer, and Manufacturer or Manufacturer's Representative 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 Engineer during construction will be the responsibility of the Owner. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

3.2 INSTALLATION AND FIELD-TESTING TRAINING

The Manufacturer or Manufacturer's Representative 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 Manufacturer's recommendations and requirements for a minimum of one (1) eight-hour day at the beginning of construction.

3.3 QUALITY CONTROL

- A. The Manufacturer or Manufacturer's Representative shall provide the services of a trained representative for a minimum of one (1) eight-hour day for the purpose of quality control during construction.
- B. To ensure quality control, the Inspector shall inspect and certify that an initial installation of the AX-Max Treatment System complies with the Manufacturer's recommendations and requirements.
- C. Upon completion of the inspection, the Inspector, in coordination with the Engineer, shall perform or direct the Contractor to perform any required adjustments to the equipment and place it into operation under the supervision of the Engineer. 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 shall be faxed, emailed, or mailed to the Engineer and Manufacturer within one (1) week of the AX-Max Treatment System being installed and prior to system commissioning.

3.4 SYSTEM COMMISSIONING

- A. The Manufacturer or Manufacturer's Representative shall provide the services of a trained representative for training the Owner's service provider and inspecting the AX-Max installation. The inspection will include items covered from the installation training.
- B. The Manufacturer or Manufacturer's Representative shall provide the services of a trained representative for a minimum of one (1) eight-hour day for the purpose of system commissioning.
- C. Upon system commissioning, the Manufacturer's or Manufacturer's Representative's trained representative shall provide the Engineer a written report of findings. The Engineer shall then perform or direct the Contractor to perform any required adjustments to the equipment and place it into operation. All equipment and materials required to perform additional testing shall be the responsibility of the Contractor. The Manufacturer shall submit to the Engineer and Owner a detailed start-up checklist according to the Manufacturer's inspection and start-up procedures.

PART 4 - OPERATION AND MAINTENANCE

4.1 OPERATION AND MAINTENANCE MANUALS

- A. The Manufacturer shall provide three (3) operation and maintenance manuals: two (2) to be sent to the Owner, and one (1) to be sent to the Engineer. Alternatively, an electronic version can be provided.
- B. During the first full year of operation, the Owner shall provide all testing results and a list of maintenance activities to the Manufacturer each month. The Manufacturer shall review results and provide feedback on operating parameters, equipment performance, and maintenance activities.

- C. At the end of the first year of operation, if requested by the Owner, the Manufacturer or Manufacturer's Representative shall commit to a site visit to assess equipment integrity and operational and maintenance processes, and to address issues raised by the Owner specific to the AX-Max treatment equipment or control parameters.

4.2 SPARE PARTS

The Manufacturer shall provide a spare pump, spare float switches, control components, nozzles, and various other components deemed necessary.

4.3 OPERATION AND MAINTENANCE TOOLS

- A. AX Lateral Brush Cleaning Kit: Upon request, the Manufacturer shall provide a minimum of one (1) AX Lateral Brush Cleaning Kit. This kit shall include a 90in (2286mm) lateral cleaning brush used to clean 1.25in (32mm) diameter laterals and shall be Orenco OM-AX-LAT BRUSH CLEANING KIT or Engineer-approved equal.
- B. AX Sheet Cleaning Wand: Manufacturer shall provide a minimum of one AX cleaning wand. Wand shall be Orenco model OM-AX-CLEANING WAND or Engineer-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
1. The Manufacturer shall provide a field test kit to monitor the following parameters:
 - a. pH
 - b. Alkalinity
 - c. Ammonia (NH₃-N)
 - d. Nitrate/Nitrite (NO₃-N/NO₂-N)
 - e. Dissolved oxygen (DO)
 - f. Chlorides
 - g. Turbidity
 - h. Temperature
 2. The field test kit shall include:
 - a. pH test strips (0-14pH)
 - b. Alkalinity test strips (0-240ppm)
 - c. Ammonia (NH₃-N) test strips (0-6ppm)
 - d. Nitrate/Nitrite (NO₃-N/NO₂-N) test strips (0-50ppm)
 - e. Dissolved oxygen (DO) kit (1-12ppm)
 - f. Chloride titrators (30-600ppm and 300-6000ppm)
 - g. Turbidity kit (0-200NTUs)
 - h. Thermometer (0-240°F/-18-116°C)
- D. Biotube® Cartridge Cleaning Cradle: Manufacturer shall include a minimum of one (1) Biotube cleaning cradle. Cradle shall be Orenco Model OM-BIOTUBE CRADLE for housing the Biotube Effluent Filter cartridges for cleaning and maintenance.
- E. Biotube Cartridge Cleaning Brush: Manufacturer shall include a minimum of one (1) Biotube brush. Brush shall be Orenco Model OM-BIOTUBE BRUSH 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 3/8in (9.5mm) 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 Model SMUG or Engineer-approved equal.
- G. Sludge Measuring Device: Manufacturer shall provide a minimum of one (1) Nasco Sludge Judge® Ultra or Engineer-approved equal. Unit shall be constructed of polycarbonate treated with an ultraviolet stabilizer, durable in cold temperatures, and able to withstand heat up to 280°F (138°C). The measuring device shall be ¾in (19mm) diameter and marked with tape to designate 1ft increments.

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