

**CONTRACT DOCUMENTS AND SPECIFICATIONS
FOR**

**LIME SLURRY FEED SYSTEM FOR THE
LYALL STREET WATER TREATMENT PLANT**

**FOR THE
CITY OF BENNETTSVILLE, SC**

**AECOM PROJECT NO. 60753190
CDBG PROJECT NO. 4-CI-24-001**

FEBRUARY 2026

FOR AGENCY REVIEW

THESE DOCUMENTS ARE PRELIMINARY AND ARE NOT FOR USE FOR CONSTRUCTION.

CONTRACTOR: _____

ADDRESS: _____

CONTRACTOR'S LICENSE NUMBER: _____



AECOM
425 S. Cashua Drive, Suite A, Florence, SC 29501
(843) 665-9166 FAX: (843) 665-9167

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LYALL STREET WATER TREATMENT PLANT

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INFORMATION FOR BIDDERS**ARTICLE 1 - RECEIPT AND OPENING OF BIDS**

The City of Bennettsville (hereinafter called the "Owner"), invites bids on the (Bid Form - Unit Price / Bid Form - Lump Sum / Bidder's Proposal) attached hereto, all blanks of which must be appropriately filled in. Bids will be received by the Owner at 501 East Main Street, Bennettsville, SC 29512 until 2 P.M. on March 17, 2026 at which time said bids will be publicly opened and read aloud. The envelopes containing the bids, Bid Bond and applicable HUD/CDBG submittals stated below must be sealed, addressed to City of Bennettsville, and designated as Bid for Lime Slurry Feed System for the Lyall Street Water Treatment Plant.

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 Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof.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 90 days after the actual date of the opening thereof.

ARTICLE 2 - PREPARATION OF BID

- 2.1 Each bid must be submitted on the Bid Form – Unit Price. All blank spaces for bid prices must be filled in, in ink or typewritten.
- 2.2 Bids which are incomplete, unbalanced, conditional or obscure, or which contain additions not called for, erasures, alterations, or irregularities of any kind, or which do not comply with the Information for Bidders, may be rejected at the option of the Owner.
- 2.3 The correct total amount bid for the completed work is defined as the correct sum total of the amounts bid for the individual items in the Proposal. The correct amount bid for each unit price item is defined as the correct product of the quantity listed for the item by the unit price bid.
- 2.4 Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, bidder's 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 above.
- 2.5 If a "No Bid" is submitted, it must be in a sealed envelope, bearing on the outside the name of the bidder, bidder's address, Contractor's License Number, and the name of the project for which the "No Bid" was submitted. If forwarded by mail, the sealed envelope containing the "No Bid" must be enclosed in another envelope addressed as specified above.
- 2.6 Only contractors who have purchased a complete set of Drawings, specifications and contract documents will be allowed to bid.

ARTICLE 3 - SUBCONTRACTS

- 3.1 The bidder is specifically advised that any person, firm or other party to whom it is proposed to award a subcontract under this contract must be acceptable to the Owner

and the Department of Housing and Urban Development, whose determination of acceptability will be based on Item 16A and 16C of this Section.

- A. Must submit Form HUD-4238-CD-3, Certification by Proposed Subcontractor Regarding Equal Employment Opportunity. Approval of the proposed subcontract award cannot be given by the Owner unless and until the proposed subcontractor has submitted the Certification and/or other evidence showing that it has fully complied with any reporting requirements to which it is or was subject.
- B. Although the bidder is not required to attach such certifications by proposed subcontractors to his bid, the bidder is here advised of this requirement so that appropriate action can be taken to prevent subsequent delay in contract awards.

ARTICLE 4 - TELEGRAPHIC MODIFICATION

- 4.1 Any bidder may modify his bid by telegraphic communication at any time prior to the scheduled time for receipt of bids, provided such telegraphic communication is received by the Owner prior to 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.

ARTICLE 5 - METHOD OF BIDDING

- 5.1 The Owner invites the following bid(s):
 - A. Unit Price

ARTICLE 6 - QUALIFICATION OF BIDDER

- 6.1 The Owner may make such investigations as 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 acceptable.

ARTICLE 7 - BID SECURITY

- 7.1 Each bid must be accompanied by cash, certified check of the bidder, or a bid bond prepared on the form of bid bond 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 five percent (5%) of the bid. Such cash, checks or bid bonds will be returned to all except the three lowest bidders within three days after the opening of bids, and the remaining 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 the bids, upon demand of the bidder at any time thereafter so long as he has not been notified of the acceptance of his bid.

ARTICLE 8 - LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT

- 8.1 The successful bidder, upon his failure or refusal to execute and deliver the contract and bonds required within ten (10) days after they have received notice of the acceptance of their bid, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his bid.

ARTICLE 9 - TIME OF COMPLETION AND LIQUIDATED DAMAGES

- 9.1 Bidder must agree to commence work on or before a date to be specified in a written "Notice to Proceed" of the Owner and to fully complete the project within the number of consecutive calendar days thereafter as indicated on the Bid Form. Bidder must agree also to pay as liquidated damages the sum indicated on the Bid Form for each consecutive calendar day thereafter as hereinafter provided in General Conditions.

ARTICLE 10 - CONDITIONS OF WORK

- 10.1 Each bidder must inform himself 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 obligation to furnish all material and labor necessary to carry out the provisions of his contract. Insofar as possible, the Contractor in carrying out his work must employ such methods or means as will not cause any interruption of or interference with the work of any other contractor.

ARTICLE 11 - ADDENDA AND INTERPRETATIONS

- 11.1 No interpretation of the meaning of the plans, specifications or other pre-bid documents will be made to any bidder orally. Each request for such interpretation should be in writing, addressed to AECOM Technical Services, Inc., 101 Research Drive, Columbia, SC 29203. To be given consideration, the request must be received at least ten days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be mailed to all prospective bidders (at the respective addresses furnished for such purposes), no later than three 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 bid as submitted. All addenda so issued shall become part of the contract documents.

ARTICLE 12 - SECURITY FOR FAITHFUL PERFORMANCE

- 12.1 Simultaneously with his 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, as specified in General Conditions included herein. The surety on such bond or bonds shall be a duly authorized surety company, bond shall be countersigned by an agent residing in South Carolina, and the said surety shall be satisfactory to the Owner.

ARTICLE 13 - POWER OF ATTORNEY

- 13.1 Attorneys-in-fact who sign bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

ARTICLE 14 - NOTICE OF SPECIAL CONDITIONS

- 14.1 Attention is particularly called to those parts of the contract documents and specifications that deal with the following:
- A. Inspection and testing of materials
 - B. Insurance requirements
 - C. Stated allowances
 - D. Nondiscrimination in employment
 - E. Wage rates

ARTICLE 15 - LAWS AND REGULATIONS

- 15.1 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.

ARTICLE 16 - METHOD OF AWARD - LOWEST QUALIFIED BIDDER

- 16.1 If at the time this contract is to be awarded, the lowest base 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 base bid only. If such bid exceeds such amount, the Owner may reject all bids or may award the contract on the base bid combined with such deductible alternates applied in numerical order in which they are listed in the Form of Bid, as produces a net amount which is within the available funds. The Owner will decide which is the lowest qualified bidder, and in determining such bidder, the following elements will be considered for each bidder:
- A. Maintains a permanent place of business.
 - B. Has adequate plant equipment and personnel to perform the work properly and expeditiously.
 - C. Has suitable financial status to meet obligations incident to the work.
 - D. Has appropriate technical experience.

ARTICLE 17 - OBLIGATION OF BIDDER

- 17.1 At the time of the opening of bids, each bidder will be presumed to have inspected the site and to have read and 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 to his bid.

ARTICLE 18 - ORDER OF WORK

- 18.1 The bidder's attention is directed to Section 00800.2, HUD Supplemental General Conditions, on special provisions associated with the order of completion of work.

ARTICLE 19 - COORDINATION OF OTHER DIVISIONS

- 19.1 The bidder's attention is directed to Section 00800, Supplemental General Conditions, on special provisions associated with the coordination of other divisions.

END OF SECTION

Section 00020
ADVERTISEMENT FOR BIDS

Project Title: Lime Slurry Feed System

Owner: City of Bennettsville

Project No. 60753190

Separate sealed bids for The City of Bennettsville for The Lime Slurry Feed System will be received at the office of 501 East Main Street, Bennettsville, SC 29512 at 2 PM on March 17, 2026. then at said office to be publicly opened and read aloud.

The scope of work includes:

The Information for Bidders, Bid Form, Contract Plans, Specifications, Bid Bond, Performance and Payment Bond, and other contract documents may be examined at the following:

Each bidder must deposit security in the amount and form specified in the Information for Bidders.

Other qualification or bid requirements include:

This project is being funded in whole or in part by the Community Development Block Grant Program (CDBG). All federal CDBG requirements will apply to the contract. All contractors are required to be registered in the federal System for Award Management (SAM). Bidders on this work will be required to comply with the President's Executive Order No. 11246 & Order No. 11375 which prohibits discrimination in employment regarding race, creed, color, sex, or national origin. Bidders must comply with Title VI of the Civil Rights Act of 1964, the Davis-Bacon Act, the Anti-Kickback Act, the Contract Work Hours and Safety Standards Act, and 40 CFR 33.240, and Build America, Buy America Act (BAP), imposed by the Build America, Buy America Act (BABA), enacted under Division G, Title IX of the Infrastructure Investment and Jobs Act (IIJA, Pub. L. No. 117-58) signed into law on November 15, 2021. The CDBG application, including the cost estimate, is available for review by contacting AECOM (attention Josh Lehr) at (843) 245-0924.

Bidders must also make positive efforts to use small and minority-owned business and to offer employment, training and contracting opportunities in accordance with Section 3 of the Housing and Urban Development Act of 1968. 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.

The owner reserves the right to waive any irregularities, or to reject any or all bids.

No bidder may withdraw his bid within 90 days after the actual date of the opening thereof.

Electronic copies (.pdf) of the drawings, specifications, and bidding documents may be obtained with Jennifer M. Ruiz Suarez via email jennifer.m.ruiz@aecom.com or call at 803-767-4602 at the office of AECOM Technical Services, Inc., 425 Cashua Drive, Florence, SC 29501. Hard copies are available for the nonrefundable payment of \$150.00. Please provide the following information about your company: POC and their email address; street address; telephone number and SC Contractors License number.

Bidder must be an official plan holder and on the projects plan holders list, for bid to be considered. Plan holders list is maintained by AECOM Technical Services, Inc.

Bidders must deposit security with all bids. Security shall be in the form of a certified check or bid bond made payable to the Owner, and shall be for an amount equal to not less than five percent (5%) of the amount of the bid. Provisions of the security shall be as described in the Information for Bidders.

Any prospective bidder, offeror, contractor or subcontractor who is aggrieved in connection with the solicitation of this contract may protest to Engineer (or) Owner in accordance with Section 11-35-4210 of the SC Code of Laws, within 15 days of the date of issuance of the Notice of Intent to Award.

No bid will be considered unless the bidder is legally qualified under the provisions of the South Carolina Contractor's Licensing Law (South Carolina Code of Laws as amended on April 1, 1999, Chapter 11, Sections 40-11-10 through 40-11-428).

Contractors shall have a classification of WL.

No bidder may withdraw the bid within 90 days after the actual date of the opening and thereof.

These bid documents will be modified only by written addenda.

The Owner reserves the right to waive any informalities or to reject any or all bids.

The Owner requests that all bidders respond with an actual bid or with a sealed "No Bid." This provision guards against receiving an insufficient response to the Advertisement for Bids.

ENGINEERS

AECOM Technical Services, Inc.

425 Cashua Drive

Florence, SC 29501

OWNER

City of Bennettsville

501 East main Street

PO Box 1036

Bennettsville, SC 29512

“EQUAL EMPLOYMENT OPPORTUNITY”

Date: _____

SECTION 00311

BID FORM

LIME SLURRY FEED SYSTEM
FOR THE LYALL STREET
WATER TREATMENT PLANT
FOR THE CITY OF BENNETTSTVILLE, SC
CDBG PROJECT NO.: 4-CI-24-001

Date: Bennettsville, SC
Project No. 60753190

PROPOSAL OF _____,

doing business as a corporation / a partnership / an individual (Strike out inapplicable terms),
with its principal office in the City of _____, County of _____, State of
_____, (hereinafter called "Bidder").

TO: City of Bennettsville
(hereinafter called "Owner"),

To all potential bidders:

The Bidder, in compliance with your invitation for bids for the construction of the Lime Slurry Feed System for the Lyall Street Water Treatment Plant 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 240 consecutive calendar days thereafter as stipulated in the specifications. Bidder further agrees to pay as liquidated damages the sum of \$500 for each consecutive calendar day thereafter as hereinafter provided in Paragraph 19 of the General Conditions.

The drawings, specifications and addenda are complementary of each other. What is called for by one shall be as binding as if called for by all. If a conflict between any of the above is discovered by the contractor, the problem shall be referred to the Engineer as soon as possible for resolution by the Engineer. Should a conflict occur which is not resolved before bid time and/or is necessary to comply with mandatory requirements (i.e., codes, ordinances, etc.), it shall be the contractor's responsibility to price and bid the more expensive method.

Bidder acknowledges receipt of the following addendum:

No. _____ Dated _____ No. _____ Dated _____
 No. _____ Dated _____ No. _____ Dated _____

Bidder agrees to perform all of the _____
 described in the specifications and shown on the plans for the following lump sum prices:

<u>Item No.</u>	<u>Est Qty</u>	<u>Unit</u>	<u>Description</u>	<u>Unit Price</u>	<u>Total</u>
1.	1	EA	Mobilization/Insurance	\$ _____	\$ _____
2.	1	EA	Equipment Start-up, O&M Manuals	\$ _____	\$ _____
3.	1	EA	Erosion & Sediment Control	\$ _____	\$ _____
4.	1	EA	Service Water & Drain Piping, Valves & Appurtenances	\$ _____	\$ _____
5.	1	EA	Site Work	\$ _____	\$ _____
6.	1	EA	Lime Slurry Equipment Pad and Above Ground Drainage Structure	\$ _____	\$ _____
7.	1	EA	Chemical Feed Piping	\$ _____	\$ _____
8.	1	EA	Chemical Feed & Taps	\$ _____	\$ _____
9.	1	EA	Caustic Day Tank, Equipment, Piping, & Feed Pump Demolition	\$ _____	\$ _____
10.	1	EA	Lime Slurry System	\$ _____	\$ _____
11.	1	EA	Electrical Work	\$ _____	\$ _____
12.	1	EA	SCADA System	\$ _____	\$ _____
13.	1	EA	Painting	\$ _____	\$ _____
14.	1	EA	Pre-cast Chemical Concrete Pull Box Equipment, Piping & Installation	\$ _____	\$ _____
15.	60	LF	Chain Link Fence	\$ _____	\$ _____
TOTAL OF BID:				\$ _____	

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

The Bidder declares that he understands that the quantities shown in the Proposal are subject to adjustment by either increase or decrease and that should the quantities of any of the items of the work be increased, the undersigned proposed to do the additional work at the unit prices stated herein, and should the quantities be decreased, he also understands that payment will be made on actual quantities at the unit price bid, and will make no claim for anticipated profits for any decrease in the quantities and that actual quantities will be determined upon completion of the work, at which time adjustment will be made to the contract amount by direct increase or decrease.

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 _____ 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 10 days and deliver a Surety Bond or Bonds as required by Paragraph 30 of the General Conditions. The bid security attached in the sum of _____

_____ Dollars _____
_____ Cents (\$ _____) 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.

By submission of this bid, each bidder certifies, and in the case of a joint bid, each party thereto certifies as to its own organization, that this bid has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this bid, with any other bidder or with any competitor.

[SEAL – (If bid is by a corporation)]

Respectfully submitted:

BY: _____

(Print Name)

(Title)

(Business Address)

SECTION 00312.1

CERTIFICATION REGARDING DEBARMENT, SUSPENSION,
INELIGIBILITY AND VOLUNTARY EXCLUSION

**CERTIFICATION REGARDING DEBARMENT, SUSPENSION,
INELIGIBILITY AND VOLUNTARY EXCLUSION LOWER TIER COVERED TRANSACTIONS**

10/16

This certification is required by the regulations implementing Executive Orders 12549 and 12689, Debarment and Suspension, and 2 CFR Part 200, Participants' responsibilities.)

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS BELOW)

- (1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- (2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Grant Number: 4-CI-24-001

Name of Participant: _____

Address of Participant: _____

Name and Title of Authorized Representative	Signature	Date
<p>1. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.</p> <p>2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.</p> <p>3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.</p> <p>4. The terms "covered transaction", "debarred", "suspended", "ineligible", "lower tier covered transaction", "participant", "person", "primary covered transaction", "principal", "proposal", and "voluntarily excluded", as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Orders 12549 and 12689.</p> <p>5. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.</p> <p>6. The prospective lower tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion -- Lower Tier Covered Transactions", without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.</p> <p>7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may check the System for Award Management (SAM).</p> <p>8. 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 this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.</p> <p>9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.</p>		

SECTION 00350

BID BOND

KNOW ALL MEN BY THESE PRESENTS: That we, the undersigned _____
_____ as Principal, and _____ as Surety,
are hereby held and firmly bound unto the _____
_____ as Owner, in the penal sum of _____
_____ Dollars _____ Cents (\$ _____
_____), for the payment of which, well and truly to be made, we hereby jointly and severally
bind ourselves, successors and assigns.

Signed this _____ day of _____, 20__.

The condition of the above obligation is such that: Whereas, the Principal has submitted to _____
_____ a certain Bid, attached hereto and by reference made a part
hereof, to enter into a contract in writing for the Lime Slurry Feed System for the Lyall Street
Water Treatment Plant.

NOW, THEREFORE,

- (a) If said BID shall be rejected, or
- (b) If said BID shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attachment hereto (properly completed in accordance with said BID) and shall furnish a BOND for faithful performance of said contract, and for the payment of all persons performing labor 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 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

(Corporate Seal)

BY: _____(L.S.)

Surety

(Corporate Seal)

BY: _____(L.S.)

COUNTERSIGNED (SC RESIDENT AGENT)

BY: _____

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.

NOTE: Bond must be countersigned by a South Carolina resident agent.

END OF SECTION

HUD/CDBG

SECTION 00400.1

NOTICE OF INTENT TO AWARD

OWNER: City of Bennettsville, SC
501 East Main Street
P.O. Box 1036
Bennettsville, SC 29512

HUD/CDBG PROJECT NO. 4-CI-24-001

PROJECT DESCRIPTION: Lime Slurry Feed System for the Lyall Street Water Treatment Plant

TO ALL BIDDERS:

This is to notify all bidders that it is the intent of the Owner to award a contract as follows:

NAME OF BIDDER: _____

DATE BIDS WERE RECEIVED: _____

AMOUNT OF BASE BID: \$ _____

ALTERNATE(S) ACCEPTED: # \$ _____

TOTAL AMOUNT OF BASE BID WITH ALTERNATE(S): \$ _____

The Owner has determined that the above named Bidder is responsible and has submitted the lowest responsive bid. The Owner may enter into a contract with this Bidder subject to the contract review by the Department of Commerce, Division of Community Grant Programs.

(Print or Type Name)

(Award Authority Title)

(Signature)

(Date Posted)

POST A COPY OF THIS FORM AT THE LOCATION ANNOUNCED AT THE BID OPENING

CONTRACT

THIS AGREEMENT made this _____ day of _____, 20____, by and between _____ acting herein through its _____, hereinafter called "Owner," and _____ doing business as a partnership / a corporation / an individual (Strike out inapplicable terms), with its principal office in the City of _____, County of _____, State of _____, hereinafter 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: Lime Slurry Feed System for the Lyall Street Water Treatment Plant for the City of Bennettsville, SC, hereinafter called the "Project," for the sum of _____

_____ Dollars _____ Cents (\$_____). Contractor further agrees to commence and complete any and all extra work in connection therewith, under the terms as stated in the General Conditions and Supplemental General Conditions of the Contract, and the Contract Special Provisions; and at his (its or their) own proper cost and expense to furnish all the materials, supplies, machinery, equipment, tools, superintendents, labor, insurance and other accessories and services necessary to complete the said project in accordance with the conditions and prices stated in the Proposal, General Conditions and Supplemental General Conditions of the Contract, CDBG Contract Special Provisions - CSP-1 through CSP-15, the plans, including all maps, plats, blueprints, and other drawings and printed or written explanatory matters thereof, the specifications and contract documents therefore as prepared by URS Corporation, herein entitled the "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 the Contract on or before a date to be specified in written Notice to Proceed from the Owner and to fully complete the project within _____ consecutive calendar days thereafter. The Contractor further agrees to pay as liquidated damages the amount of \$_____ for each consecutive calendar day thereafter that the Contractor fails to complete the project, as hereinafter provided in Paragraph 19 of the General Conditions.

The Owner agrees to pay the Contractor in current funds for the performance of the Contract, subject to additions and deductions, as provided in the General Conditions of the Contract, and to make payments on account thereof as provided in Paragraph 25, "Payments to Contractor," of the General Conditions.

IN WITNESS WHEREOF, the parties hereto have executed this contract in six counterparts, each copy of which shall be deemed an original, in the year and day first above mentioned.

(Seal)

City of Bennettsville, SC

OWNER

(Signature)

By: _____

Title: _____

ATTEST:

Witness

Witness

(Corporate Seal)

CONTRACTOR

(Signature)

By: _____

Title: _____

ATTEST:

Its Secretary

Witness

CONTRACTOR'S ADDRESS

SECTION 00600
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS THAT

(Name of Contractor)

(Address of Contractor)

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

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

City of Bennettsville
(Name of Owner)

501 East Main Street, PO Box 1036, Bennettsville, SC 29512

(Address of Owner)

hereinafter called Owner, in the penal sum of _____

_____ Dollars _____ Cents
(\$ _____) 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 and successors,
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:

The Lime Slurry Feed System for the Lyall Street Water Treatment Plant

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, with or without
notice to the Surety, and if he shall satisfy all claims and demands incurred under such
contract and fully indemnify and save harmless the Owner from all costs and damages which it
may suffer by reason failure to do so, and shall reimburse and repay the Owner all outlay and
expense which the Owner 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 said Surety, for value received hereby stipulates and agrees
that no change, extensions 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,

SECTION 00601

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS THAT

(Name of Contractor)

(Address of Contractor)

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

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

City of Bennettsville
(Name of Owner)

501 East Main Street, P.O. Box 1036, Bennettsville, SC 29512
(Address of Owner)

hereinafter called Owner, in the penal sum of _____ Dollars _____ Cents (\$ _____) 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 and successors, 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:

The Lime Slurry Feed System for the Lyall Street Water Treatment Plant

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, subcontractors and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification 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 all insurance premiums on said work, and for all labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extensions 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 the Contract or to the work or to the specifications.

SECTION 00602.4
NOTICE OF AWARD

TO:

PROJECT DESCRIPTION: Lime Slurry Feed System for the Lyall Street Water Treatment Plant, City of Bennettsville, SC

The Owner has considered the bid dated _____, 20__ submitted by you for the above described work in response to its Advertisement for Bids and its 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 ten (10) calendar days from the date of this notice to you. If you fail to execute said agreement and to furnish said bonds within ten (10) 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.

Dated this _____ day of _____, 20__.

City of Bennettsville, SC
Owner

(Signature)

By: _____

(Print Name)

Title: _____

Acceptance of Notice

Receipt of the above Notice of Award is hereby acknowledged by _____
_____, this the _____ day of _____, 20__.

By: _____

Title: _____



00603

CONTRACT CHANGE ORDER

AECOM Technical Services, Inc
Telephone (803) 254-4400 Fax (803) 845-4837
101 Research Drive - Carolina Research Park
Columbia, South Carolina 29203

Date: Project: Lime Slurry Feed System for the Lyall Street
Water Treatment Plant

Change Order No.:

Contract No.: AECOM Technical Services, Inc. Project No.: 60753190

Description of and Reason for Change:

Itemization of Proposed Change and Basis for Payment

Original Contract Price.....	\$
Previous Change Orders	\$
This Change, (An Addition) (A Deduction) of	\$
Proposed Revised Contract Price.....	\$

Additional funds are to be provided in the following manner: _____

Extension of Contract Time Required: _____ Days.

Revised Contract Completion Date: _____.

This Change is Acceptable: _____, Contractor

By _____ Date: _____

Recommended: AECOM Technical Services, Inc., Engineers

By _____ Date: _____

Approval of Change is Requested: _____, Owner

By _____ Date: _____

CONTRACT CHANGE ORDER
00603-1

60753190

SECTION 00604

EMPLOYMENT ELIGIBILITY VERIFICATION REQUIREMENTS

- A. Contractor is required to comply with all applicable State and Federal employment eligibility verification requirements including but not limited to the following:
1. By signing its bid or proposal, Contractor certifies that it will comply with the applicable requirements of Title 41, Chapter 8 of the South Carolina Code of Laws and agrees to provide to the City of Bennettville, SC ("Owner") upon request any documentation required to establish either: (a) that Title 41, Chapter 8 is inapplicable both to Contractor and its subcontractors or sub-subcontractors; or (b) that Contractor and its subcontractors or sub-subcontractors are in compliance with Title 41, Chapter 8. Pursuant to Section 41-8-70, "In addition to other penalties provided by law, a person who knowingly makes or files any false, fictitious, or fraudulent document, statement, or report pursuant to this chapter is guilty of a felony, and, upon conviction, must be fined within the discretion of the court or imprisoned for not more than five years, or both." Contractor agrees to include in any contracts with its subcontractors language requiring its subcontractors to (a) comply with the applicable requirements of Title 41, Chapter 8, and (b) include in their contracts with the sub-subcontractors language requiring the sub-subcontractors to comply with the applicable requirements of Title 41, Chapter 8.
- B. Contractor is required to complete and submit the attached affidavit along with the executed contract documents.
- C. E-Verify.
1. In addition to completing and maintaining the federal employment eligibility verification form (Form I-9), Contractor must, within three business days after employing a new employee, verify the employee's work authorization through the E-Verify federal work authorization program administered by the U.S. Department of Homeland Security. Employers may no longer confirm a new employee's employment authorization with a driver's license or state identification card.
 2. Contractor shall enroll in E-Verify at www.dhs.gov/e-verify.

END OF SECTION

Attachment

SOUTH CAROLINA ILLEGAL IMMIGRATION REFORM ACT CONTRACTOR CERTIFICATION

In accordance with the requirements of the South Carolina Illegal Immigration Reform Act, _____ (“Contractor”) hereby certifies that it is currently in compliance with the requirements of Title 8, Chapter 14 of the S.C. Code Annotated and will remain in compliance with such requirements throughout the term of its contract with the City of Bennettsville, SC (“Owner”).

Contractor hereby acknowledges that in order to comply with requirements of S.C. Code Annotated Section 8-14-20(B), it will:

1. Register and participate in the federal work authorization program (E-Verify) to verify the employment authorization of all new employees; and require agreement from its subcontractors, and through the subcontractors, the sub-subcontractors, to register and participate in the federal verification the employment authorization of all new employees.

Contractor agrees to provide to Owner any documentation required to establish the applicability of the South Carolina Illegal Immigration Reform Act to the Contractor, subcontractor, or sub-subcontractor. Contractor further agrees that it will provide Owner with any documentation required to establish that the Contractor and any subcontractors or sub-subcontractors are in compliance with the requirements of Title 8, Chapter 14 of the S.C. Code Annotated.

Date: _____

By: _____

Title: _____

SECTION 00606.5
NOTICE TO PROCEED

TO: _____ DATE: _____

PROJECT DESCRIPTION: Lime Slurry Feed System for the Lyall Street Water Treatment Plant

OWNER: City of Bennettsville, SC _____

AECOM TECHNICAL SERVICES, INC. PROJECT NO: 60753190

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 ____ consecutive calendar days thereafter.

The date of completion of all work is therefore: _____, 20__.

CITY OF BENNETTSVILLE, SC

By: _____

Title: _____

Acceptance of Notice

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by _____

_____ this the ____ day of _____, 20__.

By: _____

Title: _____

SECTION 00607.3

APPLICATION FOR PAYMENT

Contractor may submit other Pay Request form for Engineer approval in lieu of the following:

Owner: City of Bennettsville	Contractor:	Contract No.	
		Pay Estimate No.	
		Period of Estimate: From	to

CONTRACT CHANGE ORDER SUMMARY

ESTIMATE

<u>No.</u>	<u>Approval Date</u>	<u>Additions</u>	<u>Deductions</u>	
				1. Original Contract..... \$
				2. Change Orders \$
				3. Revised Contract (1+2)... \$
				4. Work Completed*..... \$
				5. Stored Materials* \$
				6. Subtotal (4+5)..... \$
				7. Retainage \$
				8. Previous Payments \$
				9. Amount Due (6-7-8)..... \$
				* Detailed breakdown attached

Totals:

Net Change:

CONTRACT TIME

Original (days):		On Schedule: Yes	No
Revised:		Starting Date:	
Remaining:		Projected Completion:	

Contractor's Certification:

The undersigned certifies that to the best of their knowledge, information and belief the work covered by this payment estimate has been completed in accordance with the contract documents, that all amounts due subcontractors and suppliers have been paid by the Contractor for work for which previous payment estimates were issued and payments received from the Owner, and that the current payment shown herein is now due.

Engineer's Certification:

The undersigned certifies that to the best of their knowledge and belief, the quantities shown in this estimate are correct and the work has been performed in accordance with the contract documents. Based on periodic but less than full time field representation, to the best of our information the quantities, items and schedule of values, work completed and material and equipment delivered are accurate as indicated on this request for payment. Some defects or problems with construction items may not be determined until final testing and operation of the system is performed. The Engineer cannot be held liable for approval for partial payments for the installation of these items from which the evidence of defects or problems were not determined until after the request for payment was approved.

AECOM Technical Services, Inc.

(Signature):

By:

Date:

(Signature):

By:

Date:

(Signature):

By:

Date:

Approved
by Owner:

PAY ESTIMATE NO. _____

DATE _____

AECOM

Page ____ of ____

PROJECT: Lime Slurry Feed System for the Lyall St Water Treatment Plant

ENGINEER'S PROJECT NUMBER: 60753190

[illegible]

SECTION 00690
CONTRACTOR'S AFFIDAVIT

The State of _____ Date: _____

The County of _____

The City/Town of _____

_____ of _____
(Officer's Name) (Officer's Title) (Contractor's Name)

being duly sworn, deposes and says that _____
(Contractor's Name)

has furnished all labor and material entering into the Lime Slurry Feed System for the Lyall Street Water Treatment Plant at 103 Lyall Street, Bennettsville, SC 29512
(Name and Location of Plant or Work)

called for in the Contract Documents dated _____ with The City of Bennettsville, SC.

_____ states further that this officer has full knowledge
(Contractor's Name)
of all obligations for such labor and materials which have entered into and become part of that certain project known and designated above, and that this officer further deposes and says that all debts and other obligations for such labor and materials have been fully and completely paid for in good and lawful money of the United States of America and that there are no suits for damages against them proceeding, prospective and/or that there are no suits for damages against them proceeding, prospective, or otherwise, in consequence of their operations on the above said project.

The said _____ will hold the
Owners, _____
(Contractor's Name)

City of Bennettsville blameless of any and all mechanic's liens that may be hereafter entered or filed for record, so as to constitute charge against said premises for work or labor done or materials furnished by them.

IN WITNESS HEREOF, this officer has heretofore put his hand and seal:

(Officer's Name) (Seal)
I, _____, Notary Public in and for the above named County and State do hereby certify that _____ personally known to me to be the affiant in the _____
(Officer's Name)
foregoing Affidavit, personally appeared before me this day and, having been duly sworn, deposes and says that the facts set forth in the above Affidavit are true and correct.

WITNESS my hand and seal this ____ day of _____, 20__.

(Seal)

Notary Public for the State of _____
My Commission Expires: _____

FOLLOWING ARE TWO 00800 SECTIONS.

WHERE A CONFLICT EXISTS BETWEEN THE TWO,
THE MORE STRINGENT REQUIREMENT OR STATEMENT SHALL APPLY.

SECTION 00700

GENERAL CONDITIONS

ARTICLE 1 - CONTRACT AND CONTRACT DOCUMENTS

- 1.1 The plans, specifications and addenda, hereinafter enumerated in Paragraph 1 of 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 herein fully set forth. The table of contents titles, heading, 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 interpretations of the provisions to which they refer.

Contents

1	Contract and Contract Documents	23	Right of Owner to Terminate Contract
2	Definitions	24	Construction Schedule and Periodic Estimates
3	Additional Instructions and Detail Drawings	25	Payments to Contractor
4	Shop Drawings and Samples	26	Acceptance of Work and Final Payment
5	Materials, Services & Facilities	27	Acceptance of Final Payment as Release
6	Contractor's Title to Materials	28	Payments by Contractor
7	Inspection and Testing of Materials	29	Insurance
8	"Or Equal" Clause	30	Contract Security
9	Patents	31	Assignments
10	Surveys, Laws and Regulations	32	Mutual Responsibility of Contractors
11	Contractor's Obligations	33	Separate Contracts
12	Weather Conditions	34	Engineer's Authority
13	Protection of Work and Property, Emergency Interpretations	35	Stated Allowances
14	Reports, Records and Data	36	Use of Premises and Removal of Debris
15	Superintendence by Contractor	37	Quantities of Estimate
16	Changes in Work	38	Rights-of-Way and Suspension of Work
17	Extras	39	Warranty for One Year After Completion of Contract
18	Time for Completion and Liquidated Damages	40	Notice and Service Thereof
19	Correction of Work	41	Required Provisions Deemed Inserted
20	Subsurface Conditions Found Different	42	Protection of Lives and Health
21	Claims for Extra Cost	43	Conflicting Conditions
22		44	Mitigation Measures and Conditions

ARTICLE 2 - DEFINITIONS

2.1 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 or 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.

ARTICLE 3 - ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

3.1 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 on the work in accordance with the additional detail drawings and instructions. The Contractor and the 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 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, supplies, 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.

ARTICLE 4 - SHOP DRAWINGS AND SAMPLES

4.1 After checking and verifying, the Contractor shall submit to the Engineer for approval in accordance with the accepted schedule of Paragraph 3, and in conformance with Section 01340, all Shop Drawings.

4.2 Samples: Contractor shall also submit to the Engineer for approval, all samples required by the Contract Documents in conformance with Section 01340.

4.3 Deviations: At the time of each submission, Contractor shall in writing call the Engineer's attention to any deviations that the Shop Drawings or samples may have from the requirements of the contract documents.

4.4 Engineer's Review: Engineer will review and approve with reasonable promptness Shop Drawings and samples, but his review and approval shall be only for conformance with the design concept of the project and for compliance with the information given in the Contract Documents. The approval of a separate item as such will not indicate approval of the assembly in which the item functions. Contractor shall make any corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and resubmit new samples until approved. Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections called for by Engineer on previous submissions. Contractor's stamp of approval on any Shop Drawing

or sample shall constitute a representation to Owner and Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers and similar data or he assumes full responsibility for doing so, and that he has reviewed or coordinated each Shop Drawing or sample with the requirements of the work and Contract Documents.

- 4.5 Contractor's Records: Where a Shop Drawing or sample submission is required by the Specifications, no related work shall be commenced until the submission has been approved by Engineer. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by Contractor at the site and shall be available to Engineer.
- 4.6 Contractor's Responsibility: Engineer's approval of Shop Drawings or sample shall not relieve Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless Contractor has in writing called the Engineer's attention to such deviation at the time of submission and Engineer has given written approval to the specific deviation, nor shall any approval by Engineer relieve Contractor from responsibility for errors or omissions in the Shop Drawings.

ARTICLE 5 - MATERIALS, SERVICES AND FACILITIES

- 5.1 All materials, services, and facilities shall be furnished by the Contractor.
- 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, gas, lights, power, transportation, superintendence, taxes, insurance, 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 Sundays, or legal holidays, shall be performed without additional expense to the Owner.

ARTICLE 6 - CONTRACTOR'S TITLE TO MATERIALS

- 6.1 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 or encumbrances.

ARTICLE 7 - INSPECTION AND TESTING OF MATERIALS

- 7.1 Unless otherwise specifically provided for in the specifications, the inspection and testing of material and finished articles to be incorporated in the work at the site shall be made by bureaus, laboratories, or agencies approved by the Owner. The cost of such inspection and testing shall be paid by the Contractor.
- 7.2 Certification by Contractor: Where the detailed specifications call for certified copies of mill or shop tests to establish conformance of certain materials with the specifications, it shall be the responsibility of the Contractor to assure delivery of such certifications to the Owner. No materials or finished articles shall be incorporated in the work until such materials and finished articles have passed the required tests. The Contractor shall promptly segregate and remove rejected material and finished articles from the site of work.

- 7.3 Guaranty: The testing and approval of materials by the laboratory, or laboratories, shall not relieve the contractor of a guarantee of workmanship and materials as called for in paragraph entitled "General Warranty for One Year After Completion of Contract" herein. The Contractor may, at his option and at his own expense, cause such other tests to be conducted as he may deem necessary to assure suitability, strength and durability of any material or finished article.

ARTICLE 8 - "OR EQUAL" CLAUSE

- 8.1 The phrase "or equal" shall be construed to mean that material or equipment will be acceptable only when, in the judgement of the Engineer, they are composed of parts of equal quality, or equal workmanship and finish, designed and constructed to perform or accomplish the desired result as efficiently as the indicated brand, pattern, grade, class, make or model. Written approval will be obtained from the Engineer prior to installation.

ARTICLE 9 - PATENTS

- 9.1 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 of, 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. If the Contractor uses any design, device or material covered by letter 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 material, 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 infringements by reason of the use of such patented or copyrighted design, device or materials or any trademark of 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.

ARTICLE 10 - SURVEYS, LAWS AND REGULATIONS

- 10.1 The Contractor shall comply with the following:
- A. Construction staking: shall be in accordance with the requirements of the Section 01050 - Field Engineering.
 - B. Laws and Regulations: The Contractor shall keep himself fully informed of all laws, ordinances and regulations of State, City and County in any manner affecting those engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, and of all orders and decrees of bodies of tribunals having any jurisdiction or authority over same. If any discrepancy or inconsistency should be discovered in this contract, or in the drawings or specifications herein referred to, in relation to any such law, ordinance, regulation, order or decree, he shall forthwith report the same in writing to the Owner. He shall at all times himself observe and comply with all such existing and future laws, ordinances and regulations, (to the extent that such requirements do not conflict with Federal Laws or regulations) and shall protect and indemnify the Owner and its agents against any claims or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by himself or by his employees.

ARTICLE 11 - CONTRACTOR'S OBLIGATIONS

- 11.1 The Contractor shall, 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 provisions of this contract and said specifications, and in accordance with the plans and drawings covered by this contract and any and all supplemental plans and drawings and in accordance with the directions of the 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 and complete the entire work to the satisfaction of the Engineer and the Owner.

ARTICLE 12 - WEATHER CONDITIONS

- 12.1 In the event of temporary suspension of work or during inclement weather, or whenever the 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 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 to so protect its work, such materials shall be removed and replaced at the expense of the Contractor.

ARTICLE 13 - PROTECTION OF WORK AND PROPERTY, EMERGENCY

- 13.1 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 by his duly authorized representatives. In case of 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 Engineer, in a diligent manner. He shall notify the Engineer immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted to the Engineer for approval. Where the Contractor has not taken action but has notified the 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 Engineer. The amount of reimbursement claimed by the Contractor on account of any emergency action shall be determined in the manner provided in the paragraph entitled "Changes in Work" of these specifications.

ARTICLE 14 - INTERPRETATIONS

- 14.1 If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of these proposed contract documents, he may submit to the Engineer a written request for an interpretation thereof. The person submitting the request will be responsible for its prompt and actual delivery. Any interpretation of such documents will be made only by addendum duly issued, and a copy of such addendum will be mailed or delivered to each person receiving a set of such documents. The Owner will not be responsible for any other explanation or interpretation of such documents which anyone presumes to make on behalf of the Owner before expiration of the ultimate time set for the receipt of bids.

ARTICLE 15 - REPORTS, RECORDS AND DATA

- 15.1 The Contractor shall submit to the Owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.

ARTICLE 16 - SUPERINTENDENCE BY CONTRACTOR

- 16.1 The Contractor shall employ only competent and skilled personnel on the work. The Contractor shall have a competent Superintendent or Foreman present all times when the work is in progress, who shall have full authority to act for the Contractor. It is understood that such representatives shall be acceptable to the 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. The Contractor shall, upon demand from the Engineer, immediately remove any superintendent, foreman or workman whom the Engineer may consider incompetent or undesirable.

ARTICLE 17 - CHANGES IN WORK

- 17.1 No changes in the work covered by the approved contract documents shall be made without having prior written approval of the Owner. All change orders including "No Cost" change orders must be approved prior to execution. 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.

ARTICLE 18 - EXTRAS

- 18.1 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 the Engineer acting officially for the Owner, and the price is stated in such order. Extra work shall be performed only upon the execution of authorized change orders as set forth in the preceding paragraph.
- 18.2 Owner and Contractor shall execute appropriate change order as recommended by the Engineer for the following:
- A. Changes in the Work
 - B. Changes in the Contract Price or Contract Times
 - C. Such changes are to be mutually agreed upon by and between the Owner and Contractor. All change orders, including no cost change orders, must obtain written approval from CDBG Grants Administration prior to execution of the change order.

ARTICLE 19 - TIME FOR COMPLETION AND LIQUIDATED DAMAGES

- 19.1 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.

- 19.2 Regular Prosecution of Work: The Contractor agrees that said work shall be prosecuted regularly, diligently and uninterruptedly at such rate of progress as will ensure 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 completion of same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.
- 19.3 Liquidated Damages: If the Contractor shall neglect, fail, or refuse to complete the work within the time herein specified, or any proper extensions thereof granted by the Owner, then the Contractor does hereby agree, as a part of 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 periodic estimates.
- 19.4 Extension of Time for Completion: 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 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 embargos, unusually severe weather, and;
 - C. To any delays of subcontractors or suppliers occasioned by any of the causes specified in subsections (a) and (b) of this article.
- 19.5 Provided further, that the Contractor shall, within seven (7) 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 delay, who shall ascertain the facts and extent of delay and notify the Contractor within a reasonable time of its decision in the matter, and grant such extension of time as the Owner shall deem suitable and just.

ARTICLE 20 - CORRECTION OF WORK

- 20.1 All work, all materials, whether incorporated in the work or not, all processes of manufacturer, and all methods of construction shall be at all times and places subject to the inspection of the Engineer, who shall be the final judge of the quality and suitability of the work, materials, processes of manufacture, and methods of construction of 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.

- A. Rejected material shall immediately be removed from the site. If, in the opinion of the 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 judgment of the Engineer, shall be equitable.

ARTICLE 21 - SUBSURFACE CONDITIONS FOUND DIFFERENT

- 21.1 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 Engineer of such conditions before they are disturbed. The 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 these specifications.
 - A. Where no specific subsurface conditions are indicated or specified, no increase in cost will be considered in regards to subsurface conditions encountered.

ARTICLE 22 - CLAIMS FOR EXTRA COST

- 22.2 No claim for extra work or cost shall be allowed unless the same was done in pursuance of a written order of the Engineer, as aforesaid, and the claim presented with the first estimate after the change or extra work is done. When work is performed under the terms of subparagraph 17 of these specifications, 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.

ARTICLE 23 - RIGHT OF OWNER TO TERMINATE CONTRACT

- 23.1 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 the surety of its intention to terminate the contract, such notices to contain the reasons for such intention to terminate the contract, and unless within 10 days after the serving of such notice upon the Contractor, such violation or delay shall cease and satisfactory arrangement or correction be made, the contract shall, upon the expiration of said 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 and perform the contract; provided, however, that if the surety does not commence performance thereof within 10 days from the date of mailing to such surety of notice of termination, the Owner may take over the work and prosecute 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 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. If the Contractor should die, be declared an incompetent, be declared bankrupt or insolvent, make an assignment for the benefit of creditors during the term of his contract, the Owner may terminate the contract in the manner and under the procedure set forth above with the exception that no notices to the Contractor shall be required, but in lieu thereof the Owner must make a reasonable effort to notify the estate of the Contractor, his guardian, assignee, or legal representative of the intention to terminate and fact of termination, if there is any such guardian, assignee, or legal representative at the time the Owner desires to terminate.

ARTICLE 24 - CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES

- 24.1 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.
- 24.2 Contractor's Estimate: The Contractor shall also furnish:
- 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 addition to or deductions from the contract price.
- 24.3 Equipment Delivery Schedule: The Contractor shall also prepare a schedule of anticipated shipping dates for materials and equipment. It is intended that equipment and materials be so scheduled as to arrive at the job site just prior to time for installation to prevent excessive materials on hand for inventory and the necessity for extensive storage facilities at the job site.

ARTICLE 25 - PAYMENTS TO CONTRACTOR

- 25.1 Payments to Contractor shall be made according to the following:
- A. Payments to the Contractor will be made within thirty (30) days upon receipt of a duly certified approved estimate of the work performed during the preceding calendar month under this contract, but to ensure the proper performance of this contract, the Owner will retain a portion of each estimate until final completion and acceptance of all work covered by this contract in accordance with the following:
 - 1. Retention of up to 10 percent of payment claimed until construction is complete without exception.
 - 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 shall thereupon become the sole property of the Owner, but this provision shall not be construed 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 the terms of the contract.
- 25.2 Owner's Right 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.

- A. If the Contractor fails to do so, then the Owner may, after having served written notice on the 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 at 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 made under the contract by the Owner to the Contractor, and the Owner shall not be liable to the Contractor for any such payment made in good faith.

ARTICLE 26 - ACCEPTANCE OF WORK AND FINAL PAYMENT

26.1 Before final acceptance of the work and payment to the Contractor of the percentage retained by the Owner, the following requirements shall be complied with:

- A. Final Construction Review: Upon notice from the Contractor that his work is completed, the Engineer will make a final construction review of the work and shall notify the Contractor of all instances where his work fails to comply with the contract drawings and specifications, as well as any defects he may discover. The Contractor shall immediately make such alterations as are necessary to make the work comply with the contract drawings and specifications, and to the satisfaction of the Engineer.
- B. Operating Test: After the alterations for compliance with the contract drawings and specifications have been made, and before acceptance of the whole of any part of the work, it shall be subjected to test to determine that it is in accordance with the contract drawings and specifications. The Contractor shall maintain all work in first-class conditions for a thirty (30) day operating period after the work has been completed as a whole, the final construction review has been made, and the Engineer has notified the Contractor in writing that the work has been finished to his satisfaction. The retained percentage as provided herein will not become due or payable to the Contractor until after the thirty (30) day operating period has expired.
- C. Cleaning Up: Before the work is considered as complete, all rubbish and unused material due to or connected with the construction must be removed and the premises left in a condition satisfactory to the Owner. Streets, curbs, crosswalks, pavements, sidewalks, fences and other public and private property disturbed or damaged should be restored to their former conditions. Final acceptance will be withheld until such work is finished.
- D. Liens: Final acceptance of the work will not be granted and the retained percentage will not be due or payable until the Contractor has furnished the Owner proper and satisfactory evidence under oath that all claims for labor and material employed or used in the construction of the work under this contract have been settled, and that no legal claims can be filed against the Owner for such labor or material.
- E. Final Estimate: Upon completion of all cleaning up, alterations and repairs required by the final construction review or operating test, the satisfactory completion of the operating test, and upon submitting proper and satisfactory evidence to the Owner that all claims have been settled, the Engineer shall then prepare his final estimate. After review and approval of the final estimate by the Engineer and the Owner, the payment shall then become due.

ARTICLE 27 - ACCEPTANCE OF FINAL PAYMENT AS RELEASE

- 27.1 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, final or otherwise, shall operate to release the Contractor or his sureties from any obligations under this contract or the performance and payment bond.

ARTICLE 28 - PAYMENTS BY CONTRACTOR

- 28.1 The Contractor shall pay:
- A. For all transportation and utility services not later than the 20th 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 (90) percent of the cost thereof not later than the 20th 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 30th day following 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 the subcontractors not later than the 5th day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his subcontractors to the extent of each subcontractor's interest therein.

ARTICLE 29 - INSURANCE

- 29.1 The Contractor shall procure and maintain during the life of this contract, whether such operation be by himself or by a subcontractor or anyone directly or indirectly employed by either of them, such insurance as required by statute and/or ordinance to adequately protect the Owner from any claims or damages, including bodily injury or death, which may arise from them during operations under this contract.
- 29.2 Limits of Liability: Insurance shall be obtained for not less than the limits of liability as specified in Section 3 of the attached Supplemental General Conditions.
- 29.3 Certificates of Insurance: The Contractor shall furnish the Owner, if requested, certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of the policies. Such certificates shall contain substantially the following statement: "The insurance covered by this certificate will not be cancelled or materially altered except after 30 days written notice has been received by the Owner".

ARTICLE 30 - CONTRACT SECURITY

- 30.1 The Contractor shall furnish a 100 percent performance bond and a 100 percent payment bond as security for the faithful performance of this contract, 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 payment bond shall be in separate instruments. Before the final acceptance, each bond must be approved by the Owner.

ARTICLE 31 - ASSIGNMENTS

- 31.1 The Contractor shall not assign the whole or any part of this contract or any moneys due or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or any part of any 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 moneys due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in this contract.

ARTICLE 32 - MUTUAL RESPONSIBILITY OF CONTRACTORS

- 32.1 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 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.

ARTICLE 33 - SEPARATE CONTRACTS

- 33.1 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 Subcontractor, shall keep informed of the progress and the detail work of other Contractors and shall notify the Engineer immediately of lack of progress or defective workmanship on the part of the 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.

ARTICLE 34 - ENGINEER'S AUTHORITY

- 34.1 The 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 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 or specifications, the determination or decision of the 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.
- 34.2 Interpretation of Drawings and Specifications: The 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 Engineer.

ARTICLE 35 - STATED ALLOWANCES

- 35.1 The Contractor shall include in his proposal the cash allowances stated in the Supplemental General Conditions. The Contractor shall purchase the "Allowed Material" by

soliciting not less than three bids as directed by the Owner. 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.

ARTICLE 36 - USE OF PREMISES AND REMOVAL OF DEBRIS

36.1 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 conform to the plans and specifications, and, except with the consent of the Engineer, not to cut or otherwise alter the work of any other contractor.

ARTICLE 37 - QUANTITIES OF ESTIMATE

37.1 The estimated quantities of work to be done and materials to be furnished under this contract, shown in any of the documents, including the proposal, 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.

ARTICLE 38 - RIGHTS-OF-WAY AND SUSPENSION OF WORK

38.1 The Owner shall furnish all land and rights-of-way necessary for the carrying out of his contract and the completion of the work herein contemplated, all land and rights-of-way have been acquired for the work shown in the contract documents. Should additional land or rights-of-way be required for additional work or should the Owner be prevented or enjoined from proceeding with the work, or from authorizing its prosecution, either before or after the commencement, by reason of any litigation or by reason of its ability to procure any additional lands or rights-of-way required for said additional work, the Contractor shall not be entitled to make or assert claim for damage by reason of said delay or to withdraw from the contract except by consent of the Owner; but time for completion of the work will be extended to such time as the Owner determines will compensate for the time lost by such delay, such determination to be set forth in writing.

ARTICLE 39 - GENERAL WARRANTY FOR ONE YEAR AFTER COMPLETION OF CONTRACT

- 39.1 For a period of at least one year after the completion of the contract, the Contractor warrants the fitness and soundness of all work done and materials and equipment put in place under the contract, and 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.

ARTICLE 40 - NOTICE AND SERVICE THEREOF

- 40.1 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 registered mail to said Contractor or his authorized representative on the work, or is deposited in the regular United States Mail in a sealed, postage prepaid envelope and the receipt thereof is acknowledged by the Contractor.
- 40.2 Owner's Notice: All papers required to be delivered to the Owner shall be delivered as indicated in the Supplemental General Conditions.

ARTICLE 41 - REQUIRED PROVISIONS DEEMED INSERTED

- 41.1 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 be 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.

ARTICLE 42 - PROTECTION OF LIVES AND HEALTH

- 42.1 In order to protect the lives and health of his employees under the contract, the Contractor shall comply with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., and shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the contract. The Contractor alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances and methods, and for any damage which may result from their failure or their improper construction, maintenance or operation.

ARTICLE 43 - CONFLICTING CONDITIONS

- 43.1 Should any provision in any of the Contract Documents be in conflict or inconsistent with any of the paragraphs in these General Conditions, the more stringent provision shall prevail.

ARTICLE 44 - MITIGATION MEASURES AND CONDITIONS (40 CFR 1505.2(c)).

- 44.1 Summary below of all mitigation measures adopted by the Responsible Entity to reduce, avoid, or eliminate adverse environmental impacts and to avoid non-compliance or non-conformance with the above-listed authorities and factors. These measures/conditions must be incorporated into project contracts, development agreements, and other relevant documents. The staff responsible for implementing and monitoring mitigation measures should be clearly identified in the mitigation plan.

Mitigation Measures and Conditions [40 CFR 1505.2(c)]

Summarize below all mitigation measures adopted by the Responsible Entity to reduce, avoid, or eliminate adverse environmental impacts and to avoid non-compliance or non-conformance with the above-listed authorities and factors. These measures/conditions must be incorporated into project contracts, development agreements, and other relevant documents. The staff responsible for implementing and monitoring mitigation measures should be clearly identified in the mitigation plan.

Law, Authority, or Factor	Mitigation Measure
SC Archives & History Catawba Indian Nation	<i>If archaeological materials consisting of fifty-year-old or older are found, Native American artifacts, and human remains are found during ground disturbing activities, these agencies must be notified, and construction must stop.</i>
SCDHEC	<i>Drinking water system construction requires a permit from the Bureau. Our review of acceptability will occur with review of application for a permit. Also, the applicant should check with the local water utility on available capacity.</i>

END OF SECTION

SUPPLEMENTAL GENERAL CONDITIONS

A. ENUMERATION OF PLANS, SPECIFICATIONS AND ADDENDA

1. The plans, specifications and addenda which form a part of this contract as set forth in Paragraph 1 of the General Conditions, Contract and Contract Documents are enumerated in Section 00005 - Table of Contents and Section 00851 - Drawings Index.

B. CONTRACTOR'S AND SUBCONTRACTOR'S INSURANCE

1. As required under Paragraph 29 of the General Conditions, 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 his Subcontract until all similar insurance required of the SUBCONTRACTOR has been so obtained and approved.
2. Unless otherwise specified in this Contract, the CONTRACTOR shall, at its sole expense, maintain in effect at all times, during the performance of WORK, insurance coverage with limits not less than those set forth below with insurers and under forms of policies satisfactory to OWNER.
3. The CONTRACTOR shall deliver Certificates of Insurance to the ENGINEER no later than ten (10) days after award of the Contract but in any event, prior to execution of the Contract by the OWNER and prior to commencing WORK on the site as evidence that policies providing such coverage and limits of insurance are in full force and effect.
 - a. Certificates shall provide that not less than thirty (30) days advance notice will be given in writing to the OWNER prior to cancellation, termination or material alteration of said policies of insurance.
 - b. Certificates shall identify on their faces the PROJECT NAME and the ENGINEER'S PROJECT NUMBER.
4. Additional Insured: The Commercial General Liability and Excess Liability (Umbrella) insurance policies shall be endorsed to include the OWNER and ENGINEER as additional insured. Such insurance shall be primary and not be contributory with any other insurance maintained by the OWNER or ENGINEER.
5. The OWNER is not maintaining any insurance on behalf of the CONTRACTOR covering against loss or damage to the WORK or to any other property of the CONTRACTOR unless otherwise specifically stated herein and as may be described by appendix hereto. In the event the CONTRACTOR maintains insurance against physical loss or damage to the CONTRACTOR'S construction equipment and tools, such insurance shall include an insurer's waiver of rights of subrogation in favor of OWNER.
6. Indemnification:
 - a. CONTRACTOR will indemnify and hold harmless the OWNER, the ENGINEER and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the WORK, provided that any such

claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act of omission of the CONTRACTOR and SUBCONTRACTOR, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

- b. In any and all claims against the OWNER or the ENGINEER, or any of their agents or employees, by an employee of the CONTRACTOR, any SUBCONTRACTOR, anyone directly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by limitation on the amount or type of damages, compensation or benefits payable by or for the CONTRACTOR or any SUBCONTRACTOR under workmen's compensation acts, disability benefit acts or other employee benefits acts.
- c. The obligation of the CONTRACTOR under this paragraph shall not extend to the liability of the ENGINEER, its agents or employees arising out of the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, design or specifications.

7. **Insurance Requirements:**

- a. **Commercial General Liability Insurance:** The CONTRACTOR shall take out and maintain during the life of the Contract such commercial general liability insurance as shall protect him from claims for damage for bodily injury, including accidental death, as well as from claims for property damage, which may arise from operations under this contract whether such operations are by himself or by any SUBCONTRACTOR or by anyone directly or indirectly employed by either of them. The amount of such insurance shall be not less than the following:

General Aggregate	\$2,000,000.00
Products - Complete/Operations Aggregate	\$2,000,000.00
Personal and Advertising Injury	\$1,000,000.00
Each Occurrence	\$1,000,000.00
Fire Damage (Any one fire)	\$50,000.00
Medical Expenses (Any one person)	\$5,000.00

- 1) The General Aggregate listed above shall be for this project only.
 - 2) **Special Hazards:** The CONTRACTOR'S and his SUBCONTRACTOR'S General Liability Insurance shall provide adequate protection against use of explosives, collapse, and underground hazards. Each detonation of blasting shall be considered a single occurrence.
- b. **Comprehensive Automobile Liability Insurance:**
 - 1) Includes coverage for all owned, hired and non-owned automobiles.
 - 2) The combined single limit of liability shall not be less than the following:

Any One Accident or Loss	\$1,000,000.00
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c. **Excess Liability (Umbrella) Insurance:**

- 1) CONTRACTOR shall carry and maintain Combined Excess Liability (Umbrella) insurance for a limit not less than the following:

Each Occurrence	\$2,000,000.00
Aggregate	\$2,000,000.00

d. **Worker's Compensation:** The insurance required by this Section shall be written for not less than the following or greater if required by law:

- 1) Statutory benefits as provided by South Carolina Law.
2) Employers' Liability:

Each Accident	\$500,000.00
Disease - Policy Limit	\$500,000.00
Disease - Each Employee	\$500,000.00

e. **Builders Risk Insurance and Installation Floater Policy:** Where buildings and applicable above-ground structures are included in the Project, CONTRACTOR shall purchase and maintain an "all risk" or special perils form builder's risk policy. Where utilities and underground structures are included in the Project, CONTRACTOR shall purchase and maintain an Installation Floater Policy. Policy shall be issued in the name of the CONTRACTOR, OWNER and all SUBCONTRACTORS for the full contract value of the insurable portions of the WORK. This policy shall contain a provision that in the event of payment of any loss or damage, the insurer will have no rights of recovery against any of the parties named as insureds or additional insureds.

f. **Flood Insurance:** The CONTRACTOR is required to carry flood insurance for projects located in designated flood hazard areas in which Federal Flood Insurance is available.

h. **OWNER'S Protective Liability Insurance:** The CONTRACTOR shall purchase and maintain an OWNER'S Protective Liability policy issued in the name of the OWNER with a combined single limit of liability of not less than the following:

Each Occurrence	\$2,000,000.00
Aggregate	\$2,000,000.00

C. **ABBREVIATIONS AND DEFINITIONS**

1. Abbreviations used in these Specifications refer to the following:

OWNER: City of Bennettsville, SC

ENGINEER: AECOM Technical Services, Inc. or their duly authorized representative

2. Definitions: Wherever in the specifications or upon the drawings the words "directed", "required", "permitted", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation or prescription of the OWNER is intended; and similarly, the words "approved", "acceptable", "satisfactory", or words of like import shall mean approved by, or acceptable to, or satisfactory to the OWNER, unless otherwise expressly stated.

D. PHOTOGRAPHS OF PROJECT

1. No photographs of the project will be required.

E. SCHEDULE OF OCCUPATIONAL CLASSIFICATIONS AND MINIMUM HOURLY WAGE RATES

1. The schedule of Occupational Classification and Minimum Hourly Wage Rates applicable to this job are included in these specifications. Any changes will be issued in addendum form prior to the bidding date.

F. NOTICE AND SERVICE THEREOF

1. All papers required to be delivered to the OWNER shall, unless otherwise specified in writing to the CONTRACTOR, be delivered to the OWNER'S representative as indicated below, and any notice to or demand upon the OWNER shall be sufficiently given if delivered to the office of said representative, or if deposited in the United States Mail, in a sealed postage prepaid envelope, or delivered with charges prepaid to any telegraph company for transmission, in each case addressed to the OWNER'S representative as indicated below, or to such other representative of the OWNER, or to such other address as the OWNER may subsequently specify in writing to the CONTRACTOR for such purposes. The OWNER'S representative is as follows:

Mr. William Simon
City Administrator
City of Bennettsville
501 Main Street
Bennettsville, SC 29512

G. CORRELATION OF PLANS AND SPECIFICATIONS

1. The contract, plans and specifications are to be interpreted as mutually explanatory or supplementary, and therefore any features shown in one and not in the other shall have the same force and effect as if shown by both, and shall be fully executed. Prior to execution of the WORK, the CONTRACTOR shall check all drawings and specifications, and shall immediately report to the ENGINEER all errors, discrepancies, conflicts and omissions discovered therein. All such errors, discrepancies, conflicts and omissions will be adjusted by the ENGINEER, and adjustment by the CONTRACTOR without prior approval shall be at his own risk. The settlement of any complications arising from such adjustments shall be made by the CONTRACTOR at his own expense and to the satisfaction of the OWNER.

H. OWNERSHIP OF DRAWINGS

1. All drawings, specifications and memoranda relating to the WORK are the property of the OWNER and are to be carefully used and returned to the OWNER upon completion or cessation of the WORK from any cause.

2. Plans and specifications to be furnished: Five (5) sets of specifications and plans will be furnished to the CONTRACTOR without charge. Additional sets can be secured from the ENGINEER upon request at cost of reproduction. The CONTRACTOR shall have available on the project site at all times one (1) copy of each of said plans and specifications.

I. ORDER OF WORK

1. The prosecution, order or sequence of the WORK shall be as approved by the ENGINEER, which approval, however, shall in no way affect the responsibility of the CONTRACTOR.

J. PHYSICAL DATA

1. The drawings, which accompany and form a part of the contract, have been prepared on the basis of surveys and observations of the site, and are intended to present an essentially accurate indication of the physical conditions at the site. However, this shall not relieve the CONTRACTOR of the necessity for familiarizing himself with physical conditions at the site, and any discrepancies found in the drawings shall not be grounds for claims by the CONTRACTOR against the OWNER, or for non-performance of WORK specifically provided for under the contract.

K. CONSTRUCTION RESOURCES AND PROGRESS

1. The following is supplemental to Paragraph 16 of the General Conditions:
 - a. The CONTRACTOR shall give his personal superintendence to the WORK, or shall have a competent superintendent with authority to act for him, to the satisfaction of the ENGINEER, on the job at all times during the progress of the WORK.
 - b. The CONTRACTOR shall employ experienced personnel and provide all necessary construction resources including tools, supplies and equipment sufficient to accomplish the WORK in a safe and workmanlike manner at a rate of progress satisfactory to the OWNER. All equipment shall be maintained in good working order and provision shall be made for immediate emergency repairs. Spares tools and equipment shall be maintained on the job site so that a failure of such does not compromise the progress of the work.
 - c. Should the CONTRACTOR fail to maintain a rate of progress which, in the opinion of the OWNER, will complete WORK within the time limit specified, the OWNER may require that additional persons working, if necessary, during additional periods or shifts, or additional equipment, or both, be placed on the WORK; or a reorganization of construction resources be implemented in order that the progress of the WORK be brought up to schedule and so maintained. Should the CONTRACTOR refuse or neglect to increase personnel, extend the working period or provide adequate construction resources, or to reorganize or reallocate personnel and resources in the manner satisfactory to the OWNER, the latter may proceed under the provisions of the Contract to rectify the conditions.

L. ENGINEER'S REVIEW AND CONTRACTOR'S INSPECTION

1. The WORK shall be periodically reviewed by the ENGINEER's representatives, but the presence of the ENGINEER's representatives shall not relieve the

CONTRACTOR or his responsible agent of responsibility for the proper execution of the WORK.

2. The CONTRACTOR will be required to furnish at his expense such labor, organization and materials which form a part of the ordinary and usual equipment and crew of the CONTRACTOR as may be reasonably necessary in inspecting and supervising the WORK. Should the CONTRACTOR refuse, neglect or delay compliance with this requirement, the specified facilities may be furnished and maintained by the OWNER and the cost thereof will be deducted from any amounts due, or to become due, the CONTRACTOR.
3. Except as specified in this paragraph, or otherwise provided for in these specifications, all expense of inspection will be borne by the CONTRACTOR.
4. It is understood that any instruction or decision given by the ENGINEER through the Resident ENGINEER is to be considered the instruction or decision of the OWNER, in all cases where, under the terms of this contract, decision rests with the ENGINEER.
5. The ENGINEER or his authorized representative shall have access to the WORK at all times.

M. STANDARD TESTS, QUALITY AND GUARANTEES

1. Standard tests, quality and guarantees shall comply with the following:
 - a. All materials, supplies and parts and assemblies thereof, entering into the WORK to be performed under these specifications, shall be tested as specified herein or otherwise required, in conformity with the contract and according to the best modern approved methods for the particular type and class of WORK.
 - b. Unless waived in writing by the ENGINEER, all tests and trials shall be made in the presence of a duly authorized representative of the ENGINEER. When the presence of the inspector is so waived, sworn statements in duplicate of the tests made and results thereof shall be furnished to the ENGINEER by the CONTRACTOR as soon as possible after completion of tests.
 - c. Unless otherwise authorized, directed or specified, where standard published specifications of recognized authorities and organizations are mentioned, the latest revision of such specification current at the time when the WORK is executed shall govern.
 - d. 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.
 - e. 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.
 - f. In accordance with the Contract, all materials, parts and equipment furnished and incorporated in the WORK shall be high grade, free from defects and imperfections, of recent manufacture and unused.

Workmanship shall be of the highest grade and in accordance with the best modern standard practice.

N. STANDARD PRODUCTS

1. All materials supplied and articles furnished shall, wherever specified and otherwise wherever practicable, be the standard products of recognized, reputable manufacturers. The standard products of manufacturers other than those specified will be accepted when it is proven to the satisfaction of the ENGINEER, in accordance with the Contract, that they are equal in strength, durability, usefulness and convenience for the purpose intended. Any changes required in the details and dimensions indicated on the drawings, or the substitution of standard products other than those provided for, shall be properly made as approved by the ENGINEER and at the expense of the CONTRACTOR.

O. INTEREST OF CERTAIN FEDERAL AND OTHER OFFICIALS

1. No member of or delegate to the Congress of the United States and no Resident Commissioner shall be admitted to any share or part of this Contract or to any benefit to arise from the same. Provided, that the foregoing provision of this Section shall not be construed to extend to this Contract if made with a corporation for its general benefit.
2. No member of the governing body of the Local Public Agency who exercises any functions or responsibilities in connection with the carrying out of the Project to which this Contract pertains, and no other officer or employee of the Local Public Agency who exercises any such functions or responsibilities, shall have any private interest, direct or indirect, in this Contract which is incompatible or in conflict with the discharge or fulfillment of his functions and responsibilities in connection with the carrying out of the project to which this Contract pertains.

END OF SECTION

Superseded General Decision Number: SC20240019

State: South Carolina

Construction Type: Building

Counties: Chesterfield, Dillon, Lee, Marion and Marlboro
Counties in South Carolina.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	<ul style="list-style-type: none">. Executive Order 14026 generally applies to the contract.. The contractor must pay all covered workers at least \$17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	<ul style="list-style-type: none">. Executive Order 13658 generally applies to the contract.. The contractor must pay all covered workers at least \$13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

SUSC2011-015 08/31/2011

	Rates	Fringes
CARPENTER, Excludes Form Work....	\$ 14.46 **	0.78
ELECTRICIAN.....	\$ 15.00 **	0.00
FORM WORKER.....	\$ 14.23 **	0.00
LABORER: Common or General.....	\$ 9.76 **	0.76
LABORER: Pipelayer.....	\$ 12.62 **	1.46
OPERATOR: Backhoe/Excavator/Trackhoe.....	\$ 16.17 **	1.76
PAINTER: Brush, Roller and Spray.....	\$ 13.55 **	1.20
PIPEFITTER.....	\$ 19.58	4.94
PLUMBER.....	\$ 16.99 **	2.17
SHEET METAL WORKER (HVAC Duct Installation Only).....	\$ 16.00 **	0.00
TRUCK DRIVER.....	\$ 12.76 **	2.04

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.75) or 13658 (\$13.30). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the

year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage

and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7).
Requests for review and reconsideration can be submitted via
email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the
interested party's position and any information (wage payment
data, project description, area practice material, etc.) that
the requestor considers relevant to the issue.

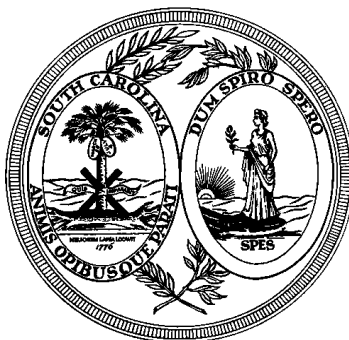
3) If the decision of the Administrator is not favorable, an
interested party may appeal directly to the Administrative
Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

**DEPARTMENT OF COMMERCE
GRANTS ADMINISTRATION
COMMUNITY DEVELOPMENT BLOCK GRANT PROGRAM**



CONTRACT SPECIAL PROVISIONS

The following CDBG Contract Special Provisions should be used with all construction contracts, including housing rehabilitation, as applicable, and professional service contracts, where CDBG funds are being used in whole or in part.

CONTRACT SPECIAL PROVISIONS

1. **Definitions:** For purposes of this Contract, the following terms shall have the meanings set forth below:
 - (a) “Assistance” means the CDBG grant funds provided, or to be provided, to the Grantee by the State, pursuant to the Grant Award Agreement.
 - (b) “CDBG” means Community Development Block Grant.
 - (c) “Contract” means the contractual agreement between the Owner and the Contractor to which these Contract Special Provisions have been incorporated and made a part thereof.
 - (d) “Contractor” means the contractor whose services are retained pursuant to the Contract.
 - (e) “Grantee” means the unit of local government designated as the recipient of the Assistance in the Grant Award and signing the acceptance provision of the Grant Award.
 - (f) “HUD” means U.S. Department of Housing and Urban Development, which is the federal agency that awards and has authority over CDBG funding to the State.
 - (g) “Owner” means the Grantee or Subrecipient, as applicable.
 - (h) “Project” means the project for which the services of the Contractor have been retained pursuant to the Contract which are funded, in whole or in part, with CDBG funds.
 - (i) “State” means the State of South Carolina, or that agency, agency division, or Office of State government which has been delegated the responsibility for administering the CDBG program for the State of South Carolina, as appropriate.
 - (j) “Subrecipient” means the agent of the unit of local government as designated by an agreement.
 - (k) “Labor Surplus Area” means a civil jurisdiction that has an unemployment rate at least 20% above the average unemployment rate for all states, the District of Columbia, and Puerto Rico during the previous two calendar years. The Department of Labor issues the labor surplus area list on a fiscal year basis.

2. **Prime Contractor Responsibilities:** The Contractor is required to assume sole responsibility for the complete effort and enforcement of laws and regulations under this Contract. The Owner will consider the Contractor to be the sole point of contact with regard to contractual matters. All contractors must be registered in SAM and eligible to receive federal contracts.
3. **Federal and State Laws:** The Contractor agrees to comply with all CDBG requirements as well as other federal and state laws, regulations, or Executive Orders. The State reserves the right to add or delete terms and conditions of this Contract as may be required by revisions and additions or changes in the requirements, regulations, and laws governing the CDBG Program.
4. **Procurement and Contracting:** In accordance with 2 CFR Part 200, the cost plus a percentage of cost and percentage of construction cost methods of contracting shall not be used. This provision shall supersede any conflicting provision in an executed contract document or agreement funded in whole or in part with CDBG funds.
 - (a) The Grantee shall ensure compliance with the requirements of the Build America, Buy America Act, as amended 41 U.S.C 8301 et. Seq. and all applicable HUD regulations. This domestic content procurement preference requires that all iron, steel, manufactured products, and construction materials used in covered infrastructure projects are produced in the United States.
5. **Ownership:** Ownership of all real or personal property, acquired in whole or in part with CDBG funds for use on this Project, shall be vested in the Grantee, unless otherwise authorized by the State. When the Grantee determines that the property is no longer required for the purposes of this Project, the Grantee must notify the State and obtain approval for disposition of the property in accordance with applicable guidelines.
6. **Copyright:** Except as otherwise provided in the terms and conditions of this Contract, the Contractor paid through this Contract is free to copyright any books, publications or other copyrightable materials developed in the course of the Project and under this Contract. However, HUD and the State reserve a royalty-free, non-exclusive and irrevocable license to reproduce, publish or otherwise use and to authorize others to use, for Federal government and State purposes:
 - (a) the copyright in any work developed under this Contract; and
 - (b) any rights of copyright to which a subcontractor purchases ownership with grant support.

The Federal government's rights and the State's rights identified above must be conveyed to the publisher and the language of the publisher's release form must insure the preservation of these rights.
7. **Reporting Requirements:** The Contractor agrees to complete and submit all reports, in such form and according to such schedule, as may be required by the State or HUD. Further, the Contractor agrees to require any subcontractors to submit reports that may be required and to incorporate such language in its agreements. Failure to meet deadlines with the required information could result in sanctions.

8. **Access to Records:** All records with respect to all matters covered by this Contract shall be made available at any time for audit and inspection by HUD, the State or the Grantee or their representatives upon their request.
9. **Maintenance of Records:** Records for non-expendable property purchased totally or partially with Federal funds must be retained for five years after final close-out of the grant. All other pertinent contract records including financial records, supporting documents and statistical records shall be retained for a minimum of five years after the final close-out report. However, if any litigation, claim, or audit is started before the expiration of the five-year period, then records must be retained for five years after the litigation, claim or audit is resolved.
10. **Confidential Information:** Any reports, information, data, etc., given to, prepared by, or assembled by the Contractor under this Contract, which the Grantee or the State requests to be kept confidential, shall not be made available to any individual or organization by the Contractor without prior written approval of the Grantee or the State, as applicable.
11. **Reporting of Fraudulent Activity:** If at any time during the term of this Contract anyone has reason to believe by whatever means that, under this or any other program administered by the State, a recipient of funds has improperly or fraudulently applied for or received benefits, monies or services pursuant to this Contract or any other contract, such information shall be reported immediately to the appropriate authorities.
12. **Political Activity:** None of the funds, materials, property or services provided directly or indirectly under this Contract shall be used for any partisan political activity, or to further the election or defeat of any candidate for public office or otherwise in violation of the provisions of Section 8-13-765 of the Code of Laws of South Carolina, 1976, as amended.
13. **Whistleblower Rights:** Grantees and subgrantees are required to inform their employees in writing of the employee's whistleblower rights and protections as prescribed under law. 2 CFR 200.217.

14. Conflicts of Interest and Ethical Standards, South Carolina Consolidated

Procurement Code: The following provisions regarding "conflicts of interest" apply to the use and expenditure of CDBG funds by the Grantee and its subrecipients, including the Contractor.

In the procurement of supplies, equipment, construction and services, the more restrictive conflict of interest provisions of the State of South Carolina Ethics, Government Accountability and Campaign Reform Act of 1991 or of the Contractor shall apply.

In cases not governed by the above, such as the acquisition and disposition of real property and the provision of CDBG assistance to individuals, businesses and other private entities, the following provisions shall apply: except for eligible administrative or personnel costs, generally no employee, officer, agent, or board member with a real or apparent conflict of interest may participate in the selection, award, or administration of a contract supported by the Federal award of CDBG funds. This conflict of interest provision applies to employees who exercise, or have exercised, any function or responsibilities with respect to CDBG activities assisted herein, or, are in a position to participate in a decision making process or gain inside information, who may obtain a financial interest or benefit from the activity, or have an interest in any contract, subcontract or agreement with respect thereto, or the proceeds thereunder either for themselves

or those with whom they have family or business ties during their tenure or for one year thereafter. See 2 CFR 200.318(c).

Should any governmental entity, contractor, subcontractor, employee, board member or official know or perceive any breach of ethical standards or conflict of interest under the CDBG grant awarded to the Grantee or any other CDBG grant, they shall immediately notify in writing the Department of Commerce, Grants Administration, 1201 Main Street, Suite 1600, Columbia, South Carolina, 29201. If the State finds any circumstances that may give rise to a breach of ethical standards or conflict of interest, under any grant, they shall notify the participating governmental entity and the State Ethics Commission as applicable. The State may undertake any administrative remedies it deems appropriate, where there is a breach of ethical standards or conflict of interest under the regulations governing the CDBG Program and the State policies.

15. **Applicable Law:** In addition to the applicable Federal laws and regulations, this Contract is also made under and shall be construed in accordance with the laws of the State. By execution of this Contract, the Contractor agrees to submit to the jurisdiction of the State for all matters arising or to arise hereunder, including but not limited to performance of said Contract and payment of all licenses and taxes of whatever kind or nature applicable hereto.
16. **Limitation of Liability:** The Contractor will not assert in any legal action by claim or defense or take the position in any administrative or legal procedures that he is an agent or employee of the Owner. This provision is not applicable to contracts for CDBG administration services where the Contractor is a Council of Government. The State shall not be liable for failure on the part of the Grantee or any other party to perform all work in accordance with all applicable laws and regulations. The Grantee agrees to defend, indemnify, and hold harmless the State from and against all claims, demands, judgments, damages, actions, causes of actions, injuries, administrative orders, consent agreement and orders, liabilities, penalties, costs, and expenses of any kind whatsoever, including, without limitation, claims arising out of loss of life, injury to persons, property, or business or damage to natural resources in connection with the activities of the Grantee and any other third parties in a contractual relationship with the Grantee, or a subsidiary, whether or not occasioned wholly or in part by any condition, accident, or event caused by any act or omission of the State as a result of the Assistance.
17. **Legal Services:** No attorney-at-law shall be engaged through the use of any funds provided under this Contract in any legal action or proceeding against the State, the Grantee, any local public body or any political subdivision.
18. **Contract:** If any provision in this Contract shall be held to be invalid or unenforceable, the remaining portions shall remain in effect. In the event such invalid or unenforceable provision is considered an essential element of this Contract, the parties shall promptly negotiate a replacement provision, which addresses the intent of such provision.
19. **Amendments:** Any changes to this Contract affecting the scope of work of the Project must be approved, in writing, by the Owner and the Contractor and shall be incorporated in writing into this Contract. Any amendments of the original contract must have written approval by the State prior to execution.
20. **Termination for Convenience:** This Contract may be terminated for convenience in accordance with 2 CFR Part 200.

- 21. Sanctions:** If the Contractor fails or refuses to comply with the provisions set forth herein, the State or Owner may take any or all of the following actions: cancel, terminate or suspend in whole or in any part the contract, or refrain from extending any further funds to the Contractor until such time as the Contractor is in full compliance.
- 22. Subcontracting:** If any part of the work covered by this Contract is to be subcontracted, the Contractor shall identify the subcontracting organization and the contractual arrangements made therewith to the Owner and to the State. All subcontracts must be approved by the Owner and the State to insure they are not debarred or suspended by the Federal or State governments and to insure the Owner and the State understand the arrangements.
- 23. Subcontracting with Small and Minority Firms, Women's Business Enterprise and Labor Surplus Areas:** It is national policy to award a fair share of contracts to disadvantaged business enterprises (DBEs), small business enterprises (SBEs), minority business enterprises (MBEs) and women's business enterprises (WBEs). Accordingly, affirmative steps must be taken to assure that DBEs, SBEs, MBEs and WBEs are utilized when possible as sources of supplies, equipment, construction and services. Affirmative steps shall include the following:
- (a) Including qualified DBEs, SBEs, MBEs and WBEs on solicitation lists;
 - (b) Assuring that DBEs, SBEs, MBEs and WBEs are solicited whenever they are potential sources;
 - (c) Whenever economically feasible, dividing total requirements into smaller tasks or quantities so as to permit maximum participation by DBEs, SBEs, MBEs and WBEs;
 - (d) Where the requirement permits, establishing delivery schedules which will encourage participation by DBEs, SBEs, MBEs and WBEs;
 - (e) Using the services and assistance of the Small Business Administration, Minority Business Development Agency, the State Office of Small and Minority Business Assistance, the U.S. Department of Commerce and the Community Services Administration as required; and
 - (f) Requiring the subcontractor, if any, to take the affirmative actions outlined in (1) – (5) above.
- 24. Debarment Certification:** The Contractor must comply with Executive Orders 12549 and 12689 regarding Federal debarment and suspension regulations prior to entering into a financial agreement for any transaction as outlined below.
- (a) Any procurement contract for goods and services, regardless of type, expected to equal or exceed the Federal procurement small purchase threshold (which is \$100,000 and is cumulative amount from all federal funding sources).
 - (b) Any procurement contract for goods and services, regardless of amount, under which the Contractor will have a critical influence on or substantive control over the transaction.
- In addition, no contract may be awarded to any contractors who are ineligible to receive contracts under any applicable regulations of the State.
- 25. South Carolina Illegal Immigration Reform Act:** The Owner and the Contractor are required to comply with the South Carolina Illegal Immigration Reform Act (signed June 4, 2008) requiring verification of lawful presence in the United States of any alien eighteen

years of age or older who has applied for state or local public benefits, as defined in 8 U.S.C. Section 1621, or for federal public benefits, as defined in U.S.C. Section 1611.

- 26. Equal Employment Opportunity:** 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 State.

In carrying out the Project, the Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor must take affirmative action to ensure that applicants for employment 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 shall post in conspicuous places, available to employees and applicants for employment, notices to be provided by the State setting forth the provisions of this non-discrimination clause. The Contractor shall state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin. The Contractor will, in all solicitations or advertisements for employees 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. The Contractor shall incorporate the foregoing requirements of this paragraph in all of its subcontracts for the Project unless exempted by rules, regulations, or orders of the State 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 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 State advising the said labor union or workers' representatives of the Contractor's commitment under this Section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by the rules, regulations, and orders of the State, or pursuant thereto, and will permit access to its books, records, and accounts by HUD and the State for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

In the event of the Contractor's noncompliance with the non-discrimination clauses of this Contract or with any of such 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 State government contracts or federally assisted construction contract procedures authorized in Executive Order 11246 of September 24, 1965, or by rules, regulations, or orders of the State, or as otherwise provided by law.

- 27. Age Discrimination:** In accordance with 45 CFR, Parts 90 and 91, the Contractor agrees there shall be no bias or age discrimination as to benefits and participation under this Contract.

- 28. Section 109 of the 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 the CDBG program of the State.

- 29. Section 504 of the Rehabilitation Act of 1973, as amended:** The Contractor agrees that no otherwise qualified individual with disabilities shall, solely by reason of his disability, be denied the benefits, or be subjected to discrimination including discrimination in employment, any program or activity that receives the benefits from the Assistance.

- 30. Section 3, Compliance and Provision of Training, Employment and Business Opportunities:** The work to be performed under this Contract is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, (12 USC § 1701u). The purpose of Section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by Section 3 shall, to the greatest extent feasible be directed to low and very low-income persons, particularly persons who are recipients of HUD assistance for housing.

The parties to this said Contract agree to comply with HUD's regulations in 24 CFR Part 75, which implement Section 3. As evidenced by their execution of this Contract, the parties to this Contract certify that they are under no contractual or other impediment that would prevent them from complying with the 24 CFR Part 75 regulations.

The contractor agrees to send to each labor organization or representative of workers with which the Contractor has a collective bargaining agreement or other understanding, if any, a notice advising the organization or workers' representative of the contractor's commitments under this Section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the Section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions; the qualifications for each; and the name and location of person(s) taking applications for each of the positions; and the anticipated date the work shall begin. The Contractor agrees to include this Section 3 clause in every subcontract subject to compliance with regulations in 24 CFR Part 75, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this Section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR Part 75. The Contractor will not subcontract with any subcontractor where the Contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR Part 75.

The Contractor will certify that any vacant employment positions including training positions, that are filled (1) after the Contractor is selected but before this Contract has been executed, and (2) with persons other than those to whom the regulations of 24 CFR Part 75 require employment opportunities to be directed, were not filled to circumvent the Contractor's obligations under 24 CFR Part 75.

The Contractor agrees to submit such reports as required to document compliance with 24 CFR Part 75. Noncompliance with the regulations in 24 CFR Part 75 may result in sanctions, termination of this Contract for default, and debarment or suspension from future HUD assisted contracts.

- 31. Lead-Based Paint:** The construction or rehabilitation of residential structures with any portion of the Assistance is subject to the HUD Lead-Based Paint regulations found at 24 CFR Part 35. Any grants or loans made by the Grantee for the rehabilitation of residential

structures with any portion of the Assistance shall be made subject to the provisions for the elimination of lead-base paint hazards under subpart B of said regulations, and the Grantee shall be responsible for the inspections and certifications required under Section 35.14(f) thereof.

32. Compliance with Air and Water Acts: (Applicable to construction contracts and related subcontracts exceeding \$100,000) This Contract is subject to the requirements of the Clean Air Act, as amended, 42 USC § 7401 et seq., the Federal Water Pollution Control Act (Clean Water Act), as amended, 33 USC § 1251 et seq., and the regulations of the Environmental Protection Agency with respect to 40 CFR Part 15, as amended from time to time, and the South Carolina Stormwater Management and Sediment Reduction Act. In particular, the following are required:

- (a) A stipulation by the Contractor or subcontractor 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 § 7414) 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 Sections 114 and 308, and all regulations and guidelines issued thereunder.
- (c) A stipulation that as a condition of award of 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 under consideration is to be listed on the EPA list of Violating Facilities.
- (d) Agreement by the Contractor that the Contractor will include or cause to be included the criteria and requirements in these subparagraphs (1) through (4), in every nonexempt subcontract and requiring that the Contractor will take such action as the State may direct as a means of enforcing such provisions.

In no event shall any amount of the Assistance be utilized with respect to a facility which has given rise to a conviction under section 113(c)(1) of the Clean Air Act or Section 309(c) of the Federal Water Pollution Control Act.

33. Federal Labor Standards Provisions: *(Applicable to construction contracts in excess of \$2,000 or residential rehabilitation contracts involving more than eight units)*

The Project or program to which the construction work covered by this Contract pertains is being assisted by the United States of America and the Federal Labor Standards Provisions as set forth on Attachment 1 are included in this Contract pursuant to the provisions applicable to such Federal assistance. These provisions must be complied with or sanctions will be instituted.

Attachment 1

U.S. Department of Housing and Urban Development, Office of Labor Relations form HUD-4010 (06/2009) ref. Handbook 1344.1

A. 1. (i) Minimum Wages. All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached thereto and made a part thereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5 (a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period.

Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification of the time actually work therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification an wage rates conformed under 29 CFR 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible, place where it can be easily seen by the workers.

(ii) (a) Any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. HUD shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

- (1)** The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- (2)** The classification is utilized in the area by the construction industry; and
- (3)** The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(b) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and HUD or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by HUD or its designee to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so

advise HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

(c) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and HUD or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), HUD or its designee shall refer the questions, including the views of all interested parties and the recommendation of HUD or its designee, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB Control Number 1214-0140.)

(d) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii)(b) or (c) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

2. Withholding. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other Federal-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice trainee or helper, employed or working on the site of the work, all or part of the wages required by the contract, HUD or its designee may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension or any further payment, advance, or guarantee of funds until such violations have ceased. HUD or its designee may, after written notice to the contractor, disburse such amounts withheld for an on account of the contractor or subcontractor to the respective employees to whom they are due. The Comptroller General shall make such disbursements in the case of direct Davis-Bacon Act contracts.

3. (i) Payrolls and basic records. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work preserved for a period of three

years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in Section 1 (b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5 (a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment of provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices and trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs. (Approved by the Office of Management and Budget under OMB Control Numbers 1215-0140 and 1215-0017.)

(ii) (a) the contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to HUD or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to HUD or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i). This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal Stock Number 029-005-00014-1), U.S. Government Printing Office, Washington, DC 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. (Approved by the Office of Management and Budget Under OMB Control Number 1215-0129.)

(b) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor or his or her agent who pays for or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be maintained under 29 CFR 5.5 (a)(3)(i) and that such information is correct and complete;

(2) That each laborer or mechanic (including each apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(c) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by subparagraph A.3.(ii)(b).

(d) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under subparagraph A.3.(i) available for inspection, copying, or transcription by authorized representatives of HUD or its designee or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, HUD or its designee may, after written notice to the contractor, sponsor, applicant or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and Trainees.

(i) **Apprentices.** Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment Training Administration, Office of Apprenticeship Training, Employer and Training Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen in any craft classification shall not be greater than the ratio permitted to the contractor as to his entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as state above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ration permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every Trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under 29 CFR Part 5 shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR Part 3 which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor will insert in any subcontracts the clauses contained in subparagraphs 1 through 11 of this paragraph A and such other clauses as HUD or its designee may by appropriate instructions require, and a copy of the applicable prevailing wage decision, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this paragraph.

7. Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause

include disputes between the contractor (or any of its subcontractors) and HUD or its designee, the U.S. Department of Labor, or the employees or their representatives.

10. (i) Certification of Eligibility. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a government contract by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001. Additionally, U.S. Criminal Code, Section 1010, Title 18, U.S.C., "Federal Housing Administration transactions", provided in part: "Whoever, for the purpose of . . . influencing in any way the action of such Administration..... makes, utters or publishes any statement knowing the same to be false..... shall be fined not more than \$5,000 or imprisoned not more than two years, or both."

11. Complaints, Proceedings, or Testimony by Employees. No laborer or mechanic to whom the wage, salary, or other labor standards provisions of this Contract are applicable shall be discharged or in any other manner discriminated against by the Contractor or any subcontractor because such employee has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the labor standards applicable under this Contract to his employer.

B. Contract Work Hours and Safety Standards Act. The provisions of this paragraph B are applicable only where the amount of the prime contract exceeds \$100,000. As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

(1) Overtime Requirements. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in subparagraph (1) of this paragraph, the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violations of the clause set forth in subparagraph (1) of this paragraph, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by the clause set forth in subparagraph (1) of this paragraph.

(3) Withholding for unpaid wages and liquidated damages. HUD or its designee shall upon its own action or upon written request of an authorized representative of the

Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract, or any other Federal contract with the same prime contract, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same prime contractor such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph (2) of this paragraph.

(4) **Subcontracts.** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraph (1) through (4) of this paragraph and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in subparagraphs (1) through (4) of this paragraph.

C. Health and Safety. The provisions of this paragraph C are applicable only where the amount of the prime contract exceeds \$100,000.

(1) No laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to this health and safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation.

(2) The Contractor shall comply with all regulations issued by the Secretary of Labor pursuant to Title 29 Part 1926 and failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act, 40 USC 3701 et. seq.

(3) The Contractor shall include the provisions of this paragraph in every subcontract so that such provisions will be binding on each subcontractor. The Contractor shall take such action with respect to any subcontract as the Secretary of Housing and Urban Development or the Secretary of Labor shall direct as a means of enforcing such provisions.

Section 3 Information Sheet for Contractors/Businesses

What is Section 3?

Section 3 is a provision of the Housing and Urban Development (HUD) Act of 1968. The purpose of Section 3 is to ensure that employment and other economic opportunities generated by certain HUD financial assistance shall, to the greatest extent feasible, and consistent with existing Federal, State, and local laws and regulation, be directed to low- and very low-income persons, particularly those who are recipients of government assistance for housing, and to business concerns which provide economic opportunities to low- and very low-income persons.

What is a Section 3 worker?

Section 3 workers are:

- Any worker who currently or when hired (within the past five years) is below documented to fit at least one of the below categories:
 - The worker's income for the previous or annualized calendar year is below the income limit established by HUD; or
 - The worker is employed by a Section 3 business concern
 - The worker is a YouthBuild participant

What is a Targeted Section 3 Worker

- A worker employed by a Section 3 business concern; or
- A worker who currently fits or when hired (within the past 5 years) is documented to fit at least one of the following categories:
 - Living within the service area or the neighborhood of the project, meaning; or
 - A YouthBuild participant

What is a Section 3 Business Concern?

A Section 3 Business Concern meets one of the following criteria:

- Is 51 percent or more owned and controlled by low- or very low-income persons;
- Over 75 percent of the labor hours performed for the business over the prior 3-month period were performed by Section 3 workers; or
- Is at least 51 percent owned and controlled by current public housing residents; residents who currently live in Section 8-assisted housing

What types of economic opportunities should be made available under Section 3?

- Job training
- Employment
- Contracts

Examples of Opportunities include:

- | | | |
|------------------------|-------------------------|-----------------------|
| • Accounting | • Electrical | • Marketing |
| • Architecture | • Elevator Construction | • Painting |
| • Appliance repair | • Engineering | • Payroll Photography |
| • Bookkeeping | • Fencing | • Plastering |
| • Bricklaying | • Florists | • Plumbing |
| • Carpentry | • Heating | • Printing Purchasing |
| • Carpet Installation | • Iron Works | • Research |
| • Catering | • Janitorial | • Surveying |
| • Cement/Masonry | • Landscaping | • Tile setting |
| • Computer/Information | • Machine Operation | • Transportation |
| • Demolition | • Manufacturing | • Word processing |
| • Drywall | | |

Who receives priority under Section 3?

For training and employment:

- Persons in public and assisted housing
- Persons in the area where the HUD financial assistance is spent
- Participants in HUD Youthbuild programs
- Homeless persons

For contracting:

- Businesses that meet the definition of a Section 3 business concern

How can businesses find Section 3 workers to work for them?

Businesses can recruit Section 3 residents in public housing developments and in the neighborhoods where the HUD assistance is being spent. Effective ways of informing residents about available training and job opportunities are:

- Contacting resident organizations, local community development and employment agencies
- Distributing flyers
- Posting signs
- Placing ads in local newspapers

Are recipients, contractors, and subcontractors required to provide long-term employment opportunities, not simply seasonal or temporary employment?

Recipients are required, to the greatest extent feasible, to provide all types of employment opportunities to low and very low-income persons, including permanent employment and long-term jobs.

Grantees and contractors are encouraged to have Section 3 workers make up at least 25 percent and targeted workers make up 5 percent of their permanent, full-time staff.

A Section 3 worker who has been employed for 5 years may no longer be counted towards meeting the 25 percent for section 3 and 5 percent for targeted section 3 worker requirements. This encourages recipients to continue hiring Section 3 and targeted Section 3 workers when employment opportunities are available.

What if it appears an entity is not complying with Section 3?

There is a complaint process. Section 3 and targeted workers, business concerns, or a representative for either may file a complaint if it seems a recipient is violating Section 3 requirements are being on a HUD-funded project.

Will HUD require compliance?

Yes. HUD monitors the performance of contractors, reviews annual reports from recipients, and investigates complaints. HUD also examines employment and contract records for evidence that recipients are training and employing Section 3 workers and awarding contracts to Section 3 business concerns.

Section 3 Business Concern Self-Certification

BASIC INFORMATION

1. Company Name: _____
2. Company Address: _____
 City _____ State _____ Zip _____ County _____
3. Telephone Number: _____ Fax Number: _____
 Email address: _____
4. Contractor's License: Class ☐A ☐B ☐C ☐N/A License Number: _____
5. Business License _____ Number Federal ID Number _____
6. Type of Business: _____

TYPES OF SECTION 3 BUSINESS ENTERPRISES

Please check "Yes" or "No". If you answer "YES" to one or more of the following questions, you may designate your company as a Section 3 Business Enterprise.

1. 51% or more of your business is owned by a Section 3 workers*; or

☐ Yes ☐ No

Attach list of Section 3 owners and income certifications

2. Over 75% of the labor hours over the previous 3-month period are performed by Section 3 workers; or

☐ Yes ☐ No

Attach list of employees, Section 3 employees, and self certifications

3. At least 51% owned and controlled by current residents of public housing or Section 8 assisted housing.-

☐ Yes ☐ No

Attach list of subcontracted businesses, types and amounts

VERIFICATION - The company hereby agrees to provide, upon request, documents verifying the information provided on this form.

I declare and affirm under penalty of law that the statements made herein are true and accurate to the best of my knowledge. I understand that falsifying information and incomplete statements will disqualify certification status.

Signature of Business Owner or Authorized Representative: _____

Signature: Date: _____

Attested by: Date: _____

***Section 3 Worker and Targeted Section 3 Worker definitions can be found in the "Section 3 Definitions" document.**

Targeted Section 3 Worker Certification

A Targeted Section 3 Worker seeking the preference in training and employment provided by this part shall certify or submit evidence to the recipient contractor or subcontractor that the person is a Targeted Section 3 Worker, as defined in Section 24 CRF 75.

Worker Name: _____ (Print Name)

Household Income Guidelines

Place a check mark beside the number of people in your (the worker's) household.

Place Check	Household/ Family Size	Income Limit
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	

Section 3 Project/Service Area:

Place a check mark beside any of the following that apply below:

_____ My income for the previous year was below the amount next to the household/family size I checked on the table above, and I live within the project/service area as defined above.

_____ I am employed by a Section 3 Business Concern

_____ I am a YouthBuild participant

I hereby certify that the information provided by me to be true and correct and understand any falsification of any of the information could subject me to disqualification from participation.

Signature

Date

This Section to be Completed by SC Department of Commerce Staff

Reviewed By: _____

Approved on
Date: _____

Comments: _____

Company:

Notes

Only list the payroll numbers for weeks where work occurred. Do not include "no work" payrolls.

1

SECTION 00851

DRAWINGS INDEX

<u>TITLE</u>	<u>SHEET NO.</u>
<u>GENERAL (G)</u>	
COVER	G00.00
ABBREVIATIONS, DRAWING INDEX, & GENERAL NOTES	G01.10
GENERAL LEGEND AND SYMBOLS	G01.20
<u>CIVIL (C)</u>	
EXISTING SITE & DEMOLITION PLAN	C01.10
OVERALL SITE PLAN	C01.20
CIVIL DETAILS	C99.10
SEDIMENT & EROSION CONTROL NOTES & DETAILS	C99.20
<u>PROCESS MECHANICAL (D)</u>	
CHEMICAL CONTAINMENT AREA DEMOLITION PLAN	D01.10
CHEMICAL CONTAINMENT AREA MODIFICATIONS PLAN	D01.20
CHEMICAL CONTAINMENT AREA DEMOLITION & MODIFICATIONS SECTION	D01.30
CHEMICAL INJECTION VAULT DEMOLITION & MODIFICATIONS	D01.40
LIME SLURRY CONTAINMENT STRUCTURE PLAN AND SECTION	D01.50
MISCELLANEOUS DETAILS I	D99.10
<u>STRUCTURAL (S)</u>	
TYPICAL DETAILS AND STRUCTURAL NOTES	S00.10
LIME SILO FOUNDATION PLAN	S01.10
LIME SILO SECTIONS AND DETAILS	S01.11
<u>PROCESS & INSTRUMENTATION (P)</u>	
P&ID LEGENDS	P01.10
P&ID SYMBOLS	P01.20
P&ID DIAGRAM	P01.30

ELECTRICAL (E)

ELECTRICAL LEGEND AND ABBREVIATIONS	E00.01
OVERALL ELECTRICAL SITE PLAN	E01.00
ELECTRICAL DEMOLITION PLAN	E01.10
LIME SLURRY CONTAINMENT ELECTRICAL PLAN	E01.20
ELECTRICAL ONE-LINE DIAGRAMS & SCHEDULES	E01.30
ELECTRICAL DETAILS	E01.40

SECTION 01050
FIELD ENGINEERING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide such field engineering services as are required for proper completion of the Work including, but not necessarily limited to:
 - 1. Provide all staking required to construct the facility from coordinates established by the Engineer.
 - 2. Establish proper line and levels for installation of utilities.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Additional requirements for field engineering also may be described in other Sections of these Specifications.
 - 3. Section 02210 - Site Grading.
 - 4. Section 02220 - Excavation, Backfilling for Structures.
 - 5. Section 02510 - Stone Base Course.
 - 6. Section 02760 - Well Piping, Valves and Appurtenances
- C. Work by others:
 - 1. Not less than two benchmark elevations will be provided.

1.2 QUALITY ASSURANCE

- A. Provide a competent survey party and surveying instruments for staking the work.
- B. Exercise proper precautions to verify the figures shown on the Drawings prior to laying out any part of the Work.
 - 1. The Contractor will be held responsible for any errors therein that otherwise might have been avoided.
 - 2. Promptly inform the Engineer of any error or discrepancies discovered in the Drawings or Specifications in order that proper corrections may be made.

1.3 PROCEDURES

- A. Locate and protect control points before starting work on the site.
- B. Preserve permanent reference points during progress of the Work.
- C. Do not change or relocate reference points or items of the Work without specific approval from the Engineer.
- D. Promptly advise the Engineer when a reference point is lost or destroyed, or requires relocation because of other changes in the Work.

END OF SECTION

FIELD ENGINEERING
01050-1

SECTION 01060

REGULATORY REQUIREMENTS

- A. The following requirements of Regulatory Agencies having an interest in this project are hereby made a part of this Contract.
- B. The construction of the project, including the letting of contracts in connection therewith, shall conform to the applicable requirements of State, territorial, and local laws and ordinances to the extent that such requirements do not conflict with Federal laws and this subchapter.
- C. South Carolina Sales Tax: All applicable South Carolina sales tax shall be to the account of the Contractor.
- D. Use of chemicals: All chemicals used during the project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.
- E. Safety and Health Regulations: The Contractor shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54).
- F. Hazardous gas safety:
 - 1. In accordance with 29 CFR 1910.119(h)(2)(I) (Process Safety Management Standard), Contractor to provide the following information when working on or around the gas chlorination or sulfur dioxide process:
 - a. Copy of Contractor Safety Program; and the following for the year to date and the previous year.
 - b. Total OSHA Recordable Case Rate.
 - c. Total OSHA Lost Workday Case Rate.
 - d. Total Lost Workday Cases Away From Work.
 - e. Fatalities.
 - f. Worker's Compensation Insurance Experience Modification Rate.
 - g. OSHA Inspections.
 - h. OSHA Citations.
 - 2. Assure that each employee is trained in the work practices necessary to safely perform his or her job.
 - 3. Assure that each employee is instructed in the known potential fire, explosion, or toxic release hazards related to his or her job and the process, and the applicable provisions of the emergency action plan.
 - 4. Document that each employee has received and understood the training required by 29 CFR 1910.119 and prepare a record containing the employee identity, training date and means used to verify that the employee understood the training.
 - 5. Assure that each employee follows the safety rules and procedures of the facility including the safe practices per 29 CFR 1910.119(f)(4).
 - 6. Advise the Owner of any unique hazards presented by the work, or of any hazards are found.
- G. The Contractor shall comply with Part V of the South Carolina Manual on Uniform Traffic Control Devices for Streets and Highways.
- H. Inspection by Agencies: The representatives of the South Carolina Department of Health and Environmental Control, Environmental Protection Agency, and the Corps of

Engineers shall have access to the work wherever it is, in preparation or in progress, and the Contractor shall provide proper facilities for such access and inspection.

I. Withholding for non-residents shall comply with the following:

1. Attention of non-resident Contractors is invited to Code Sections 12-8-540 and 12-8-550 as amended effective July 1, 1994, Section 49, Appropriations Bill, Part II.
2. If a non-resident Contractor is the successful bidder on this project, he shall be required to provide the Owner with an Affidavit (Form I-312, Nonresident Taxpayer Registration Affidavit Income Tax Withholding) affirming registration with the South Carolina Department of Revenue or the South Carolina Secretary of State's office. (See attached form).
3. Forms to register for all taxes administered by the South Carolina Department of Revenue may be obtained by calling the License and Registration Section at (803) 737-4872 or writing to South Carolina Department of Revenue, Registration Unit, Columbia, South Carolina 29214-0140.
4. In the absence of an Affidavit being provided, withholding in the amount of two (2) percent of the contract price will be made by the Owner.

J. Bypassing of wastewater: No wastewater bypassing will be permitted during construction unless a schedule has been approved by the South Carolina Department of Health and Environmental Control, if required pursuant to the terms of the NPDES permit.

1. Schedule work to minimize bypassing.
2. Coordinate all work which will affect operation of the existing treatment facility with the Owner and the Engineer to assure the least interruption possible in operation of the existing facilities.
3. Make no connections to the existing treatment facility diverting flow to the new facility until directed by the Engineer.

END OF SECTION

SECTION 01061
PERMITS AND RIGHTS-OF-WAY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: This section establishes requirements pertaining to the securement and payment for licenses, building permits, rights-of-way, etc., necessary for the construction of the project.
- B. Work not included: The Owner will obtain and provide to the Contractor, as required, copies of:
 - 1. South Carolina Department of Health and Environmental Control, Permit to Construct.
- C. Related work: Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.

1.2 SUBMITTALS

- A. Submit to the Engineer satisfactory evidence that all necessary licenses, building permits, etc., have been secured prior to commencing the work.

PART 2 - PRODUCTS

No products are required for this work.

PART 3 - EXECUTION

3.1 BUSINESS LICENSE

- A. Determine licenses necessary to perform the work at project location.
- B. Obtain all necessary licenses at no additional cost to the Owner.

3.2 BUILDING PERMITS

- A. Secure and pay for all building permits required, whether of temporary or permanent nature.

3.3 RIGHTS-OF-WAY, UTILITY LINES

- A. Owner will provide necessary rights-of-way or easements for construction of utility lines, whether on privately or publicly owned property.
- B. The Contractor shall confine his activities to a _____-foot construction easement. The _____-foot easement is not in all cases equidistant, _____ feet each side of the centerline of the utility.
 - 1. Contact the _____ for rights-of-way as actually obtained.

C. The Owner will provide no right-of-way over other property.

3.4 LAND

A. The necessary land for construction of treatment facilities, pump stations, etc., will be provided by the Owner.

END OF SECTION

Water Supply Construction Permit Bureau of Water



Permission is Hereby Granted To: CITY OF BENNETTSVILLE
501 E MAIN ST
BENNETTSVILLE SC 29512

for the construction of a surface water system in accordance with the construction plans, specifications, design calculations and the SC DES Construction Permit Application signed by Keiran Ryan, Registered Professional Engineer, S.C. Registration Number: 43039.

Project Name: LIME SLURRY FEED SYSTEM FOR THE LYALL STREET WTP **County:** Marlboro
Location: 103 LYALL STREET, BENNETTSVILLE, SC 29512

Project Description: Installation of a lime slurry feed system at the Bennettsville Lyall Water Plant.

Service By: The water will be provided by Bennettsville City Of (System Number: 3410001)

Special Conditions

1. All materials/products that contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61. The certifying party shall be accredited by the American National Standards Institute.
2. Before an approval to "Place Into Operation" can be issued for the proposed construction, an operation and maintenance (O&M) manual must be developed. This must be a comprehensive O&M manual developed for all facility processes. The complete O&M manual must be available for review at the time of final inspection. Note that if an O&M manual already exists for a facility then only an addendum for the proposed work is required.

In accepting this permit, the owner agrees to the admission of properly authorized persons at all reasonable hours for the purpose of sampling and inspection.

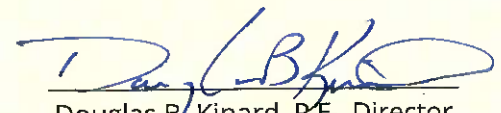
This is a permit for construction only and does not constitute State Department of Environmental Services approval, temporary or otherwise, to place the system in operation. An Approval to Place in Operation is required and can be obtained following the completion of construction by contacting Mr. Richard A. Welch, P.E., Manager Drinking Water Compliance Section, at 803-898-3546. Additional permits may be required prior to construction (e.g., stormwater).

Permit Number: 38865-WS

Date of Issue: September 22, 2025

Expiration Date: Construction must be completed prior to September 22, 2028 or this permit will expire.

TLS


Douglas B. Kinard, P.E., Director
Drinking Water & Recreational Waters
Protection Division

SECTION 01090
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Throughout the Project Documents, reference is made to specifications and standards issued by nationally recognized professional and/or trade organizations.
1. These referenced standards are generally identified by abbreviating the name of the organization following with the specification/standard number.
 2. Unless specifically indicated otherwise, all references to standards refer to the latest edition available at the time of the bidding.

1.2 ABBREVIATIONS

- A. Wherever the following abbreviations are used in these Project Documents, they are to be construed the same as the respective expressions represented:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ALS	American Lumber Standards
ANSI	American National Standards Institute, Inc.
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWPA	American Wood Preservers Association
AWS	American Welding Society
FSS	Federal Specifications and Standards, General Services Administration
IBC	International Building Code
NACE	National Association of Corrosion Engineers
NFPA	National Fire Protection Association
NSF	Formerly: National Sanitary Foundation
OSHA	Occupational Safety and Health Administration
SPIB	Southern Pine Inspection Bureau
SSPC	Steel Structures Painting Council

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01200

CONTRACTOR/SUBCONTRACTOR QUALIFICATIONS

PART 1 - GENERAL

The following information and completed forms may be requested by the Owner of the three lowest bidders. The request will be made within five (5) days following the bid opening. Requested data to be received by the Owner within ten (10) days of the request. Failure to provide the data in this section, upon request, will subject bidder to disqualification.

1.1 DESCRIPTION

- A. Information submitted will be used by the Owner to determine the competency and ability of the Contractor/Subcontractor to perform the scheduled work in a manner deemed satisfactory to the Owner. The Owner's decision shall be final.
- B. Any Subcontractor used by the General Contractor whose portion of this project exceeds 5% of the total bid price shall be required to provide the same information as the General Contractor.
- C. The Contractor/Subcontractor shall include with this section a detailed financial statement indicating the Contractor's/ Subcontractor's financial resources. The information on that statement shall be certified by a Certified Public Accountant and shall be submitted on the Associated General Contractor's of America form "Standard Questionnaires and Financial Statement for Bidders".
- D. The Contractor/Subcontractor shall certify by attaching his signature to this Section as provided that all information contained herein is complete and all statements and answers are accurate and true. Providing misinformation, incomplete information, inaccurate information, or failure to certify the information, will subject bidder to disqualification.

1.2 QUALIFICATIONS

- A. Complete the following (attach additional sheets as required):

Name: _____

Address: _____

City, State, Zip: _____

Principal: _____

- B. Number of years your firm has been in business: _____

- C. List and describe a minimum of five (5) previous projects of similar size and nature completed in the last ten (10) years. (Attach additional sheets, if necessary):

1. _____

2. _____

3. _____

4. _____

5. _____

D. List Owner, contact and telephone number for each of the five (5) projects referenced above. (Attach additional sheets, if necessary):

1. _____

2. _____

3. _____

4. _____

5.

E. For the projects listed in Item C, list the original bid price, final construction costs, specified completion time, actual completion time and explanations for differences in costs and times as required. (Attach additional sheets, if necessary):

1. Original contract price:

Final construction price:

Specified completion time:

Actual completion time:

Explanation:

2. Original contract price:

Final construction price:

Specified completion time:

Actual completion time:

Explanation:

3. Original contract price:

Final construction price:

Specified completion time:

Actual completion time:

Explanation:

4. Original contract price: _____
Final construction price: _____
Specified completion time: _____
Actual completion time: _____
Explanation: _____

5. Original contract price: _____
Final construction price: _____
Specified completion time: _____
Actual completion time: _____
Explanation: _____

- F. List the names, addresses and work of any portion of this project which will be subcontracted (more than 1% of the bid price). (Attach additional sheets, if necessary):

1. _____

2.

3.

4.

5.

G. List equipment owned that is available for this project:

H. List equipment to be purchased, leased or rented to perform this work:

- I. List superintendent(s), foremen or others in charge who will be assigned to this project. Provide resumes and qualifications (insert sheets as required):

- J. List and describe current projects, current status of job and estimated schedule of completion. (Attach additional sheets, if necessary):

1.

2.

3.

4.

5.

K. List past projects completed with Owner of project proposed in last fifteen (15) years. (Attach additional sheets, if necessary):

1.

2.

3.

4.

5.

L. List past projects bid on with Owner of project proposed in last fifteen (15) years. (Attach additional sheets, if necessary):

1.

2. _____

3. _____

4. _____

5. _____

M. List all past projects completed with Engineer in past fifteen (15) years (use additional sheets, if necessary):

1. Project Name: _____
 Project Manager: (Engineer's) _____
 Original Contract Price: _____
 Final Construction Price: _____
 Specified Completion Time: _____
 Actual Completion Time: _____
 Explanation: _____

2. Project Name: _____
 Project Manager: (Engineer's) _____
 Original Contract Price: _____
 Final Construction Price: _____
 Specified Completion Time: _____

Actual Completion Time: _____
Explanation: _____

3. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____
Final Construction Price: _____
Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

4. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____
Final Construction Price: _____
Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

5. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____
Final Construction Price: _____

Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

6. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____
Final Construction Price: _____
Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

7. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____
Final Construction Price: _____
Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

8. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____
Final Construction Price: _____

Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

9. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____
Final Construction Price: _____
Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

10. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____
Final Construction Price: _____
Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

11. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____

Final Construction Price: _____
Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

12. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____
Final Construction Price: _____
Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

13. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____
Final Construction Price: _____
Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

14. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____

Final Construction Price: _____
Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

15. Project Name: _____
Project Manager: (Engineer's) _____
Original Contract Price: _____
Final Construction Price: _____
Specified Completion Time: _____
Actual Completion Time: _____
Explanation: _____

N. List all projects involving litigation, arbitration and/or mediation in past twenty (20) years (Attach additional sheets, if necessary):

1. Project Name: _____
Owner: _____
Engineer: _____
Date: _____
Explanation: _____

Result: _____

2. Project Name:

Owner:

Engineer:

Date:

Explanation:

Result:

3. Project Name:

Owner:

Engineer:

Date:

Explanation:

Result:

4. Project Name:

Owner: _____
Engineer: _____
Date: _____
Explanation: _____

Result: _____

5. Project Name:

Owner: _____
Engineer: _____
Date: _____
Explanation: _____

Result: _____

O. Attach rate schedule for equipment, labor, overhead and profit.

☐

Rate schedule attached.

[illegible]

I HEREBY CERTIFY that as a duly authorized representative of _____
_____(bidder), the information provided is to the best of my knowledge
accurate and that failure to provide accurate information will result in disqualification of my bid.

Signature

Name(Please Print)

Title

Date

(SEAL)

Notary Public for South Carolina

My Commission Expires: _____

END OF SECTION

SECTION 01210
PRECONSTRUCTION CONFERENCE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: To help clarify construction contract administration procedures, the Engineer will conduct a Preconstruction Conference prior to start of the Work. Provide attendance by the designated personnel.
- B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. For those persons designated by the Contractor, his subcontractors, and suppliers to attend the Preconstruction Conference, provide required authority to commit the entities they represent to solutions agreed upon in the Conference.

1.3 SUBMITTALS

- A. To the maximum extent practicable, advise the Engineer at least 24 hours in advance of the Conference as to items to be added to the agenda.
- B. The Engineer will compile minutes of the Conference, and will furnish three copies of the minutes to the Contractor and required copies to the Owner. The Contractor may make and distribute such other copies as he wishes.

1.4 PRECONSTRUCTION CONFERENCE

- A. The Conference will be scheduled to be held within 30 working days after the Owner has determined the low bidder and may be held prior to issuance of the Notice to Proceed when required by regulatory agencies having jurisdiction. In any event, the Conference will be held prior to actual start of the work.
- B. Attendance:
 - 1. Provide attendance by authorized representatives of the Contractor and major subcontractors.
 - 2. The Engineer will advise other interested parties, including the Owner, and request their attendance.
- C. Minimum agenda: Data will be distributed and discussed on:
 - 1. Organizational arrangement of Contractor's forces and personnel and those of subcontractors, materials suppliers, and the Engineer.
 - 2. Channels and procedures for communication.
 - 3. Construction schedule, including sequence of critical work.
 - 4. Contract Documents, including distribution of required copies of Drawings and revisions.
 - 5. Processing of Shop Drawings and other data submitted to the Engineer for review.
 - 6. Processing of field decisions and Change Orders.
 - 7. Rules and regulations governing performance of the Work.

8. Procedures for security, quality control, housekeeping, and related matters.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01220
PROJECT MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: To enable orderly review during progress of the Project, and to provide for systematic discussion of problems, the Engineer may conduct project meetings throughout the construction period.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility and normally are not part of project meetings content.

1.2 QUALITY ASSURANCE

- A. For those persons designated by the Contractor to attend and participate in project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings.

1.3 SUBMITTALS

- A. Agenda items: To the maximum extent practicable, advise the Engineer at least 48 hours in advance of project meetings regarding items to be added to the agenda.
- B. Minutes:
 - 1. The Engineer will compile Minutes of each project meeting, and will furnish three copies to the Contractor and required copies to Owner.
 - 2. Recipients of copies may make and distribute such other copies as they wish.

PART 2 - PRODUCTS

(No products are required in this Section)

PART 3 - EXECUTION

3.1 MEETING SCHEDULE

- A. Project meetings will be held monthly or as requested by the Engineer or Owner.
- B. Coordinate as necessary to establish mutually acceptable schedule for meetings.

3.2 MEETING LOCATION

- A. The Engineer will establish meeting location. To the maximum extent practicable, meetings will be held at the project site.

3.3 PROJECT MEETINGS

A. Attendance:

1. To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work.
2. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspect of the Work is involved.

B. Minimum agenda:

1. Review, revise as necessary, and approve Minutes of previous meetings.
2. Review progress of the Work since last meeting, including status of submittals for approval.
3. Identify problems that impede planned progress.
4. Develop corrective measures and procedures to regain planned schedule.
5. Complete other current business.

C. Revisions to Minutes:

1. Unless published Minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.
2. Persons challenging published Minutes shall reproduce and distribute copies of the challenge to all Minutes.
3. Challenge to Minutes shall be settled as priority portion of "old business" at the next regularly scheduled meeting.

END OF SECTION

SECTION 01310
CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: To assure adequate planning and execution of the Work so that the Work is completed within the number of calendar days allowed in the Contract, and to assist the Engineer in appraising the reasonableness of the proposed schedule and in evaluating progress of the Work, prepare and maintain the schedules and reports described in this Section.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Requirements for progress schedule: General Conditions.
 - 3. Construction period: Form of Agreement.
- C. Definitions: "Day", as used throughout the Contract unless otherwise stated, means calendar day.

1.2 QUALITY ASSURANCE

- A. Employ a scheduler who is thoroughly trained and experienced in compiling construction schedule data, and in preparing and issuing periodic reports as required below.
- B. Perform data preparation, analysis, charting, and updating in accordance with standards approved by the Engineer.
- C. Approved scheduling software is Primavera P6 or Microsoft Projects latest version.
 - 1. Submit all other products to the Engineer for approval.
- D. Reliance upon the approved schedule:
 - 1. The construction schedule as approved by the Engineer will be an integral part of the Contract and will establish interim completion dates for the various activities under the Contract.
 - 2. Should any activity not be completed within 15 days after the stated scheduled date, the Owner shall have the right to require the Contractor to expedite completion of the activity by whatever means the Owner deems appropriate and necessary, without additional compensation to the Contractor.
 - 3. Should any activity be 30 days or more behind schedule, the Owner shall have the right to perform the activity or have the activity performed by whatever method the Owner deems appropriate.
 - 4. Costs incurred by the Owner and by the Engineer in connection with expediting construction activity shall be reimbursed by the Contractor.
 - 5. It is expressly understood and agreed that failure by the Owner to exercise the option either to order the Contractor to expedite an activity or to

expedite the activity by other means shall not be considered to set a precedent for any other activities.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Preliminary analysis: Within 10 calendar days after the Contractor has received the Notice to Proceed, submit electronic PDF and four prints of a preliminary construction schedule prepared in accordance with Part 3 of this Section.
- C. Construction schedule: Within 10 calendar days after the Contractor has received the Engineer's approval to revisions of a preliminary construction schedule, submit electronic PDF and four prints of a construction schedule prepared in accordance with Part 3 of this Section.
 - 1. Upon approval of construction schedule, submit electronic project scheduling file in Microsoft Project (latest version) format to the Engineer.
- D. Periodic reports: On the first working day of each month following the submittal described in Paragraph 1.3.C above, submit electronic PDF and four prints of the construction schedule updated as described in Part 3 of this Section.

PART 2 - PRODUCTS

2.1 CONSTRUCTION ANALYSIS

- A. Graphically show by bar chart the order and interdependence of all activities necessary to complete the work, and the sequence in which each activity is to be accomplished, as planned by the Contractor and his project field superintendent in coordination with all subcontractors whose work is shown on the diagram.
 - 1. Provide two line bar chart; one for planned activity, and one for actual completion.
- B. Include, but do not necessarily limit indicated activities to:
 - 1. Project mobilization.
 - 2. Submittal and approval of shop drawings and samples.
 - 3. Procurement of equipment and critical materials.
 - 4. Fabrication of special material and equipment, and its installation and testing.
 - 5. Final cleanup.
 - 6. Final inspecting and testing.
 - 7. All activities by the Engineer that affect progress, required dates for completion, or both, for all and each part of the Work.

PART 3 - EXECUTION

3.1 PRELIMINARY ANALYSIS

- A. Contents:
 - 1. Show all activities of the Contractor under this Work for the period between receipt of Notice to Proceed and submittal of construction schedule.

2. Show the Contractor's general approach to remainder of the Work.
3. Show cost of all activities scheduled for performance before submittal and approval of the construction schedule.

3.2 CONSTRUCTION SCHEDULE

- A. Provide a construction schedule incorporating all revisions from review of the preliminary analysis.

3.3 PERIODIC REPORTS

- A. Provide monthly updates of the approved construction schedule.
 1. Indicate "actual" progress for each activity on the bar chart.
 2. Provide written narrative summary of revisions causing delay in the program, and an explanation of corrective actions taken or proposed.

3.4 REVISIONS

- A. Make periodic revisions to the schedule to incorporate delays, early completion, etc.
- B. Make only those revisions to approved construction schedule as are approved in advance by the Engineer.

END OF SECTION

SECTION 01340

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Make submittals required by the Contract Documents and revise and resubmit as necessary to establish compliance with the specified requirements.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
 - 2. Individual requirements for submittals also may be described in pertinent sections of these specifications.
- C. Work not included:
 - 1. Unrequired submittals will not be reviewed by the Engineer.
 - 2. The Contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the work, but such data shall remain between the Contractor and his subcontractors and will not be reviewed by the Engineer.

1.2 QUALITY ASSURANCE

- A. Coordination of submittals:
 - 1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.
 - 2. Verify that each item and the submittal for it conform in all respects with the specified requirements.
 - 3. By affixing the Contractor's signature to each submittal, certify that this coordination has been performed.
 - 4. Review and coordinate each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.
- B. Completeness of submittal:
 - 1. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes.
 - 2. Determine and verify all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- C. "Or equal":
 - 1. Where the phrase "or equal" occurs in the Contract Documents, do not assume that the materials, equipment or methods will be considered as

equal unless the item has been specifically so approved for this Work by the Engineer.

2. The decision of the Engineer shall be final.
- D. The Engineer shall assume that no shop drawing or related submittal comprises a variation unless the Contractor advises the Engineer otherwise in writing.

1.3 SUBMITTALS

- A. Within 15 calendar days after the Contractor has received the Owner's notice to proceed, submit:
 1. Schedule for submittals including specification section, type of submittal and submittal date.
 2. Construction schedule.
 3. Schedule of partial payment requests.
- B. Make submittals of shop drawings, samples, substitution requests and other items in accordance with the provisions of this Section.

PART 2 - PRODUCTS

2.1 SHOP DRAWINGS

- A. Scale and measurements: Make shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the Work.
- B. Large prints (11" x 17" or larger):
 1. Submit shop drawings in the form of white copies.
 2. Blueprints will not be acceptable.
- C. Manufacturer's literature:
 1. Where contents of submitted literature from manufacturers includes data not pertinent to the submittal, clearly show which portions of the contents are being submitted for review.
 - a. Cross out or strikethrough all data not pertinent to the submittal.
 2. Submit the number of copies which are required to be returned, plus four copies of electrical and three copies of all other submittals which will be retained by the Engineer.
- D. Number of copies:
 1. Submit the number of copies which are required to be returned, plus three copies which will be retained by the Engineer.
 2. Electrical shop drawings: submit the number of copies which are required to be returned, plus four copies which will be retained by the Engineer.
 3. Submit all shop drawings electronically in PDF searchable format.
 - a. Electronic version to be a searchable PDF with an internal table of contents.
 4. Once approved, submit three (3) paper copies of the shop drawings to be retained by the Engineer.

- E. Do not begin fabrication of equipment or materials prior to Engineer's approval of shop drawings.

2.2 VARIATIONS

- A. With each submittal, provide specific written notice of any variations, that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.
- B. Provide an explanation of why the item(s) submitted are considered to be equal to the item(s) specified.
- C. Failure to submit a written notice will result in rejection of the submittal.

2.3 SAMPLES

- A. Provide sample or samples identical to the precise article proposed to be provided. Identify as described under "Identification of submittals" below.
- B. Number of samples required:
 - 1. Unless otherwise specified, submit samples in the quantity which is required to be returned, plus one which will be retained by the Engineer.
 - 2. By prearrangement in specific cases, a single sample may be submitted for review and, when approved, be installed in the work at a location agreed upon by the Engineer.

2.4 COLORS AND PATTERNS

- A. Unless the precise color and pattern is specifically called out in the Contract Documents, and whenever a choice of color or pattern is available in the specified products, submit accurate color and pattern charts to the Engineer for selection.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW OF SUBMITTALS

- A. Before submitting a shop drawing or any related material, Contractor shall:
 - 1. Determine and verify all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto.
 - 2. Determine and verify the suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work
 - 3. Review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of Contractor.
 - 4. Approve each such submission before submitting it.
 - 5. Stamp and sign each such submission before submitting it.

- B. Shop drawings and related materials shall be returned with comments provided that each submission has been specified and is stamped by the Contractor.
- C. Shop drawings or material not specified or which have not been approved by the Contractor shall be returned without comment.
- D. Contractor is to utilize the following stamp on all shop drawing submittals:

This shop drawing has been reviewed by [NAME OF CONTRACTOR] and approved with respect to the means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incidental thereto. [NAME OF CONTRACTOR] also warrants that this shop drawing complies with contract documents and comprises no variations thereto.	
By:	_____
Date:	_____

- E. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of the General Conditions and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of the General Conditions.

3.2 IDENTIFICATION OF SUBMITTALS

- A. Consecutively number all submittals.
 - 1. When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new transmittal number.
 - 2. On resubmittals, cite the original submittal number for reference.
- B. Accompany each submittal with a letter of transmittal showing all information required for identification and checking.
- C. On at least the first page of each submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.
- D. Maintain an accurate submittal log for the duration of the work, showing current status of all submittals at all times. Make the submittal log available to the Engineer for his review upon request.

3.3 GROUPING OF SUBMITTALS

- A. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.
 - 1. Partial submittals may be rejected as not complying with the provisions of the Contract.
 - 2. The Contractor may be held liable for delays so occasioned.

3.4 TIMING OF SUBMITTALS

- A. Make submittals far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.
- B. In scheduling, allow at least twenty-five working days for review by the Engineer following his receipt of the submittal.

3.5 RESUBMITTAL SCHEDULE

- A. For submittals marked "Furnish as Corrected" by the Engineer, resubmittal shall be within ninety (90) days of the review date shown on the Engineer's shop drawing review stamp.
- B. For submittals marked "Revise and Resubmit", "Submit Specified Item", or "Rejected", resubmittal shall be within thirty (30) days of the review date shown on the Engineer's shop drawing review stamp.

3.6 ENGINEER'S REVIEW

- A. Review by the Engineer does not relieve the Contractor from responsibility for errors which may exist in the submitted data.
- B. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer.
- C. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
- D. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto.
- E. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
- F. Revisions:
 - 1. Make revisions required by the Engineer.
 - 2. If the Contractor considers any required revision to be a change, he shall so notify the Engineer as provided for in the General Conditions.
 - 3. Make only those revisions directed or approved by the Engineer.
 - 4. Submittals which have been reviewed and returned to the Contractor marked "Revise and Resubmit" or "Rejected" and which are resubmitted and not in an approvable state, will not be reviewed a third time unless payment for the third and any subsequent review is by the Contractor. The engineering costs for review shall be equal to the Engineer's charges to the Owner under the terms of the Engineering Agreement with the Owner.

END OF SECTION

SECTION 01410
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included:

1. Cooperate with the Owner's selected testing agency and all others responsible for testing and inspecting the work.
2. Provide such other testing and inspecting as are specified to be furnished by the Contractor in this Section and/or elsewhere in the Contract Documents.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
2. Requirements for testing may be described in various Sections of these specifications.
3. Where no testing requirements are described, but the Owner decides that testing is required, the Owner may require such testing to be performed under current pertinent standards for testing. Payment for such testing will be made as described in this Section.

C. Work not included:

1. Selection of testing laboratory: The Owner will select a prequalified independent testing laboratory.
2. Payment for initial testing: The Owner will pay for all initial services of the testing laboratory as further described in Article 2.1 of this Section.
3. Tests at point of manufacture as specified in other Sections of these documents are to be made with all costs borne by the Contractor.

1.2 QUALITY ASSURANCE

- A. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E 329.
- B. Testing, when required, will be in accordance with all pertinent codes and regulations, and with selected standards of the American Society for Testing and Materials.

1.3 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. Promptly process and distribute required copies of test reports and related instructions to assure necessary retesting and replacement of materials with the least possible delay in progress of the work.

PART 2 - PRODUCTS

2.1 PAYMENT FOR TESTING

A. Initial services:

1. The Owner will pay for initial testing services requested by the Owner.
2. When initial tests indicate non-compliance with the Contract Documents, the costs of initial tests associated with that non-compliance will be deducted by the Owner from the Contract Sum.
3. Retesting: When initial tests indicate non-compliance with the Contract Documents, subsequent re-testing occasioned by the non-compliance shall be performed by the same testing agency and all costs there from will be deducted by the Owner from the contract sum.

2.2 CODE COMPLIANCE TESTING

- #### A.
- Inspections and tests required by codes or ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

2.3 CONTRACTOR'S CONVENIENCE TESTING

- #### A.
- Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

PART 3 - EXECUTION

3.1 COOPERATION WITH TESTING LABORATORY

- #### A.
- Representatives of the testing laboratory shall have access to the work at all times and at all locations where the work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.

3.2 TAKING SPECIMENS

- #### A.
- All specimens and samples for testing, and deliveries to laboratory, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

3.3 SCHEDULES FOR TESTING

A. Establishing schedule:

1. By advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.
2. Provide all required time within the construction schedule.

- #### B. Revising schedule:
- When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.

- C. Adherence to schedule: When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the work, all extra charges for testing attributable to the delay may be back-charged to the Contractor and shall not be borne by the Owner.

END OF SECTION

SECTION 01500
TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide temporary facilities needed for the work including, but not necessarily limited to:
 - 1. Temporary utilities such as heat, water, electricity, and telephone.
 - 2. Field office for the Contractor's and Engineer's personnel.
 - 3. Sanitary facilities.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
 - 2. Permanent installation and hookup of the various utility lines are described in other Sections.

1.2 PRODUCT HANDLING

- A. Maintain temporary facilities in proper and safe condition throughout progress of the work.

1.3 QUALITY CONTROL

- A. Referenced manufacturer of field office trailer is G. E. Modular Space and is named to establish standards of quality. Other suppliers meeting these specifications may be provided upon approval by the Engineer.

1.4 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed under this Section.
 - 2. Proposed layout of Engineer's field office.

PART 2 - PRODUCTS

2.1 UTILITIES

- A. Water:
 - 1. Provide necessary temporary piping and water supply and, upon completion of the work, remove such temporary facilities.
 - 2. Provide and pay for water used in construction.
- B. Electricity:

1. Provide necessary temporary wiring and, upon completion of the work, remove such temporary facility.
 2. Provide and pay for electricity used in construction.
- C. Heating and Cooling: Provide and maintain heat and air conditioning necessary for proper conduct of operations needed in the work.
- D. Telephone: (Cellular telephone service is acceptable)
1. Make necessary arrangements and pay costs for installation and operation of telephone service to the Contractor's office at the site.
 2. Provide a "touch tone" telephone available to the Engineer for use in connection with the work.
 - a. Provide an expandable, 5.8 ghz, long range, portable phone with intercom feature.
 - 1) Provide two (2) additional handsets.
 - 2) Handsets to have speakerphone.
 - b. Provide separate line service from Contractor's.
- E. Internet service:
1. Make arrangements and pay for dedicated internet service, minimum 50 mbs, to the Engineer's field office.
 2. Maintain until final project completion.
 3. Provide ethernet connections in all rooms of Engineer's field office.
 4. Provide Wireless-N router for Engineer's field office.

2.2 FACILITIES

- A. General:
1. Mobile trailers to be Class A, new and modified for field use.
 2. Structurally sound.
 3. Floors raised above ground.
 4. Properly weatherproofed.
- B. Contractor's facilities:
1. Provide a field office building and sheds adequate in size and accommodation for Contractor's offices, supply and storage.
 2. Locate only at sites approved by Engineer.
 3. Maintain surroundings in a sanitary and satisfactory manner.

2.3 PROJECT SIGNS

- A. Provide and erect where directed a project sign.
1. Maintain in good condition until project completion.
- B. Sign shall be approximately 4'x8' of 3/4" exterior plywood, mount on 4"x4" treated posts with bottom edge approximately 5' above ground line.
1. Comply with construction details, lettering and coloring as shown on Attachment No. 1 hereto.

2.4 CONFINED SPACE SAFETY EQUIPMENT

- A. Work under this contract may require construction or work in a confined space, defined as any space having one or more of the following characteristics:
 - 1. Limited openings for entry and exit.
 - 2. Unfavorable natural ventilation.
 - 3. Not designed for continuous worker occupancy.
- B. The Contractor shall have on the job site at all times the following minimum safety equipment:
 - 1. Gas monitor capable of testing and detecting for combustible gas, oxygen deficiency and hydrogen sulfide.
 - 2. Confined space access and retrieval winch system.
 - 3. Ventilating fan with large diameter ventilating hose.
 - 4. Supplied air respirator, MSHA/NIOSH approved type.
 - 5. Safety harness and life lines.
- C. This equipment to be available for use by the Contractor, Engineer and Owner for the duration of the project.
- D. All entries into or work within confined spaces to be conducted in accordance with the U.S. Department of Health and Human Services/National Institute for Occupational Safety and Health [DHHS (NIOSH)] Publication No. 87-113, A Guide to Safety in Confined Spaces.

PART 3 - EXECUTION

3.1 MAINTENANCE AND REMOVAL

- A. Maintain temporary facilities and controls as long as needed for safe and proper completion of the work.
- B. Remove such temporary facilities and controls as rapidly as progress of the work will permit, or as directed by the Engineer.

END OF SECTION

Attachment

SECTION 01640
PRODUCT HANDLING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Protect products scheduled for use in the work by means including, but not necessarily limited to, those described in this Section.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
 - 2. Additional procedures also may be prescribed in other Sections of these specifications.

1.2 QUALITY ASSURANCE

- A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.3 MANUFACTURERS' RECOMMENDATIONS

- A. Except as otherwise approved by the Engineer, determine and comply with manufacturer's recommendations on product handling, storage and protection.

1.4 PACKAGING

- A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.
 - 1. Maintain packaged materials with seals unbroken and labels intact until time of use.
 - 2. Promptly remove damaged material and unsuitable items from the job site and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.
- B. The Engineer may reject as non-complying such material and products that do not bear identification satisfactory to the Engineer as to manufacturer, grade, quality and other pertinent information.

1.5 PROTECTION OF MATERIAL AND WORK

- A. General:
 - 1. Carefully and properly protect all materials of every description, both before and after being used in the Work in accordance with manufacturer's recommendations.
 - 2. Provide any enclosing or special protection from weather deemed necessary by the Engineer at no additional cost to the Owner.
- B. Partial payments under the Contract will not relieve the Contractor from responsibility.

1. When materials and work at the site that have been partially paid for are not adequately protected by the Contractor, such materials will be protected by the Owner at the expense of the Contractor and no further partial payment thereon will be made.
- C. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.
- D. No field cutting or other modifications of equipment or materials without written approval of the Engineer.

1.6 STORAGE

- A. Store all items of equipment, component parts, etc., in accordance with the manufacturers' recommendations or as may otherwise be necessary to prevent damage or deterioration of any sort.
- B. Electrical and control equipment:
 1. Store in a dry area protected from dust and humidity.
 2. Equipment can be protected by a weatherproof cover if shipped to the site no more than two (2) weeks prior to installation and energization.

1.7 REPAIRS AND REPLACEMENTS

- A. In the event of damage, promptly make replacements and repairs to the approval of the Engineer and at no additional cost to the Owner.
- B. Additional time required to secure replacements and to make repairs will not be considered by the Engineer to justify an extension in the contract time of completion.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01650
GENERAL EQUIPMENT REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Requirements relating to providing of equipment and services specified in other Sections of these specifications.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections of Division 1 of these Specifications.
 - 2. Additional provisions concerning this work may be stated in other sections of these specifications.
 - 3. Where new equipment is to be installed into existing structures or systems, verify the plan dimensions with existing dimensions and note any discrepancies on the shop drawings.
- C. Allotted space and modifications:
 - 1. Equipment furnished under this Section shall be installed at the location and in the space allotted on the Contract Drawings.
 - 2. Any structural, piping, wiring, drawings, or other modifications required to accommodate equipment offered other than that shown on the Drawings, or specified, shall be done at no additional cost to the Owner.
- D. Instruct and train Owner's personnel in operation and maintenance of equipment, equipment components, control and instrumentation systems supplied and installed under this Contract; herein defined as the "training program" and adhering to the Owner's training objectives.

1.2 QUALITY ASSURANCE

- A. Equipment manufacturers shall, upon request of the Engineer, provide a detailed list of installations of comparable function.
- B. Equipment in each Section shall be by a single manufacturer regularly engaged in the development of equipment designed for the intended function.
- C. Guarantee the availability of repair parts and service for a period of not less than fifteen (15) years.
 - 1. Provide each component with a serial number and the manufacturer shall maintain records of same.

1.3 OPERATION, MAINTENANCE AND SERVICE MANUALS

- A. Prepare and submit for the Owner's use six (6) copies of O&M Manual for each piece of equipment and three (3) electronic copies in searchable PDFs with and internal table of contents.
 - 1. Submit Manuals 60 days prior to delivery of equipment

- B. Manuals shall be specific to the equipment supplied.
 - 1. Manuals applicable to many different configurations and which require the operator to selectively read portions of the instructions will not be accepted.
 - 2. The equipment model that the Manual applies to shall be indicated by an arrow.
- C. Provide a Table of Contents specific to each Manual.
- D. At the beginning of each Manual, provide a description of the equipment to include model numbers, purchase order numbers, serial numbers, motor information, and performance and design criteria.
- E. Correlate Manuals with the approved shop drawings and include the following minimum information:
 - 1. Parts list, including recommended spare parts list.
 - 2. Guaranties.
 - 3. Recommended maintenance instructions.
 - 4. Recommended lubricants and lubrication instructions.
 - 5. Address and telephone number of the source for repairs, spare parts and service.
 - 6. Detailed description of operating procedure for the item of equipment specifically written for this installation, including start-up and shutdown procedures.
 - 7. Equipment performance specifications, including pump curves.
 - 8. Results of start-up and any further recommendations resulting from start-up.
 - 9. Current cost for each recommended spare part and agreement to provide updated costs at Owner's request.
- F. Provide a maintenance and lubrication schedule to be a summary of all preventative maintenance and lubrication, including the following information:
 - 1. Title.
 - 2. Type of activity (inspection, adjustment, oil change, etc.).
 - 3. Brief description of activity.
 - 4. Type of lubricant.
 - 5. Frequency (daily, weekly, etc.).
- G. The manufacturer shall provide the Owner with a log chart to record all servicing and maintenance required during the equipment warranty period.
- H. For process oriented equipment, treatment plants, etc., provide a detailed description of the process operation and trouble-shooting of problems.
- I. Provide clear and legible copies. Type parts lists, etc.
- J. Layout and detail drawings shall be reduced to a maximum size of 11" x 17", unless written approval is received from the Engineer prior to submittal of Manuals.
- K. Provide a clearly labeled three-ring binder for Manuals having a thickness greater than 1/4". Provide sheet lifters if binder is more than 2/3 full.
 - 1. Provide multiple binders for Manuals having a thickness greater than 2".

1.4 TECHNICAL INSTRUCTION AND TRAINING

- A. Provide technical instruction and training where indicated for each item of equipment.
- B. Schedule each training session at least ten days in advance with the Owner and Engineer and prior to equipment start-up and acceptance by the Owner. The final approved copies of operation and maintenance manuals must have been delivered to the Engineer prior to scheduling the instruction period with the Owner.

1.5 ONLINE TRAINING

- A. When indicated in specification sections, develop Online Learning Modules.
 - 1. Prepare quizzes and a test with the full cooperation of the manufacturers.
 - 2. Provide course work, hosting services and programming by 360water, Inc.
 - a. Suppliers must have provided the platform to 10 municipal clients and been in business for 5 years.
 - b. Equals must provide a list and with contact phone numbers of 10 municipal installations completing technical training similar to this project.
 - 3. Provide Modules capable to evaluate and test personnel on:
 - a. Start-up /Shut down of equipment
 - b. Basic operations, maintenance and safety
 - c. Trouble shooting techniques
 - 4. The Online Education Program will include the following functions:
 - a. Intermittent quizzes and test questions;
 - b. Wrong answer notification;
 - c. 100% proficiency is required before a certificate of completion is generated;
 - d. A real time clock on screen that verifies the time spent on the course material;
 - e. Automatically bookmark when personnel leaves a course (in case of power outage or an emergency in the facility).
 - f. The online education program needs to be approved by the state-regulating agency for continuing education.
 - 5. The manufacturers will provide all relevant information needed to train personnel on mandatory procedures.
 - 6. Host this service for a minimum of 5-years. Provide A hard copy and an electronic version for the Owner to use for other non-online training programs.

B. SUBMITTAL REQUIREMENTS

- 1. Submittal material will include the following O&M manual components for the online provider to begin courses for the equipment:
 - a. Brochures
 - b. Start-up and shut down procedures
 - c. Operation and Maintenance material required to operate and maintain the equipment.
 - e. Troubleshooting guide
- 2. Include any additional material the manufacture has to assist the Owner to properly operate and maintain the equipment.

C. REVIEW OF ONLINE TRAINING:

- 1. Manufacturers selected for online training review will be required to review and comment on online training materials developed for the equipment they are providing.
- 2. Comments and corrections will be required within a schedule determined

by the contractor.

D. DATA CAPTURE:

1. Provide ____ days, broken up into ____ trips.
2. During these visits the data capture personnel will capture digital images and video for the courseware.
3. During 1 of the trips review some of the courseware with the training liaison, an operation supervisor and a maintenance supervisor to demonstrate the review process that will be conducted in house by the Owner.

E. Digitally tape each training class and provide the Owner with two (2) copies on DVD.

1. Clearly label each DVD with an adhesive label with the following information.
 - a. Project title.
 - b. City project number.
 - c. Manufacturer name.
 - d. Equipment name.
 - e. Date of instruction.
2. Supplier of Online Training specified herein to video each training class in 1080 HD format and provide instructor with wireless microphone for clear audio.
 - a. Submit video/audio documentation complying with this section.

F. EQUIPMENT LIST:

INSERT EQUIPMENT SECTIONS BELOW

1. Equipment and Systems that require Online Training.

SPECIFICATION SECTION	TYPE OF EQUIPMENT

**INCLUDE THE FOLLOWING FOR SOPHISTICATED EQUIPMENT.
INSERT INFORMATION IN THE EQUIPMENT TABLE.**

G. Face to Face Training Review

1. Personnel involved in the writing of the courseware shall attend a training session provided by the manufacturer
 - a. Document any additional information stated but not captured in the operation and maintenance manual as well as note any discrepancies or contradictions with the materials.
 - b. These trips will coincide with the Digital Capture Visits.
 - c. Applies to the following equipment.

SPECIFICATION SECTION	TYPE OF EQUIPMENT

2. Provide comments and notes to the contractor to submit to the engineer.
 - a. The engineer will decide if the contradictions or discrepancies warrant a return visit from manufacturer's representative to clarify comments.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Supply all materials, tools, equipment, labor and supervision to properly complete installation of equipment, piping, controls, etc., in compliance with the contract documents.

2.2 IDENTIFICATION

- A. Provide stamped identification labels on motors and equipment with pertinent information including serial numbers, model numbers, capacities, voltage, amps, etc.
- B. Label to be aluminum or stainless steel.
- C. Attach with stainless steel or aluminum hardware.

2.3 LUBRICANTS AND LUBRICATING EQUIPMENT

- A. Provide and install necessary oils, greases, etc., for initial operation of equipment.
- B. Where manufacturer's recommendations include changing of initial lubricants after 1,000 hours or less of operation, provide sufficient lubricants to make the change.
- C. Provide one of every type lubricating gun required to properly maintain the equipment.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide information that may be requested without undue delay.
- B. Deliver O&M Manuals to the Engineer for review and approval and transmittal to the Owner.
 1. Do not start equipment unless the Owner has approved O&M Manuals.
- C. Properly lubricate all equipment prior to start-up.

- D. Work under sections requiring submittal of O&M Manual will not be considered complete and final payment will not be made until all Manuals have been submitted and approved.
- E. Provide revisions to O&M Manuals to reflect any changes made during installation and start-up of equipment.

3.2 WARRANTY PERIOD

- A. Equipment warranties shall commence upon successful completion of the thirty (30) day operational period after project acceptance by Owner and shall be for a period of one (1) year unless otherwise noted.
- B. Contractor will be notified in writing of beginning and ending dates of warranty period.

END OF SECTION

SECTION 01660
TECHNICAL SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Providing technical services to ensure proper installation and training of Owner's personnel in operational procedures for various items of equipment.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Other requirements for technical services are stated in other Sections of these Specifications.

1.2 QUALITY ASSURANCE

- A. Provide services of qualified service engineers, process engineers, or technicians only.
- B. Qualifications of personnel provided shall be subject to approval of the Engineer.
 - 1. Services of personnel found not to be qualified will not be considered a part of the period of service specified.

1.3 SUBMITTALS

- A. Provide credentials of all process engineers for approval 30 days prior to their scheduled period of service.

PART 2 - PRODUCTS

2.1 REPORTS

- A. Provide written copies of reports, certified results of tests, etc. complying with other Sections of these Specifications.

PART 3 - EXECUTION

3.1 GENERAL

- A. Where service is required by a manufacturer, it shall be extended to all other items of equipment provided by him, whether individually specified or not.
- B. A day of service is defined as not less than 8 working hours performed between 7:00 a.m. and 7:00 p.m., unless otherwise required.
- C. A trip is defined as a scheduled visit to the project site for the express purpose of providing technical services specified.

D. Travel time to or from the project site is not a part of the service time.

3.2 PERIOD OF SERVICE

A. Provide number of days service and number of trips as indicated in individual equipment sections.

3.3 FIELD MEASUREMENTS

A. Measure and record amperage, voltage, and speed (rpm) at operating conditions of the equipment.

B. Include all measurements of the equipment.

END OF SECTION

SECTION 01670
START-UP SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide personnel to place all equipment in operation, fine tune treatment processes and instruct Owner's personnel in operation and maintenance procedures.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
 - 2. Other provisions concerning Start-up Services may also be stated in other Sections of these specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled personnel who are thoroughly trained and experienced in the necessary procedures and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Provide manufacturers technical services as specified or needed.

PART 2 - PRODUCTS

No products are required under this Section.

PART 3 - EXECUTION

3.1 GENERAL

- A. Upon final completion of all components, the Contractor shall be responsible for placing the plant in initial operation.
- B. Provide personnel on the job site for first 30 days of operation, or until successful operation is attained, whichever is the longest.

3.2 SCHEDULING

- A. Determine date of start-up jointly with Engineer and Owner.
- B. Schedule services of manufacturers technical personnel jointly with Engineer prior to date of start-up.

3.3 FIELD MEASUREMENTS

- A. Measure and record amperage, voltage, and speed (rpm) at operating conditions of the equipment.

B. Include all measurements in the start-up report.

3.4 COMPLETION

A. Start-up services will not be considered completed until all equipment is operating properly and treatment processes are functioning as designed.

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included shall be providing compliance with the requirements of the General Conditions of these Specifications for administrative procedures in closing out the project work.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Other requirements for technical services are stated in other sections of these Specifications.
 - 3. Section 00690 - Contractor's Affidavit.
 - 4. Section 01660 - Technical Services.
 - 5. Section 01670 - Start-up Services.
 - 6. Section 01720 - Project Record Documents.

1.2 SUBSTANTIAL COMPLETION

- A. The Contractor shall notify the Engineer that, in his opinion, the project is substantially complete. A written statement listing items complete shall be submitted.
- B. Upon receipt of the Contractor's notice, the Engineer shall make an observation to determine if substantial completion is provided.
- C. If, in the Engineer's opinion, the project is not substantially complete, a written notice to the Contractor shall follow outlining reasons and deficiencies in work that comprised the Engineer's decision. The Engineer's decision shall be final.

1.3 FINAL OBSERVATION

- A. The Engineer will make a final observation for the Contractor after all items noted in the substantial completion observation have been corrected. The Contractor shall notify the Engineer in writing when a final observation is needed. Incomplete and/or defective work shall be given to the Contractor by written notice.

1.4 REOBSERVATION

- A. Re-observation required due to failure by the Contractor to make previously noted corrections will be performed by the Engineer.
- B. Cost for such observations will be due to and payable by the Contractor at a rate equal to charges to the Owner for similar work.
- C. Re-observations will continue until the work is acceptable to the Engineer.

1.5 COMPLETION BY CONTRACTOR

- A. When the Engineer finds the Contractor's work acceptable, the Contractor shall be given such notice and should proceed with closeout submittals.
- B. Closeout submittals shall contain at least the following:
 - 1. Project record documents.
 - 2. Equipment operation and maintenance manuals and copies of start-up reports.
 - 3. Warranties and bonds.
 - 4. Keys and keying schedule.
 - 5. Spare parts and manuals.
 - 6. Evidence of payment and release to liens per General Conditions.
 - 7. Section 00690 - Contractor's Affidavit.

1.6 FINAL PAYMENT

- A. Final payment to the Contractor will be made upon completion of the previous items and others required by these specifications. A final statement shall be forwarded to the Engineer. The statement shall address:
 - 1. Previous change orders.
 - 2. Unit prices.
 - 3. Deductions for uncorrected work.
 - 4. Deductions for liquidated damages.
 - 5. Deductions for re-testing work.
 - 6. Deductions for re-observation.
 - 7. Deductions for shop drawing review.
 - 8. Adjusted contract sum.
 - 9. Previous payments.
 - 10. Amount due.
- B. When required, the Engineer will prepare a contract change order for adjustments not previously made.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included:
 - 1. Throughout progress of the Work, maintain an accurate record of changes in the Contract Documents, as described in Article 3.1 below.
 - 2. Upon completion of the Work, deliver the recorded changes to the Engineer.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
 - 2. Other requirements affecting Project Record Documents may appear in pertinent other Sections of these specifications.

1.2 QUALITY ASSURANCE

- A. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Engineer.
- B. Accuracy of records shall be such that future search for items shown on the Project Record Documents may rely reasonably on the information provided under this Section of the Work.

1.3 SUBMITTALS

- A. The Engineer's approval of the current status of Project Record Documents may be a prerequisite to the Engineer's approval of requests for progress payment and request for final payment under the Contract.
- B. Prior to submitting each request for progress payment, secure the Engineer's approval of the current status of the Project Record Documents.
- C. Prior to submitting request for final payment, submit the final Project Record Documents to the Engineer and secure his approval.

1.4 PRODUCT HANDLING

- A. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the Work and transfer to the Engineer.
- B. In the event of loss of recorded data, use means necessary to again secure the data to the Engineer's approval.
 - 1. Such means shall include, if necessary in the opinion of the Engineer, removal and replacement of concealing materials.
 - 2. In such case, provide replacements to the standards originally required by the Contract Documents.

PART 2 - PRODUCTS

2.1 JOB SET DOCUMENTS

- A. Promptly following receipt of the Owner's Notice to Proceed, secure from the Engineer, at no charge to the Contractor, one complete set of all Documents comprising the Contract.

PART 3 - EXECUTION

3.1 MAINTENANCE OF JOB SET

- A. Immediately upon receipt of the job set described in above paragraph titled "JOB SET DOCUMENTS", identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET".
- B. Preservation:
 - 1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Engineer.
 - 2. Do not use the job set for any purpose except entry of new data and for review by the Engineer.
 - 3. Maintain the job set at the site of Work as that site is designated by the Engineer.
- C. Field work and making entries on Job Set Drawings:
 - 1. Use erasable colored pencil, preferably red (not ink or indelible pencil) to delineate changes.
 - 2. Show by station number location of all fittings, manholes, valves, wye locations, etc.
 - 3. Reference all fittings and valves at least to two aboveground items reasonably safe from being relocated and indicate such references on the drawings.
 - 4. Reference all pipelines from the center of the parallel roadway at least every 100 feet or where changes occur in the direction of the pipeline.
 - 5. Reference all bores from the center of the roadway to the beginning and end of the casing and ductile iron pipe. Depths of bury must also be provided.
 - 6. Reference all stream crossings and their distance from the center of the parallel roadway and the bridge or other obstruction. A profile of the stream crossing shall also be provided to show the depth of the pipeline under the stream.
 - 7. Field measure and reference all fittings and valves to two aboveground items reasonably safe from being relocated and indicate such references on the drawings.
 - 8. Show location of electrical conduit, pull boxes, etc.
 - 9. Gravity sewers and storm sewers
 - a. Provide survey grade state plane Geographic Information System (G.I.S.) electronic data horizontal coordinates for each manhole location.

- b. Provide ground elevation, top elevation and invert elevations for each manhole.
- c. Comply with Section 01050.1

D. Submittal:

- 1. Submit "marked-up" set of drawings to the Engineer.
- 2. Make any necessary additions as required by the Engineer.

END OF SECTION

SECTION 02060

DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Demolition and removal of selected portions of existing buildings, structures, utilities, and equipment as indicated on the Drawings and as specified.
- B. Remove, salvage, or otherwise dispose of minor site improvements as specified in this section.
- C. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
 - 2. Section 02210: Site Grading

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Comply with the International Building Code with due regard to the protection of the public and the provision of safeguards during the performance of the work.
- C. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.
- D. Comply with requirements of governmental agencies having jurisdiction.
- E. Contractor is responsible for being aware of and complying with Asbestos NESHAP regulations, as well as other applicable codes, laws and regulations.
 - 1. The Owner is to be notified immediately upon discovery of asbestos materials.

PART 2 - PRODUCTS

- A. No products are required in this Section.

3.1 EXAMINATION:

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

- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.
- D. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of measured drawings.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS:

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - 4. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION:

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 01500.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, lighting, power, heating, and cooling specified in Section 01500.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- D. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL:

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated and as specified. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. 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 fire watch and portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly off-site.
- B. Do not demolish building elements beyond what is indicated on the Drawings without Engineer and Owner's approval.
- C. 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 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS:

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Refer to the Drawings and technical Specifications for additional and specific selective demolition for specific materials.

E. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to Section 07531 for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

F. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 DISPOSAL OF DEMOLISHED MATERIALS:

A. General: Remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

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. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 SALVAGE:

A. Items designated for salvage shall be turned over to the City. The following items shall be carefully removed from existing facilities and neatly stored by the Contractor in a location at the site designated by the Owner:

1. Two 150 HP vertical turbine pumps #1 and #4 and associated motor starters
2. Two additional 150 HP motor starters from pumps #2 & #3 to receive new VFD's.

3.8 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

SECTION 02210

SITE GRADING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Cut, fill, excavate, backfill, compact and grade the site as necessary to bring the roads, drives, building sites, paved areas and open areas to the lines and grades shown on the drawings.
1. The work includes, but is not necessarily limited to:
 - a. Building site preparation.
 - b. Roadway, parking area, drive and walk subgrade preparation.
 - c. Excavations and formations of embankments.
 - d. Dressing of graded areas, shoulders and ditches.
 - e. Construction and lining of treatment basins.
 2. Classification: All excavation is unclassified and excavation of every description, regardless of material encountered within the grading limits of the project, shall be performed to the lines and grades indicated.
- B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
 2. Section 02220 - Excavating, Backfilling for Structures.
 3. Section 02221 - Trenching, Backfilling for Utilities.
 4. Section 02260 - Erosion and Sediment Control.
- C. Definitions:
1. Open areas: Open areas shall be those areas that do not include building sites, paved areas, street right-of-way and parking areas.
 2. Maximum density: Maximum weight in pounds per cubic foot of a specific material.
 3. Optimum moisture: Percentage of water in a specific material at maximum density.
 4. Rock excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery. To be considered as rock excavation, the material shall be continuous; individual boulders or rocks in soil will not be considered rock excavation.
 5. Muck: Materials unsuitable for foundation because of organic content, saturation to the extent that it is somewhat fluid and must be removed by dragline, dredge or other special equipment, are designated as muck. No extra payment will be made for muck removal.
 6. Unsuitable material: Unsuitable material is defined as earth material unsatisfactory for its intended use and as classified by the soils technician. In addition to organic matter, sod, muck, roots and rubbish, highly plastic clay soils of the CH and MH descriptions, and organic soils of the OL and OH descriptions, as defined in the Unified Soil Classification System shall be considered as unsuitable material.
 7. Suitable material: Where the term suitable material is used in specification sections pertaining to earthwork, it means earth or materials designated as being suitable for their intended use by soils technicians or

the Engineer. Suitable material shall be designated as meeting the requirements of the Unified Soil Classification System types SW, GW, GC, SC, SM, ML, CL or as designated in these specifications.

8. Select material: Select material is defined as granular material to be used where indicated on the drawings or where specified herein consisting of soils conforming to the Unified Soil Classification types SW, SM, GW or GM or as otherwise approved by the Engineer as select fill. Select material shall contain no stones or rubble larger than 1-1/2" in diameter.
 9. Crushed stone (gravel): Crushed stone shall be No. 57 aggregate or equal conforming to ASTM C-33.
 10. Excavation: Excavation is defined as unclassified excavation of every description regardless of materials encountered.
- D. The Contractor must determine for himself the volume of material required by the site.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Comply with requirements of governmental agencies having jurisdiction.
- C. A testing laboratory retained by the Owner will make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts of fill material and shall keep the laboratory informed of his progress. The cost of the initial tests shall be paid for by the Owner. Subsequent tests required as a result of improper compaction shall be paid for by the Contractor.

1.3 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

1.4 JOB CONDITIONS

- A. Notification of intent to excavate:
 1. South Carolina Underground Utility Damage Prevention Act (S.C. Code Ann, 58-35-10, CT-SEQ, Supp. 1978) requires persons to ascertain the location of underground public utility property prior to excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish prior to commencing such operations. Failure to comply could subject the violator to a civil penalty of up to one thousand dollars (\$1,000) for each violation of the Act.
 2. Notification of intent to excavate may be given by calling this toll free number: 1-800-922-0983.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Soil material used as fill, backfill, subgrade for structures or pavements, embankments, or site grading shall consist of suitable material as found available on site until such supply of on-site material is depleted.
 - 1. Provide suitable material free from organic matter and deleterious substances, containing no rocks or lumps over 6" in greatest dimension, and with not more than 15% of the rocks or lumps larger than 2-1/2" in their greatest dimension.
 - 2. Do not permit rocks having a dimension greater than 1" in the upper 6" of fill or embankment.
- B. Should the quantity of suitable on-site material be insufficient to complete the work, suitable borrow material as approved by the Engineer shall be provided by the Contractor at no additional expense to the Owner.
- C. Select materials may be provided from on-site if acceptable material as approved by the Engineer is available on site. Otherwise approved select material shall be provided by the Contractor from an off-site source.

2.2 TOPSOIL

- A. Use topsoil consisting of material removed from the top 3" to 6" of existing on-site soils or from off site.
 - 1. Maximum clay content of 25%.
- B. Use topsoil containing no stones, roots, large clods of soil or other foreign matter.
- B. Stockpile topsoil separate from other excavated material.

2.3 WEED KILLER

- A. Provide a dry, free-flowing, dust free chemical compound, soluble in water, capable of inhibiting growth of vegetation and approved for use on this work by governmental agencies having jurisdiction.

2.4 EQUIPMENT

- A. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner without undue waste or damage of material.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- 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.

3.2 PREPARATION

- A. Clearing and grubbing: Clear and grub areas to be graded prior to commencement of the grading operations.
- B. Where so directed by the Owner, protect and leave standing designated desirable trees.

- C. Complete any demolition and/or removal work as may be required prior to grading operations.
- C. Dispose of all clearing, grubbing and demolition debris and other deleterious material off the project site. Vegetation, roots, brush, rubbish, stumps, etc. may be burned on-site where permitted by local authorities and regulations and approved by the Engineer.
- E. Topsoil: Strip topsoil to a depth of 3" to 6" without contamination from the subsoil and stockpile topsoil separate from other excavated materials.
 - 1. Transport and deposit topsoil in storage piles convenient to areas that are to receive topsoil or in other locations as indicated or approved by the Engineer.
 - 2. Deposit topsoil in areas that are already graded and will not be disturbed by on-going construction.
 - 3. Dispose of unsuitable or unusable stripped material off-site or as otherwise directed by the Engineer.
- F. Sampling and preliminary testing:
 - 1. Prior to beginning the grading operations, the Contractor shall submit to the Engineer his proposed sequence of excavation operations.
 - 2. Based upon the sequence of excavation, samples of the fill materials will be obtained as excavation proceeds and tested for grain size permeability and moisture density relationship using the Standard Proctor Method (ASTM D698, Method A).
 - 3. Allow sufficient time for completion of laboratory tests before any fill operations begin, using the soils being tested.

3.3 FINISH ELEVATIONS AND LINES

- A. Construct areas outside of building or structure lines true to grades shown.
 - 1. Where no grade is indicated, shape finish surface to drain away from buildings or structures, as approved by the Engineer.
- B. Degree of finish shall be that ordinarily obtainable from blade grader, supplemented with hand raking and finishing.
- C. Finish surfaces to within 0.10' above or below the established grade or approved cross section.

3.4 GENERAL PROCEDURES

- A. Existing utilities:
 - 1. Unless shown to be removed, locate and protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.
 - 2. If active utility lines are encountered and are not shown on the drawings or otherwise made known to the Contractor, promptly notify the Engineer and take necessary steps to assure that service is not interrupted.
 - 3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.

4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
 5. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.
- B. Protection of persons and property:
1. Barricade open holes and depressions occurring as part of this Work, and post warning lights on property adjacent to or with public access.
 2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.
- C. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
- D. Maintain access to adjacent areas at all times.
- E. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.

3.5 EXCAVATING (CUTS)

- A. Perform excavating of every type of material encountered within the limits of the Work to the lines, grades and elevations indicated and specified herein.
- B. Provide sloping, sheeting, shoring, and bracing for excavations conforming with 29CFR1926 Subpart P-Excavations and the Contract Documents.
- C. Suitable excavated materials:
1. Use all suitable materials removed from the excavation as far as practicable in the formation of the embankments, subgrades, shoulders, building sites and other places as directed.
 2. Unless otherwise indicated on the drawings or approved by the Engineer, surplus suitable material shall be removed from the site and disposed of by the Contractor.
- D. Unsuitable excavated material: Remove from the site and dispose of all unsuitable material unless otherwise approved by the Engineer.
- E. Rock excavation:
1. Notify the Engineer upon encountering rock or similar material which cannot be removed or excavated by conventional earth moving or ripping equipment.
 2. Do not use explosives without written permission from the Engineer.
 3. When explosives are permitted, use only experienced powdermen or persons who are licensed or otherwise authorized to use explosives. Store, handle and use explosives in strict accordance with all regulatory bodies and the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc.
 4. The Contractor shall be solely responsible for any damage resulting from the use of explosives.

5. The Contractor is responsible for securing all permits required in performing this work.
- F. Unauthorized excavation:
 1. Excavation of material to depths below the grades indicated unless so directed by the Engineer will be deemed unauthorized excavation.
 2. Unauthorized overexcavation shall be backfilled and compacted without any additional expense to the Owner.
- G. Authorized overexcavation:
 1. In the event that it is necessary to remove unsuitable material to a depth greater than that shown on the drawings or otherwise specified, the Contractor shall remove, replace and compact such material with suitable material as directed by the Engineer at no additional expense by the Owner.

3.6 FILLING AND BACKFILLING

- A. Use fills formed of suitable material placed in layers of not more than 8" in depth measured loose and rolled and/or vibrated with suitable equipment until compacted.
- B. Do not place rock that will not pass through a 6" diameter ring within the top 12" of the surface of the completed fill or rock that will not pass through a 3" diameter ring within the top 6" of the completed fill.
- C. Do not use broken concrete or asphaltic pavement in fills.
- D. Selection of borrow material:
 1. Material in excess of that available on the site shall be suitable material furnished by the Contractor from private sources selected by the Contractor. The material shall be approved by the Engineer before use. All expenses involved in securing, developing, transporting and placing the material shall be borne by the Contractor.
- E. Placing and compacting:
 1. Place backfill and fill materials in layers not more than 8" in loose depth with a moisture condition of $\pm 2\%$ of optimum.
 2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.
 - a. At the time of compaction, the water content of the material must be at optimum water content or within 2% above optimum.
 - b. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.
 3. Compact each layer to required percentage of maximum density for the area.
 4. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 5. Place backfill and fill materials evenly adjacent to structures, to required elevations.
 6. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structures to approximately the same elevation in each lift.

F. Moisture control:

1. Do not use soil material that is either too dry or too wet to achieve proper compaction.
2. Where subgrade or layer of soil material is too dry to achieve proper compaction, uniformly apply water to surface of soil material such that free water does not appear on the surface during or subsequent to compacting operations.
3. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.
4. Soil material that has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests approved by the Engineer.

G. Compaction requirements:

1. Compact soils to not less than the following percentages of maximum dry density as determined in accordance with ASTM D698, Method A (Standard Proctor).
2. Fill beneath structures and beneath an area extending 10' beyond the limits of the foundation:

Top 12" of subgrade	100%
All other fill material	98%

3. Fill beneath roadway:

Top 12" of subgrade	100%
All other fill material	95%

4. Embankments:

Top 12" of subgrade	98%
All other fill material	95%

5. Fill beneath walkways:

Top 12" of subgrade	95%
All other fill material	90%

6. Lawn and unpaved open areas:

All other fill material	90%
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3.7 FINISH GRADING

A. General:

1. Uniformly grade the areas within limits of grading under this Section, including adjacent transition areas.
2. Smooth the finished surfaces within specified tolerance.
3. Grade with uniform levels or slopes between points where elevations are shown on the drawings, or between such points and existing grades.
4. Where a change of slope is indicated on the drawings, construct a rolled transition section having a minimum radius of approximately 8'0", unless adjacent construction will not permit such a transition, or if such a transition defeats positive control of drainage.

B. Grading adjacent to structures: Grade areas adjacent to buildings to achieve drainage away from the structures and to prevent ponding.

C. Ditches and gutters and swales:

1. Cut accurately to the cross sections, grades and elevations shown.

2. Maintain excavations free from detrimental quantities of leaves, sticks, trash and other debris until completion of the work.
3. Dispose of excavated materials as specified herein; do not in any case deposit materials within 3'0" of the edge of a ditch.

3.8 FIELD QUALITY CONTROL

- A. Secure the Engineer's construction review and observation and approval of subgrades and fill layers before subsequent construction is permitted thereon.
- B. Field density determinations will be made, at no cost to the Contractor, to ensure that the specified densities are being obtained. Field density tests will be performed as determined by the Engineer, considering the following:
 1. At areas to receive paving, at least one field density test for every 5,000 sq. ft. of subgrade area, but not less than three tests.
 2. In each compacted fill layer, one field density test for every 5,000 sq. ft. of overlying paved area, but not less than three tests.
 3. In fill beneath structures, one field density test for every 2,500 sq. ft. in each layer.
 4. Other tests as deemed necessary by the Engineer.
- C. If, in the Engineer's opinion based on reports of the testing laboratory, subgrade or fills which have been placed are below specified density, provide additional compacting and testing until specified requirements are met.
 1. Additional testing will be provided by the Owner's selected testing laboratory and all costs for the additional testing will be borne by the Contractor.
- D. Proofrolling:
 1. The Contractor shall proofroll subgrade of areas to receive paving, structures on fill or impervious lining material.
 - a. Make not less than 3 passes of a 25 to 50 ton rubber tired roller over the full area.
 - b. Unstable, soft or otherwise unsuitable materials revealed by the proofrolling shall be removed and replaced with satisfactory materials, compacted as specified herein.

3.9 PLACING TOPSOIL

- A. Upon completion of site grading and other related site work, topsoil shall be uniformly spread over the graded or improved areas. Topsoil shall be evenly distributed to conform to final grade elevations shown on the plans.
- B. Place, level and lightly compact topsoil to a depth of not less than 3".
- C. Maintain topsoil free of roots, rocks, debris, clods of soil and any other objectionable material which might hinder subsequent grassing or mowing operations.
- D. Any surplus materials shall be disposed of in approved areas on the site.

3.10 MAINTENANCE

- A. Protection of newly graded areas:

1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.
 2. Repair and re-establish grades in settled, eroded and rutted areas to the specified tolerances.
- B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

3.11 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 02220

EXCAVATING, BACKFILLING FOR STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Excavating, backfilling, compacting and grading to build the structures as shown on the Drawings, as specified herein, and as needed to meet the requirements of the construction shown in the Contract Documents.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 02210 - Site Grading.
- C. Classification: All excavation is unclassified and excavation of every description, regardless of material encountered within the excavation limits of the structure, shall be performed to the lines and grades indicated.
- D. Definitions:
 - 1. Open areas: Open areas shall be those areas that do not include building sites, paved areas, street right-of-way, and parking areas.
 - 2. Maximum density: Maximum weight in pounds per cubic foot of a specific material.
 - 3. Optimum moisture: Percentage of water in a specific material at maximum density.
 - 4. Rock excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery. To be considered as rock excavation, the material shall be continuous; individual boulders or rocks in soil will not be considered rock excavation.
 - 5. Muck: Materials unsuitable for foundation because of organic content, saturation to the extent that it is somewhat fluid and must be moved by dragline, dredge, or other special equipment, are designated as muck. No extra payment will be made for muck removal.
 - 6. Unsuitable material: Unsuitable material is defined as earth material unsatisfactory for its intended use and as classified by the soils technicians. In addition to organic matter, sod, muck, roots, and rubbish, highly plastic clay soils of the CH and MH descriptions, and organic soils of the OL and OH descriptions, as defined in the Unified Soil Classification System shall be considered as unsuitable material.
 - 7. Suitable material: Where the term suitable material is used in specification sections pertaining to earthwork, it means earth or materials designated as being suitable for their intended use by soils technicians or the Engineer. Suitable material shall be designated as meeting the requirements of the Unified Soil Classification System types SW, GW, GC, SC, SM, ML, CI or as designated in these specifications.
 - 8. Select material: Select material is defined as granular material to be used where indicated on the drawings or where specified herein consisting of soils conforming to the Unified Soil Classification types SW, SM, GW, or

- GM or as otherwise approved by the Engineer as select fill. Select material shall contain no stones or rubble larger than 1-1/2" in diameter.
9. Crushed stone (gravel): Crushed stone shall be No. 57 aggregate or equal conforming to ASTM C 33.
 10. Excavation: Excavation is defined as unclassified excavation of every description regardless of materials encountered.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Comply with requirements of governmental agencies having jurisdiction.
- C. Testing: A testing laboratory retained by the Owner will make such tests as are deemed advisable.
 1. Schedule fill and backfill operations so as to permit a reasonable time for inspection and testing before placing succeeding lifts and keep the laboratory and Engineer informed of progress.
 2. Notify the Engineer and allow sufficient time for observation and/or testing of foundation subgrades prior to commencing any work on the exposed excavation.

1.3 JOB CONDITIONS

- A. If conditions encountered during construction warrant additional removal of unsuitable material below foundation subgrades, then remove unsuitable material and replace it as specified at no additional expense to the Owner.
- B. Restoration of disturbed areas:
 1. Restore all areas disturbed by, during or as a result of construction activities to their existing or better condition.
 - a. For existing areas with sod type grasses, replace with new sod. Existing sod may be reused where properly removed and stored.
 2. Do not interpret this as requiring replacement of trees and undergrowth in undeveloped sections of the rights-of-way.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Soil material used as fill, backfill or subgrade for structures shall consist of suitable material.
 1. Provide suitable material free from organic matter and deleterious substances, containing no rocks or lumps over 6" in greatest dimension, and with not more than 15% of the rocks or lumps larger than 2-1/2" in their greatest dimension.

2. Do not permit rocks having a dimension greater than 1" in the upper 6" of fill or subgrade.
- B. Where select material is indicated on the drawings or specified, use select granular material as defined herein and approved by the Engineer.
 - C. Where indicated on the drawings or specified, use gravel or crushed stone as defined herein.
 - D. Where indicated on the drawings, provide a lean concrete "mud slab" beneath foundations.
 1. Use 2000 psi concrete and a minimum thickness of 2-1/2".
 2. With prior approval of the Engineer, a "mud slab" may be substituted for gravel base material except where the gravel base is required for drainage or for use with pressure relief valves.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Provide sloping, sheeting, shoring, and bracing for excavations conforming with 29CFR1926 Subpart P-Excavations and the Contract Documents.
- B. Protection of persons and property:
 1. Protect structures, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.
 2. Unless shown to be removed, locate and protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.
 3. If active utility lines are encountered and are not shown on the drawings or otherwise made known to the Contractor, promptly notify the Engineer and take necessary steps to assure that service is not interrupted.
 4. Barricade open holes and depressions occurring as part of this work, and post warning lights on property adjacent to or with public access. Operating warning lights during hours from dusk to dawn each day and as otherwise required.
 5. Side slopes: Slope, bench and/or shore sides of excavations and trench walls to maintain stability of the wall or sides. Pile materials obtained from the excavation a minimum of four feet from the edge of the excavation.
 6. Shoring and sheeting: Where necessary, shore and sheet excavations with members of sizes and arrangement sufficient to prevent injury to persons, damage to structures or injurious caving or erosion.
 - a. Furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures from undermining or other damage. Any movement or bulging that may occur shall be corrected immediately by the Contractor. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and compacted.
 - b. Take all precautions to prevent distress of existing structures because of sheeting installation or removal. Where the removal of

sheeting may cause damage to existing or newly constructed structures, such sheeting shall be left in place at no expense to the Owner.

- c. All sheeting and shoring operations and maintenance thereof shall be the responsibility of the Contractor.

C. Excavating: Perform excavating of every type of material encountered to the lines, grades and elevations indicated or as necessary for construction of the structures shown.

- 1. Conform to elevations and dimensions shown within a tolerance of 0.10', and extending a sufficient distance from footings and foundations to permit placing and removing concrete formwork, installation of services, other construction required and for construction observation.
- 2. Where earth will stand, shallow footing excavations may be cut to the exact size of the footing.
- 3. Separate suitable materials and stockpile for future use.
- 4. Dispose of unsuitable material and excess suitable material.

D. Foundation subgrades: Excavate foundations and footings to a level bottom in firm, solid, suitable material.

- 1. Take care not to disturb the bottom of the excavation unless further compaction of the subgrade is required.
- 2. Notify the Engineer in due time to permit observation of the completed excavation prior to performing work on the foundation subgrade.
- 3. Should unsuitable or soft material be encountered at subgrade elevation, remove such material and replace with compacted suitable material or crushed stone from firm earth up to the indicated elevation.
 - a. In wet excavations or where groundwater is normally present, replace unsuitable material with crushed stone or lean concrete.
 - b. In dry excavations above the normal groundwater level, replace unsuitable material with compacted suitable material.
 - c. Unsuitable material shall be removed and replaced at no expense to the Owner.
- 4. Where rock is encountered at foundation level:
 - a. Use drilling, picking, wedging or similar methods leaving the foundation rock in an entirely solid and unshattered condition.
 - b. Roughen approximately level surfaces to provide satisfactory bond with concrete.
 - c. Cut steps or benches in sloped surfaces to provide satisfactory bond.

E. Drainage: Provide drainage and control grading in the vicinity of the work to prevent drainage into the excavation.

F. Rock excavation:

- 1. Notify the Engineer upon encountering rock or similar material that cannot be removed or excavated by conventional earth moving or ripping equipment.
- 2. Do not use explosives without written permission from the Engineer.
- 3. When explosives are permitted, use only experienced powdermen or persons who are licensed or otherwise authorized to use explosives. Store, handle and use explosives in strict accordance with all regulatory bodies and the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc.

4. The Contractor shall be solely responsible for any damage resulting from the use of explosives.
 5. The Contractor is responsible for securing all permits required in performing this work.
 6. Do not use blasting adjacent to existing buildings or structures.
 - a. Remove rock at such locations using jack hammers and bull points.
 7. If rock is encountered at final grade, overexcavate to a depth of six (6) inches and place suitable material approved by the Engineer to establish final grade.
- G. Unauthorized excavation:
1. Excavation of material to depths below the grades indicated unless so directed by the Engineer will be deemed unauthorized excavation.
 2. Backfill and compact unauthorized over excavation at no expense to the Owner.
 - a. In wet excavations or excavations below normal groundwater elevations: Use crushed stone or lean concrete as directed by the Engineer.
 - b. In dry excavations above normal groundwater elevations: Use compacted suitable material.

3.2 DEWATERING

- A. Remove all surface and subsurface waters from excavations and maintain the excavation in a dry condition during construction operations.
- B. Maintain the water level below the excavation subgrade during excavation and construction.
1. Material disturbed below the foundation subgrade due to improper dewatering shall be removed and replaced with crushed stone or lean concrete at no expense to the Owner.
 2. Use sumps, pumps, drains, trenching or well point system as necessary to maintain a dry excavation.
 3. Dewatering by trench pumping will not be permitted if migration of fine grained natural material (running sand) from bottom, side walls or bedding material will occur.
- C. Water pumped or drained from excavations must be treated by an appropriately sized sediment and erosion control device prior to leaving the site. Discharging untreated or contaminated dewatering effluent is prohibited.
1. Contractor is responsible for acquiring all permits required to discharge the water and shall protect waterways from turbidity during the operation.
 2. Prevent flooding of streets, roadways, or private property.
 3. Prevent onsite erosion that can be caused by concentrated discharges related to dewatering pumping, drains, or trenching.
 4. Provide engines driving dewatering pumps with residential type mufflers.

3.3 BACKFILLING, FILLING AND COMPACTION

- A. Use suitable material for all filling and backfilling operations.
- B. Fill under structures: Deposit suitable material in layers not exceeding 8" in depth with a moisture condition of $\pm 2\%$ of optimum and compact each layer using proper equipment.

1. Do not place rock that will not pass through a 6" diameter ring within the top 12" of the surface of the completed fill or rock that will not pass through a 3" diameter ring within the top 6" of the completed fill.
 2. Do not place broken concrete, bricks, or asphaltic pavement in fills.
 3. Where indicated on the drawings, provide select granular material.
- C. Backfill excavations as promptly as progress of the Work permits, but not until completion of the following:
1. Inspection and acceptance of construction below finish grade including, where applicable, damp proofing and waterproofing.
 2. Inspecting, testing, approving and recording locations of underground utilities.
 3. Removing concrete formwork.
 4. Removing shoring and bracing, and backfilling of voids with satisfactory materials.
 5. Removing trash and debris.
 6. Foundation walls have been in place seven days.
- D. Placing and compacting:
1. Place backfill and fill materials in layers not more than 8" in loose depth.
 2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content within $\pm 2\%$.
 3. Compact each layer to required percentage of maximum density for area.
 4. Do not place backfill or fill material on surfaces that are muddy, frozen, or containing frost or ice.
 5. Place backfill and fill materials evenly adjacent to structures, to required elevations.
 6. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.
 7. Do not operate heavy equipment closer to foundation or retaining walls than a distance equal to height of backfill above the footing.
 - a. Compact remaining area using power driven hand tampers.
 8. Where the construction includes basement or other underground walls having structural floors over them, do not backfill such walls until the structural floors are in place and have attained sufficient strength to support the walls.
- E. Compaction requirements:
1. Compact soils to not less than the following percentages of maximum dry density as determined in accordance with ASTM D698, Method A (Standard Proctor).
 2. Existing in place subgrade below structures where subgrade has been disturbed by water, improper dewatering, or construction traffic.

Top 12" of subgrade:	100%
Below top 12" of subgrade:	98%
 3. Fill beneath structures and beneath an area extending 10 feet beyond the limits of the foundation:

Top 12" of subgrade:	100%
Below top 12" of subgrade:	98%
 4. Compaction of suitable material used to replace unsuitable material below foundation subgrades:

Top 12" of subgrade:	100%
Below top 12" of subgrade:	98%

3.4 FIELD QUALITY CONTROL

- A. Secure the Engineer's construction observation and approval of subgrades and fill layers before subsequent construction is permitted thereon.
- B. Field density determinations will be made, at no cost to the Contractor, to ensure that the specified densities are being obtained. Field density tests will be performed as determined by the Engineer, considering the following:
 - 1. At areas to receive paving, at least one field density test for every 5000 sq.ft. of subgrade area, but not less than three tests.
 - 2. In each compacted fill layer, one field density test for every 5000 sq.ft. of overlying paved area, but not less than three tests.
 - 3. In fill beneath structures, one field density test for every 2500 sq.ft. in each layer.
 - 4. Other tests as deemed necessary by the Engineer.
- C. If, the Engineer's opinion based on reports of the testing laboratory, subgrade or fills that have been placed are below specified density, provide additional compacting and testing until specified requirements are met.
 - 1. Additional testing will be provided by the Owner's selected testing laboratory and all costs for the additional testing will be borne by the Contractor.
- D. Proofrolling:
 - 1. Upon request by the Engineer, proofroll the subgrade of structure foundations.
 - a. Make not less than three passes of a 25 to 50 ton rubber tired roller over the full area.
 - b. Unstable, soft or otherwise unsuitable materials revealed by the proofrolling shall be removed and replaced with satisfactory material and compacted as specified herein.

3.5 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this section and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 02221

TRENCHING, BACKFILLING FOR UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the Work.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.
 - 2. Section 02751 - Plant Piping, Valves & Appurtenances.
 - 3. Section 16400 - Electrical.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

1.3 JOB CONDITIONS

- A. Existing utilities:
 - 1. There now exists in the construction areas, waterworks, storm drainage, sanitary sewers, street paving, gas mains and other utilities.
 - 2. Approximate location of certain underground lines and structures are shown on the plans for information only, other underground lines or structures are not shown.
 - 3. Locate these and other possible unknown utility lines using electronic pipe finder, or other approved means.
 - 4. Locate, excavate and expose all existing underground lines in advance of trenching operations.
 - 5. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these utilities in the execution of his work under this Section.
 - 6. The Contractor shall familiarize himself with the existing conditions and be prepared to adequately care for and safeguard himself and the Owner from damage.
- B. Notification of intent to excavate:
 - 1. South Carolina Underground Utility Damage Prevention Act (S.C. Code Ann, 58-35-10, CT-SEQ, Supp. 1978) requires persons to ascertain the location of underground public utility property prior to excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish prior to commencing such operations. Failure to comply could subject the violator to a civil

penalty of up to one thousand dollars (\$1,000) for each violation of the Act.

2. Notification of intent to excavate may be given by calling this toll free number: 1-888-721-7877.
- C. Protecting trees, shrubbery and lawns:
1. Trees and shrubbery in developed areas and along the trench line shall not be disturbed unless absolutely necessary, and subject to the approval of the Engineer.
 - a. Any such trees and shrubbery necessary to be removed shall be heeled in and replanted.
 2. Where trenches cross private property through established lawns, sod shall be cut, removed, stacked and maintained in suitable condition until replacement is approved by the Engineer.
 - a. Topsoil underlying lawn areas shall be removed and kept separate from general excavated materials.
- D. Clearing:
1. Perform all clearing necessary for installation of the complete work.
 2. Clearing shall consist of removing all trees, stumps, roots, brush and debris in the rights-of-way obtained for the Work.
 3. All timber of merchantable size shall remain the property of the Owner and shall be trimmed and cut in such lengths as directed and stacked along the edge of the right-of-way.
 4. All other material, including trimmings from above, shall be completely disposed of in a satisfactory manner.
- E. Removing and resetting fences:
1. Where existing fences must be removed to permit construction of utilities:
 - a. Remove such fences and, as the Work progresses, reset the fences in their original location and condition.
 - b. Provide temporary fencing or other safeguards as required to prevent stock and cattle from wandering to other lands.
- F. Restoration of disturbed areas:
1. Restore all areas disturbed by, during or as a result of construction activities to their existing or better condition.
 - a. For existing areas with sod type grasses, replace with new sod. Existing sod may be reused where properly removed and stored.
 2. Do not interpret this as requiring replacement of trees and undergrowth in undeveloped sections of the rights-of-way.
- G. Minimizing silting and bank erosion during construction:
1. During construction, protective measures shall be taken and maintained to minimize silting and bank erosion of creeks and rivers adjacent to the work being performed during construction.

PART 2 - PRODUCTS

2.1 EXCAVATED MATERIALS

- A. Perform all excavation of every description and of whatever substances encountered to depths indicated or specified.
- B. Pile material suitable for backfilling in an orderly manner at safe distance from banks or trenches to avoid overloading and to prevent slides or cave-ins.
- C. Remove and deposit unsuitable or excess materials as directed by the Engineer.

2.2 BACKFILL MATERIALS

- A. Provide from materials excavated for installation of utility.
 - 1. Select soil material free from organic matter and deleterious substances, containing no rocks or lumps over 2" in greatest dimension for backfill up to 12" above top of utility being covered.
 - 2. Do not permit rocks larger than 2" in greatest dimension in top 6" of backfill.

2.3 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.
- B. Should the quantity of suitable on-site material be insufficient to complete the work, provide suitable borrow material as approved by the Engineer at no additional expense to the Owner.
- C. Provide select materials from on-site if acceptable material as approved by the Engineer is available on-site. Otherwise, provide approved select material from an off-site source.

PART 3 - EXECUTION

3.1 PROCEDURES

- A. Existing utilities:
 - 1. Unless shown to be removed, protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the Owner.
 - 2. If active utility lines are encountered and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
 - 3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
 - 4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
 - 5. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.
- B. Locations within streets or highways:
 - 1. Comply with South Carolina Department of Transportation's (SCDOT) "Encroachment Permit" issued for the Work, and the South Carolina

Department of Transportation's (SCDOT) "A Policy for Accommodating Utilities on Highway Rights-of-Way".

2. Take all precautions and comply with all requirements as may be necessary to protect the improvements, including barricades for protection of traffic.
3. Keep minimum of one lane open to traffic at all times where utility crosses street or highway.

C. Protection of persons and property:

1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.
2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.

D. Dewatering:

1. Remove all surface and subsurface waters from excavations and maintain the excavation in a dry condition during construction operations.
2. Maintain the ground water level a minimum of 3-feet below the trench bottom during excavation, installation and backfilling.
 - a. Material disturbed below the invert elevation due to improper dewatering shall be removed and replaced with crushed stone or lean concrete at no expense to the Owner.
 - b. Use sumps, pumps, drains, trenching, wells, vacuum or well point system as necessary to maintain the ground water level a minimum of 3-feet below the trench bottom and maintain a dry excavation.
 - c. Dewatering by trench pumping will not be permitted if migration of fine grained natural material (running sand) from bottom, side walls or bedding material will occur.
 - d. Provide monitoring wells sufficient in size, location, number and depth to monitor the ground water level in the construction area during excavation and backfill operations.
 - e. Maintain dewatering operations until backfilling and compaction operations are complete.
3. Water pumped or drained from trenches must be treated by an appropriately sized sediment and erosion control device prior to leaving the site. Discharging untreated or contaminated dewatering effluent is prohibited.
 - a. Contractor is responsible for acquiring all permits required to discharge the water and shall protect waterways from turbidity during the operation.
 - b. Prevent flooding of streets, roadways, or private property.
 - c. Prevent onsite erosion that can be caused by concentrated discharges related to dewatering pumping, drains, or trenching.
 - d. Provide engines driving dewatering pumps with residential type mufflers.

E. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

F. Maintain access to adjacent areas at all times.

3.2 TRENCH EXCAVATION (Unclassified)

- A. Provide sloping, sheeting, shoring, and bracing for excavations conforming with 29CFR1926 Subpart P-Excavations and the Contract Documents.
- B. Remove all materials of whatever substance encountered.
- C. Where trenching occurs in existing lawns, remove turf in sections and keep damp. Replace turf upon completion of the backfilling.
- D. Open cut:
 - 1. Excavate for utilities by open cut.
 - 2. If conditions at the site prevent such open cut, and if approved by the Engineer, tunneling may be used.
 - 3. Short sections of a trench may be tunneled if, in the opinion of the Engineer, the conductor can be installed safely and backfill can be compacted properly into such tunnel.
 - 4. Remove boulders and other interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.
 - 5. Remove wet or otherwise unstable soil incapable of properly supporting the utility, as determined by the Engineer, to depth required and backfill to proper grade with stone bedding material, at no additional cost to the Owner.
 - 6. Excavating for appurtenances:
 - a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12" clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.
 - b. Overdepth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the Engineer, and at no additional cost to the Owner.
- E. Trench to the minimum width necessary for proper installation of the utility, with sides as nearly vertical as possible. Accurately grade the bottom to provide uniform bearing for the utility.
- F. Provide sheeting and shoring necessary for protection of the Work and for the safety of personnel.
 - 1. Remove in units when level of backfilling has reached the elevation necessary to protect the utility work and adjacent property.
 - 2. Sheeting at the bottom of trenches over 10' deep for sewers 15" and larger in size, shall remain in place and be cut off no less than 2" above top of pipe, at no additional cost to the Owner.
 - 3. When, in the opinion of the Engineer, other sheeting cannot be safely removed, it shall be left in place and the Contractor will be paid for such sheeting at the prices bid.
 - a. Cut such sheeting off at least 2' below finished surface.
 - b. No lumber for sheeting or shoring exceeding that size customarily used will be paid for unless the use of larger sizes has been ordered, in writing, by the Engineer.
- G. Depressions:
 - 1. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.
 - 2. Except where rock is encountered, do not excavate below the depth indicated or specified.

3. Where rock is encountered, excavate rock to a minimum overdepth of 4" below the trench depth indicated or specified, and to provide 6" clearance in any horizontal direction from all parts of the utility and appurtenances.
- H. Special requirements relating to excavation for specific types of utilities shall comply with the following:
1. Water distribution lines:
 - a. Provide depth of cover shown or minimum cover of 36", whichever is greater.
 - b. Where minimum cover only is required, carry excavations to depths necessary to properly grade the pipe on tangents and vertical curves as directed by the Engineer.
 - c. Provide minimum clearance of 6" between pipe walls and trench walls or sheeting and bracing lines.
 - d. If minimum cover of 36" cannot be provided, then thermoplastic piping may not be used. Use ductile iron piping or other Engineer-approved material.
 2. Electrical conduit:
 - a. Provide depth of cover shown or minimum cover of 36", whichever is greater.
 - b. Where minimum cover only is required, carry excavations to depths necessary to properly grade the conduit on tangents and vertical curves as directed by the Engineer.
 - c. Provide minimum clearance of 12" between conduit and trench wall or sheeting and bracing lines.
 - d. If minimum cover of 36" cannot be provided, then thermoplastic piping may not be used. Use ductile iron piping or other Engineer-approved material.
- I. Comply with pertinent OSHA regulations in regards to the excavation of utilities.

3.3 BACKFILLING

A. General:

1. Backfill trenches and excavations immediately after the pipes are laid, unless other protection is directed or indicated.
2. Select and deposit backfill materials with special reference to the future safety of the pipes.
3. Reopen trenches which have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified, or otherwise correct to the approval of the Engineer.
4. Surplus material shall be disposed of as directed by the Engineer.
5. Original surface shall be restored to the approval of the Engineer.
6. Maintain proper dewatering during backfill and compaction operations.

B. Lower portion of trench:

1. Deposit approved backfill and bedding material in layers of 6" maximum thickness, and compact with suitable tampers to the density of the adjacent soil until there is a cover of not less than 24" over sewers and 12" over other utility lines.
2. Take special care in backfilling and bedding operations not to damage pipe and pipe coatings.

C. Remainder of trench:

1. Except for special materials for pavements, backfill the remainder of the trench with material free from stones larger than 6" or 1/2 the layered thickness, whichever is smaller, in any dimension.
 2. Deposit backfill material in layers not exceeding the thickness specified, and compact each layer to the minimum density directed by the soil engineer.
- D. Adjacent to buildings: Mechanically compact backfill in 6" layers within ten (10') feet of buildings.
- E. Under roads, streets and other paved areas:
1. Mechanically tamp in 6" layers using heavy duty pneumatic tampers or equal.
 2. Tamp each layer to a density equivalent of not less than 100% of an ASTM D 698 Proctor Curve.
 3. Provide additional compaction by leaving the backfilled trench open to traffic while maintaining the surface with crushed stone.
 4. Refill any settlement with crushed stone and continue such maintenance until replacement of pavement is authorized by the Engineer.
- F. Undeveloped areas:
1. Backfill in wooded, swampy or undeveloped areas shall be as specified hereinbefore, except that tamping of the backfill above a level 2' over the top of the pipe will not be required.
 2. Mound excavated material neatly over the ditch to provide for future settlements.

3.4 MEASUREMENT AND PAYMENT

- A. Unclassified excavation for trenching:
1. No measurement or direct payment will be made for the Work under this Section and all costs for same shall be included in the price bid for the utility line to which it pertains.

END OF SECTION

SECTION 02260
EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide protection of the environment during the construction of this project to reduce soil erosion and siltation to the lowest reasonably achievable level.

1.2 GENERAL

- A. Exercise every reasonable precaution, throughout the life of the project, to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground or roadway surfaces, or other property. Erosion control practices to be used for this project are shown on the drawings and are to conform to South Carolina Department of Health and Environmental Control regulations.

PART 2 - PRODUCTS

2.1 CRUSHED STONE

- A. Provide No. 1 aggregate (ASTM C 33) as defined in Section 815 of the SCDOT Standard Specifications for Highway Construction, Latest Edition, for the stabilized construction entrance and exit.
- B. Provide #57 crushed stone for temporary sediment barriers around inlets and for temporary stone check dams.

2.2 GRASSING

- A. Comply with Section 02930 - Grassing.

2.3 SILT FENCE

- A. All posts to be self-fastener angle steel, 5' in length.
 - 1. Wooden posts are not acceptable.
- B. Woven wire shall conform to the requirements of ASTM A 116, Class I zinc coating for wire. Each woven square shall measure 6" x 6". The top and bottom wires shall be 10 gauge. All other wires shall be 12-1/2 gauge.
 - 1. Securely attach woven wire to posts with wire ties.
- C. Provide filter fabric meeting the requirements of the South Carolina Department of Health and Environmental Control (SCDHEC), complying with the most current edition of the SCDOT Standard Specifications for Highway Construction and appearing on the SCDOT Approved Materials Sheet #34.
 - 1. Limit splices in filter fabric using continuous rolls whenever possible.
 - 2. Whenever splices are necessary a minimum overlap of 6" is required and all splices must occur at a post so that the integrity of the fence is not compromised.
 - 3. Securely attach filter fabric to top of woven wire and at posts with wire ties.

- D. Silt fences should be continuous and transverse to the flow. The silt fence should follow the contours of the site as closely as possible. Place the fence such that the water cannot runoff around the end of the fence.

2.4 EROSION CONTROL BLANKET

- A. Use erosion control blanket S150, from North American Green or approved equal.
 - 1. Use Biostakes where staples are required or indicated on the drawings for stabilization.
 - a. Staple in pattern recommended by blanket manufacturer.
 - 2. Staple locations must be clearly marked on the blanket when stakes are used.

2.5 FILTER FABRIC (Temporary Stone Check Dam)

- A. Use Stabilenka Filter Fabric (T-140N), Mirafil (140N) or approved equal.

2.6 SEDIMENT TUBES

- A. Use sediment tubes as designated on the plans to control erosion along contours, around inlets, and in drainage conveyance swales.
- B. Use sediment tubes manufactured by an experienced manufacturer producing tubes for erosion control.
- C. Tube fill is to be composed of 100% weed free materials consisting of a mix of some or all of the following: curled excelsior wood, natural coconut fibers, hardwood mulch and agricultural straw.
- D. Tubular netting is to be constructed of a flexible outer netting that will contain the fill materials and sediment. Netting is to be constructed from seamless high density polyethylene, polyester, and/or ethyl vinyl acetate, photodegradable materials, treated with ultraviolet stabilizers.
- E. Tubes are to be minimum 20-inches in diameter with minimum weight of 3.2 lbs per foot +/- 10%. Minimum tube length is 10-feet. Netting weight is to be 0.35 oz/foot minimum.

PART 3 - EXECUTION

3.1 GENERAL

- A. Construct and maintain all erosion control measures until the substantial completion of the project.

3.2 TEMPORARY CONSTRUCTION ENTRANCE/EXIT

- A. Construct a gravel area or pad at points where vehicles enter and leave a construction site.
- B. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade and place gravel to the grade and dimensions shown on the plans.

- C. Construct drainage channels to carry water to a sediment trap or other suitable outlet.
- D. Use geotextile fabrics to improve stability of the foundation in locations subject to seepage or high water table.
- E. Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site by periodic top dressing with two inches of stone.
- F. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary.
- G. Immediately remove objectionable materials spilled, washed, or tracked onto public roadways.

3.3 TEMPORARY GRASSING

- A. Provide a temporary cover for erosion control on disturbed areas that will remain unstabilized for a period of more than 30 days in accordance with Section 02930.
- B. This practice applies to cleared areas, diversions, dams, temporary sediment basins, temporary road banks, and topsoil stockpiles where vegetation is needed for less than 1 year.
- C. Provide grassing on slope 5% or greater within 14 days of disturbance. Comply with Section 02930.

3.4 SILT FENCE

- A. Provide silt fence barrier where shown on the plans and on utility construction parallel to the disturbed trench where perpendicular sheet flow runoff occurs on disturbed areas with slopes greater than 4%.
- B. Place at the extreme limits of the area to be disturbed as shown.
- C. Construct temporary sediment barriers of filter fabric, buried at the bottom, stretched and supported by posts and install below small disturbed areas as indicated on the drawings to retain sediment by reducing the flow velocity to allow sediment deposition.
- D. Space posts 10'-0" on center, maximum or as indicated on the drawings.
- E. Remove sediment deposits prior to reaching one-third height of the fence.
- F. Monitor site frequently and place additional silt fencing should evidence indicate that erosion is about to occur at locations other than those shown on plan.

3.5 INLET PROTECTION

- A. Construct temporary sediment barriers around storm drain curb inlets using block and gravel as indicated on the drawings.
- B. Construct metal frame barriers around grate and frame of drop inlets as indicated on the drawings.
- C. Inspect structure after each rainfall and repair as required.
- D. Remove sediment when trap reaches one-half capacity.

- E. Remove structure when protected areas have been stabilized.

3.6 EROSION CONTROL BLANKET

- A. Provide on areas as shown on the plans or on all embankments with slopes equal to or steeper than 2-1/2:1.

3.7 TEMPORARY STONE CHECK DAMS

- A. Utilize temporary stone check dams as indicated on the plans or directed by Engineer.
- B. Provide temporary stone check dams constructed of both rip-rap and #57 stone, as illustrated on the plans.

3.8 SEDIMENT TUBES

- A. Construct small U-shaped trench that is 20% of depth of tube perpendicular to stormwater flow pattern.
- B. Anchor tube in trench according to manufacturers recommendations.
- C. Compact the upstream soil surface adjacent to the tube.
- D. Backfill sediment tube with coarse filter material on the upstream side.
- E. Follow manufactures recommendation on installation.
- F. Maintain, repair and/or replace sediment tubes as required to maintain their effectiveness throughout the project

3.9 MAINTENANCE

- A. Place all erosion control devices or measures prior to any land disturbing activity within the drainage area they are located.
- B. Inspect erosion control devices and clean or otherwise remove silt buildup as necessary once a week or 24-hours following a rain event of ≥ 0.1 ".

3.10 REMOVAL

- A. Remove temporary structures after protected areas have been stabilized.

3.11 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the items under this Section and all costs for same shall be included in the lump sum price bid for the project.

END OF SECTION

SECTION 02511
CRUSHED STONE PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide crushed stone paving where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 02512 - Fabric Underlay Material.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Certificates, signed by materials producer, stating that materials meet the specified requirements.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

PART 2 - PRODUCTS

2.1 COARSE AGGREGATE

- A. Furnish a coarse aggregate (retained on No. 4 sieve) consisting of hard, durable particles of stone, reasonably free from soft, thin, elongated or laminated pieces and deleterious substances.
- B. Furnish aggregate with an abrasion loss of less than 65% as measured by the Los Angeles Abrasion Test.

2.2 FINE AGGREGATE

- A. Furnish a fine aggregate consisting of material produced by stone crushing operations.
- B. Liquid limit shall not exceed 25 and the plasticity index shall not exceed 6 when tested in accordance with AASHTO T-89 and T-90, respectively.
- C. Provide fine aggregate uniformly graded within the following limits:

Sieve Designation	Percent by Weight Passing
2"	100
1-1/2"	95-100
1"	70-100
1/2"	48-75
No. 4	30-50
No. 30	11-30
No. 200	0-12
Liquid Limit	25 max.
Plasticity Index	6 max.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBGRADE

- A. Proofroll all areas to receive crushed stone paving.
 1. Make not less than three passes over the full area, using a 35 to 50 ton rubber tired roller.
- B. Remove all soft, unstable or unsuitable material that will not compact readily.
 1. Remove to full depth of unsuitable material, or to a depth of 30", whichever is less.
 2. Replace with satisfactory materials.
- C. Fill all holes, ruts or depressions which develop in the subgrade with approved on-site material, bringing subgrade to indicated line and grades.
- D. Compact subgrade using suitable construction procedures to provide not less than 100% Standard Proctor Maximum Dry Density.
- E. Seal roll the subgrade surface with a steel wheel roller, sealing the surface against excessive water infiltration.

3.2 PLACING AND MIXING OF PAVING MATERIAL

- A. Place aggregates using spreader boxes or other approved spreaders uniformly on one operation.
- B. Take care to avoid segregation of the fine from the coarse aggregate during handling, spreading or shaping operations.
- C. Mix, while at proper moisture, with motor grader or other equipment and maintain to required section and grade until thoroughly compacted.

3.3 ROLLING AND COMPACTING

- A. Perform using 3-wheel steel wheel roller weighing not less than 10 tons, tandem roller weighing at least 8 tons, or other rollers approved by the Engineer.
- B. Start rolling at edges and proceed toward the center, continue rolling until aggregates are firmly keyed or set.

- C. When initial compaction is completed, should voids remain, place fine aggregates on the surface in an amount only sufficient to fill the voids.
- D. Broom, wet and roll until coarse aggregate is set, bonded and thoroughly compacted for full width and depth.

3.4 ALLOWABLE TOLERANCES

- A. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 1/2".
- B. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 3/8" in 10', parallel to the center line of the roadway nor more than 1/2" from a template conforming to the cross sections shown on the plans.
- C. Deviations: Correct by removing materials, replacing with new materials, and reworking or recompacting as required.

3.5 FINAL PROOFROLL

- A. A proofroll of the finished surface will be required to verify that the roadway is not pumping and before approval and acceptance of the roadway. Proofroll to be conducted with 35 to 50 ton rubber tired equipment.

3.6 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for this work and all costs for same shall be included in the price bid for the work to which it pertains.

END OF SECTION

SECTION 02512
FABRIC UNDERLAY MATERIAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide stabilization fabric underlay material on existing grade under paving as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 02210 - Site Grading.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Certificates, signed by the materials producer and the asphalt paving subcontractor, stating that the materials meet or exceed the specified requirements.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

PART 2 - PRODUCTS

2.1 PROPERTIES

- A. Provide fabric woven from isolactic polypropylene monofilaments, non-biodegradable, resistant to chemicals and treated to withstand exposure to ultraviolet degradation.
- B. Fabric shall have the following properties:

1.	Grab Tensile Strength	315 lb.
2.	Grab Elongation	15%
3.	Mullen Burst Strength	600 psi

4.	Trapezoid Tear Strength	120 lb.
5.	Apparent Opening Size (AOS)	.425 mm 40 (U.S. Sieve)
6.	Permittivity	0.05 Sec ⁻¹
7.	Flow Rate	4.0 gal/min/ft ²
8.	Thickness	25 mils
9.	Weight	6.0 oz./sq. yd.
10.	Ultraviolet Stability	70% @ 500 hours

- C. Fabric underlay material shall be Mirafi 600X or approved equal.

PART 3 - EXECUTION

3.1 EQUIPMENT AND CONSTRUCTION METHODS

- A. Equipment and construction methods shall conform with the requirements of the South Carolina State Highway Department Standard Specifications for Highway Construction, Edition of 2004, Section 305.06 through 305.15, entitled "Construction Requirements", and latest revisions and supplements.

3.2 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for this work and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 02516

DISINFECTION OF POTABLE WATER LINES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide disinfection of potable water lines as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to the Special Provisions, General Specifications, and Sections in Division 1 of these specifications.
 - 2. Section 02751 – Plant Piping, Valves, and Appurtenances.

1.2 REFERENCES

- A. American Water Works Association (AWWA):
 - 1. C-651: Disinfecting Water Mains.
 - 2. B-300: Standard for Hypochlorites.

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. All work shall comply with South Carolina Department of Health and Environmental Control (SCDHEC) State Primary Drinking Water Regulations.
- C. All work shall conform to provisions of AWWA C-651 for water line distribution.
 - 1. Do not use Tablet Method or Slug Method therein.

1.4 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Submit chlorination and dechlorination plan to Engineer thirty (30) days before chlorination and dechlorination.
- C. Submit flushing plan to Engineer.

PART 2 - PRODUCTS

2.1 DISINFECTANT

- A. Sodium Hypochlorite complying with AWWA B-300.
- B. Calcium Hypochlorite granules and tablets complying with AWWA B-300. Calcium hypochlorite intended for use in swimming pools is not permitted.
- C. Disinfection with pure chlorine gas is not permitted.

2.2 DECHLORINATION (NEUTRALIZING) AGENTS

- A. Liquid sulfur dioxide or sulfite solution
- B. Sulfur dioxide gas is not permitted.

2.3 TEST KITS

- A. High Range Test Kit for Chlorine Residual (0 - 200 mg/l): Provide Hach Chemical Company Model CN-21P or approved equal.
- B. DPD Chlorine Residual Test Kit (0 – 3.5 mg/l): Provide Hach Chemical Company Model CN-66 or approved equal.

2.4 MISCELLANEOUS PARTS AND ACCESSORIES

- A. Use standard commercial grade suitable for the type of installation or system involved, and conforming to the applicable standards and specifications of the AWWA and approved by the Engineer.

PART 3 - EXECUTION

3.1 GENERAL

- A. Upon completion of testing, disinfect all water lines to meet requirements of AWWA C-651 and the SCDHEC.
 - 1. Utilize the Continuous Feed Method.
- B. Newly laid valves or other appurtenances shall be operated several times while line is filled with chlorinating agent.
- C. Should initial treatment fail to meet results specified, repeat procedures until satisfactory results are obtained, at no additional cost to the Owner.
- D. All pipe taps, feeders, chemicals, etc. for sterilization shall be provided by the Contractor.
- E. Perform hydrostatic testing of water main prior to disinfection.

3.2 DISCHARGE REQUIREMENTS

- A. Discharges to the environment:
 - 1. Discharges shall not cause or have the reasonable potential to cause or contribute to a violation of a SCDHEC water quality standard.
 - 2. Utilize Best Management Practices (BMPs) to prevent erosion from discharge of water during any construction activities including flushing and disinfection.
- B. Notify the Engineer immediately in the event of any accidental discharge.

3.3 PRELIMINARY FLUSHING

- A. Prior to chlorination, fill water main with clear water to eliminate air pockets and flush to remove foreign materials that might have entered the main during installation or repair.

- B. Provide flushing of sufficient magnitude and duration to flush all foreign material out of the lines, valves, and hydrants.
- C. Provide a minimum flushing velocity of 2.5 feet per second (FPS). Required flow and openings required to produce proper flushing velocity of forty (40) PSI are:

Pipe Size (Inches)	Flow (GPM) at 2.5 FPS	Hydrant Openings
4	100	1 - 2-1/2"
6	200	1 - 2-1/2"
8	400	1 - 2-1/2"
10	600	1 - 2-1/2"
12	900	1 - 2-1/2"
16	1600	2 - 2-1/2"
24	3530	1 - 4-1/2" 1 - 2-1/2"
48	14100	6 - 4-1/2"

- D. All valves and hydrants to be fully opened and closed under water pressure to ensure proper operations during flushing and to dislodge foreign material.
- E. All valves or connections to existing distribution system to be closed and backflow preventer or other approved equipment installed at the source during flushing operations to prevent contamination of existing distribution system.
- F. Provide protection of existing site improvements during flushing operation.
- G. For water mains twenty-four (24) inches and larger, an acceptable alternative to flushing is to broom-sweep the main.
 - 1. Remove sweepings prior to chlorinating the main.

3.4 DISINFECTION OF WATER MAINS

- A. Provide water supplied from a temporary, backflow-protected connection to the existing distribution system at a constant measured rate into the new water main.
 - 1. In absence of a meter, determine the flow rate either by placing a pilot gauge at discharge or by measuring the time to fill a container of known volume.
- B. Inject water entering the new main with a chlorine solution fed at a constant rate. Chlorine solution feed rate to provide and maintain a free chlorine concentration of no less than fifty (50) milligrams per liter (mg/L) during the filling of the water main.
 - 1. Injection point to be no more than ten (10) feet downstream from the beginning of the new water main.
 - 2. Measure chlorine concentration at regular intervals utilizing high-range chlorine test kits to ensure the minimum chlorine concentration is provided.

3. Chlorine solutions may be prepared with sodium hypochlorite or calcium hypochlorite. The amount of chlorine required for each one hundred (100) feet of pipe to produce a fifty (50) mg/L concentration is:

Pipe Size (Inches)	100% Chlorine (LB)	1% Chlorine Solution (gal)
4	0.013	0.16
6	0.030	0.37
8	0.054	0.65
10	0.085	1.02
12	0.122	1.47
16	0.218	2.61
24	0.490	5.87
48	1.960	23.50

4. Feed chlorine solution until the entire main is filled with chlorinated water with a minimum concentration of fifty (50) mg/L.
5. Provide a gasoline or electrically powered chemical-feed pump designed for feed chlorine solutions to feed hypochlorite solutions.
- Provide feed lines made of material capable of withstanding the corrosion caused by concentrated chlorine solutions and the maximum pressures that may be caused by the feed pumps.
 - Check all connections for tightness before the chlorine solution is applied to the main.
- C. Retain the chlorinated water in the water main for a minimum of twenty-four (24) hours.
- Operate valves and hydrants in the treated section of the water main during the twenty-four (24) hours period to ensure disinfection of appurtenances.
- D. At end of the twenty-four (24) hour retention period, all sample locations shall have a residual of not less than ten (10) mg/L of free chlorine.
- E. Final flushing: After the retention period, flush the chlorinated water from the water main, valves, and branches until the chlorine residual is less than 0.5 mg/L.
- Provide dechlorination of the chlorinated water in the main by applying a dechlorination agent.

3.5 SAMPLING PROGRAM AND ACCEPTANCE

- A. After final flushing, provide two separate samples for each sample location, taken at twenty-four (24) hour intervals, free of coliform bacteria.
- Contractor to take 1st and 2nd samples, deliver to SCDHEC approved laboratory for testing.
 - The 1st and 2nd sample results shall include the free chlorine residual at the time the samples were collected.
 - Notify SCDHEC to take a 3rd sample.
- B. At a minimum, sample locations shall be as required by SCDHEC and the following:
- The tie-in location of new and existing water lines.
 - The end of all dead end lines.

- 3. At intervals of no more than 1,200' for all new lines longer than 1,200' in length.
- C. All sample locations are to be given an identifying label and a corresponding identification label is to be included on the record drawings indicating each sample location.
- D. Provide all results to the Engineer.
- E. Resampling: If the initial disinfection fails to produce satisfactory bacteriological results or if other water quality is affected, reflush the water main and resample.
- F. Redisinfection: If the check samples fail to produce acceptable results, repeat disinfection procedures until satisfactory results are obtained.

3.6 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the items under this Section and all costs for same shall be included in the price bid for the project.

END OF SECTION

SECTION 02615
REMOVING AND REPLACING PAVEMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Removal and replacement of existing pavements for installation of utility lines, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
 - 2. Section 02221 - Trenching, Backfilling for Utilities.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods for proper performance of the work of this Section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

1.5 WARRANTY

- A. All remove and replace pavement work within the South Carolina Department of Transportation (SCDOT) rights-of-way shall be warranted for two years beginning on the date of acceptance by the SCDOT.

PART 2 - PRODUCTS

2.1 CONCRETE

- A. Comply with Section 03300, using strength specified herein.

2.2 ASPHALTIC CONCRETE

- A. Use Types 1 and 2 complying with South Carolina Department of Transportation Standard Specifications, Section 403 and latest revisions and supplements.

2.3 AGGREGATE BASE COURSE WITH PRIME

- A. Comply with applicable portions of South Carolina Department of Transportation Standard Specifications, Section 305, Macadam Base Course, and latest revisions and supplements.

PART 3 - EXECUTION

3.1 GENERAL

- A. Remove to neat lines and dispose of as directed.
- B. Replace with bases and pavements similar to type removed, unless otherwise indicated.

3.2 CUTTING

- A. Concrete pavement or base:
 - 1. Cut on straight and true lines, to a minimum depth of 2", using powered concrete saw.
 - 2. Shear off remaining depth with pneumatic tools.
- B. Concrete sidewalks shall be removed back to the nearest joint on each side of the crossing.
- C. Asphaltic concrete pavements: Cut to straight and true lines with powered concrete saw.

3.3 REPLACEMENT

- A. Concrete pavements:
 - 1. Use 4000 psi concrete.
 - 2. Replace to 6" below existing slab and undercut each edge 6" to form shelf.
 - 3. Finish surface to match existing surface.
- B. Concrete sidewalks:
 - 1. Replace with 4000 psi concrete.
 - 2. Depth shall be equal to existing section removed, but not less than 4".
 - 3. Finish surface to match existing sidewalk.
- C. Flexible pavements (Ditch Line) – Secondary and Primary Roads:
 - 1. Backfill with controlled density (flowable fill) in accordance with Section 02225 with 2" depression.
 - 2. Top with 2" of asphaltic concrete.
- D. Flexible pavements (Ditch Line) - Driveways:
 - 1. Compact subgrade thoroughly.
 - 2. Place 8" deep aggregate base course with prime.
 - 3. Top with 2" of asphaltic concrete.
- E. Flexible pavements (Resurfacing):
 - 1. In some instances where utilities are installed within existing pavements, resurfacing of the entire width of the original pavement will be required.
 - 2. Replace pavement in ditch line as specified above.
 - 3. Prime and resurface with 2" of asphaltic concrete.

4. Taper resurfacing to existing pavement evenly for a distance of 50 feet beyond repaired area.

3.4 MEASUREMENT AND PAYMENT

- A. Ditch line replacements: Payment will be made at the unit price per square yard as stated in the Bid Form.

END OF SECTION

SECTION 02751

PLANT PIPING, VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide plant, gravity, pressure, yard and interior piping systems as shown on the Drawings, specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 02221 - Trenching, Backfilling for Utilities.
 - 3. Section 02516 - Disinfection of Potable Water Lines.
 - 4. Section 05990 - Miscellaneous Metals.
 - 5. Section 09900 - Painting.
 - 6. Section 10445 - Piping Identification Systems.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. All materials in this Section are to be 100% manufactured in the United States.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
- C. Detailed piping layouts to include details and location of pipe supports.
- D. Certified records of manufacturer's pipe tests per Paragraph 2.1B of this Section.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. Storage of PVC pipe:
 - 1. Store in unit packages as received from manufacturer until just prior to use.
 - 2. Stack units in such manner as to prevent deformation to pipe barrel and bells.

3. PVC pipe shall be protected from direct sunlight by covering with opaque material if storage period will exceed six (6) weeks.
4. Protect from severe impact blows, gouging or cutting by metal surfaces or rocks.

1.5 JOB CONDITIONS

- A. Work under this Section may require construction or work in a confined space.
- B. Provide safety equipment as specified in Section 01500.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Service requirements:
 1. Pipe materials for the various services shall be as indicated on the drawings. If not shown on the drawings, piping 4" and larger shall be ductile iron pipe, including sanitary sewer lines, force mains and water lines unless otherwise indicated below:

Service	Size (Inches)	Buried (B) Exposed (E)	Pipe Material	Pipe Schedule	Lining	Gaskets
Air Release Valve Discharge			Stainless Steel	40		
Chemical Tubing			Reinforced PVC Tubing			
Drain Lines	4" & above		DIP		Cement	
Drain Lines	3" & under		PVC	80		
Lime Slurry Solution			Reinforced Tygon Tubing			Viton
Sump Pump Discharge		B	PVC	80		
Sump Pump Discharge		E	Stainless Steel	40		
Water Lines	4" & larger		DIP		Cement	
Water Lines	3" & smaller	B	PVC	80		
Water Lines	3" & smaller	E	Stainless Steel	40		

2. Design pressures: Pipe, regardless of type of material, shall be designed for minimum of 150 psi internal pressure, safety factor of 2 with an additional surge allowance pressure of 100 psi, and for trench loads as indicated on the drawings.

- B. Factory testing:

1. Test each type of pipe material in accordance with the requirements for that particular type of pipe as specified hereinafter.

2. Certified records of the tests made by the manufacturer or by an approved commercial laboratory shall be furnished to the Engineer for each shipment of pipe delivered to the job site.
- C. Lead content:
1. Any pipe, solder, or flux used shall be lead free (lead free is defined as less than 0.2% lead in solder or flux and less than 8.0% lead in pipes and fittings).
- D. Ductile iron pipe and fittings (DIP):
1. Provide pressure class pipe with a minimum working pressure as indicated in the design pressures specified and complying with ANSI/AWWA C151/A21.51, ASTM A377, latest revision, minimum Pressure Class 350.
 2. Clearly mark the class or nominal thickness, net weight without lining, and casting period on each length of pipe. Additionally, cast or stamp the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" on the pipe.
 3. Buried Piping:
 - a. Provide depth of cover indicated on the drawings.
 - b. Bedding:
 - 1) For gravity sewer lines refer to Part 3.6 Installation of Gravity Sanitary Sewer Pipe for bedding conditions.
 - 2) For other piping use Type 3 bedding conditions, having a wall thickness required for the design pressures specified.
 - c. Provide mechanical or push-on joints complying with ANSI/AWWA C111/A21.11 as modified by ANSI/AWWA C151/A21.51 with rubber gaskets and lubricants complying with ANSI/AWWA C111/A21.11.
 - d. All buried fittings, valves, etc. to be mechanical joint.
 - e. Bolts and nuts:
 - 1) Provide Cor-Ten steel tee head bolts for use on mechanical joints complying with ASTM A242.
 - 2) For connecting to wall pipes, provide Grade B, ASTM A307, hot dipped galvanized, standard carbon steel machine bolts, hex head.
 4. Exposed piping:
 - a. Provide Class 53 minimum.
 - b. Provide flanged joints complying with ANSI/AWWA C115/A21.15, latest revision.
 - c. Provide solid type flanges with country where cast stamped or cast into the flange.
 - d. Provide full face, red rubber, factory cut, 1/16" thick gasket for pipe up to 10" diameter and 1/8" thick gasket for larger sizes.
 - e. Bolts and nuts: Provide standard carbon steel machine bolts, hex head.
 5. Fittings:
 - a. Provide 250 psi rated ductile iron fittings or specials unless otherwise indicated, complying with ANSI/AWWA C110/A21.10 and in accordance with ANSI/AWWA C111/A21.11.
 - b. Clearly cast the manufacturer's mark, country where cast, year in which the fitting was produced, and the letters "DI" or "Ductile" on the fitting.
 - c. Provide minimum of three (3) tap locations on opposing sides for each fitting complying with ANSI B16.1.
 6. Companion flanges for fabricated flanged pipe:

- a. Provide Class 125 ductile iron flanges unless otherwise indicated, complying with ANSI/AWWA C110/A21.10 (latest revision) and in accordance with ANSI/AWWA C111/A21.11.
 - b. Clearly cast the manufacturer's mark, country where cast, pressure rating, size, and the letters "DI" or "Ductile" on each flange.
7. Restrained joint pipe and fittings:
- a. Provide restrained joint pipe and fittings on all piping at each fitting, including valve connections and on the pipe joints to a distance of 30' each side of fitting for 12" piping and smaller and to a distance of 60' each side of the fitting for piping over 12".
 - b. Pipe larger than 12" - Provide one of the following for use with push-on joints:
 - 1) Snap-Lok by Griffin Pipe.
 - 2) American Cast Iron Pipe Company.
 - a) Flex-Ring (4" to 48")
 - b) Lok-Ring (54" to 64")
 - 3) U.S. Pipe.
 - a) TR-Flex (4" to 36")
 - b) HP-Lok (42" to 64")
 - 4) Approved equal.
 - c. Pipe 12" and smaller and all fittings:
 - 1) Provide retainer glands for use with mechanical joint pipe and fittings.
 - 2) Provide wedge type.
 - 3) Provide ductile iron gland conforming to ASTM A 536-80. Provide split gland where standard gland cannot be installed.
 - 4) Provide ductile iron set screws, heat-treated to a minimum hardness of 370 BHN with twist-off nuts and permanent standard hex head remaining.
 - 5) Provide for the following rated pressure with minimum 2 to 1 safety factor; 3" - 16" 350 psi, 18" - 48" 250 psi.
 - 6) Provide tee-head bolts conforming to ANSI/AWWA C111/A21.11 latest revision.
 - 7) Provide "MEGALUG" as manufactured by EBAA Iron Sales, Inc. of Eastland, Texas or approved equal.
8. Lining (All pipes and fittings):
- a. Water, drains and other services:
 - 1) Provide with standard thickness cement lining complying with ANSI/AWWA C104/A21.4 unless otherwise noted or approved equal.
9. Exterior coatings:
- a. For buried service, provide shop applied bituminous coating, 1 mil thick. Do not apply to the first 6" of the spigot end.
 - b. For exposed locations, provide prime coat per Section 09900.

E. Plastic pipe and fittings (PVC and CPVC):

1. Provide PVC or CPVC pipe as specified herein with a minimum working pressure as indicated in the design pressures specified and the followings:
2. Buried pipe:
 - a. Pipe 3" and smaller: PVC: Comply with ASTM D2241 for PVC 1120, SDR 21, with NSF approval marked at 18" intervals. CPVC: Comply with ASTM D1784 for CPVC, SDR 21, with NSF approval marked at 18" intervals.
 - b. Joints:
 - 1) Provide integral bell or coupling type with elastomeric gaskets.
 - 2) Integral bells to comply with ASTM D2672.

- 3) Couplings to comply with ANSI/AWWA C900.
 - 4) Gaskets to comply with ASTM F477.
 - 5) Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents.
3. Exposed pipe:
- a. Provide PVC or CPVC as specified herein or indicated on the Drawings.
 - b. PVC: Provide pipe complying with ASTM D1785 for PVC 1120, Schedule 80, dark gray color, unless otherwise indicated and NSF approved.
 - c. CPVC: Provide pipe complying with ASTM F441 for PVC, Schedule 80, dark gray color, unless otherwise indicated and NSF approved.
 - d. Provide solvent weld coupling joints.
4. Fittings:
- a. Buried pipe:
 - 1) 4" and larger: Provide ductile iron fittings as specified above.
 - 2) 3" and smaller:
 - a) Provide PVC or CPVC as specified herein or indicated on the Drawings.
 - b) Provide PVC fittings, 160 psi at 73°F pressure rating, joint design to conform to pipe joints.
 - c) Provide CPVC fittings, 200 psi at 73°F pressure rating, joint design to conform to pipe joints.
 - b. Exposed pipe:
 - 1) Use schedule 80 PVC fittings with solvent weld joints.
 - 2) Where threaded fittings are indicated, use Schedule 80 conforming to ASTM D2464.
 - a) Comply with ASTM F437 for CPVC.
 - 3) Expansion joints: Telescoping type, ASAHI/America or approved equal.
 - 4) Where flanged joints are indicated, provide Type 316 stainless steel bolts, nuts and washers. Provide molybdenum disulfide based anti-seize compound, Molycoat-6 or approved equal.
5. PVC and CPVC Primer and Solvent Cement:
- a. Primer:
 - 1) Provide NSF approved low VOC and CPVC primer that meets the requirements of ASTM F-656, SCAQMD Rule 1168/316A.
 - 2) Provide primer that is purple in color and has a specific gravity of 0.858 +/- 0.040.
 - 3) Provide primer with a max. VOC emissions of 550 G/L.
 - 4) Provide IPS Weld-On P-70 primer or equal.
 - b. Solvent Cement:
 - 1) Provide NSF approved CPVC chemical resistant solvent cement that meets the requirements of ASTM F-493 and SCAQMD Rule 1168/316A.
 - 2) Provide solvent cement that is specifically manufactured for chemical resistance to caustics, including hypochlorite solutions.
 - 3) Provide solvent cement that is gray in color and has a specific gravity of 0.982 +/- 0.040.
 - 4) Provide solvent cement with a max. VOC emissions of 490 G/L.
 - 5) Provide IPS Weld-On CPVC 724 chemical resistant solvent cement or equal.

F. Plastic flexible tubing (Tygon tubing):

1. Provide flexible tubing where indicated on the Drawings.
2. Comply with Federal Specification L-T-7908.
3. Tubing shall be clear in color.
4. Provide NSF approved nylon reinforced tubing where indicated on the plans, for suction applications, and for pressure applications greater than the un-reinforced tubing working pressure.
5. Provide nylon fittings with stainless steel hose clamps.

G. Stainless steel pipe and fittings, 2-1/2" diameter and smaller:

1. Provide Schedule 40 pipe.
2. Provide Type 304L.
3. Provide NPT threaded connections and fittings.
4. Provide stainless steel unions at all connections to fixtures, pumps, equipment, etc.
5. Provide joint compound for thread sealant on threaded connections.
 - a. Provide Lok-Tite PST or approved equal.

2.2 PLUGS OR CAPS

- A. Provide at all pipe ends and unused branches of fittings.
- B. All plugs and caps shall be tapped 2" and provided with 2" plug.
- C. Provide restrained fittings on ductile iron lines.

2.3 LINK SEAL SLEEVE SEAL

- A. Provide sleeve seals where indicated on the plans to seal between pipe sleeves and piping.
- B. Provide glass reinforced nylon plastic pressure plates.
- C. Provide Type 316 stainless steel bolts and nuts.
- D. Provide EPDM sealing element.
- E. Provide square two (2) piece escutcheon plate on exposed side(s) of sleeve(s).
 1. Fabricate from .063" clear anodized aluminum sheet.
 2. Mount with stainless steel sleeve and stainless steel stove bolts.
- F. Acceptable manufacturer is Link Seal, Type S or equal.

2.4 PIPE WALL SLEEVES

- A. Provide ductile iron pipe sleeves at locations shown on the drawings.
- B. Provide pipe sleeves with flanged wall collars located at the center of the overall sleeve length.
- C. Pipe sleeves shall be statically cast with integral wall collars or fabricated from centrifugally cast ductile iron pipe with welded on collars.

- D. Pipe sleeve diameter shall be compatible with the carrier pipe diameter and the specified type of annular space sealing method.
- E. Provide square two (2) piece escutcheon plate on exposed side(s) of sleeve(s).
 - 1. Fabricate from .063" clear anodized aluminum sheet.
 - 2. Mount with stainless steel sleeve and stainless steel stove bolts.

2.5 ADAPTER FLANGES

- A. Provide adapter flanges where indicated on the plans.
- B. Provide high strength ductile iron flange, ASTM A536, Grade 65-45-12.
- C. Provide set screws with a Rockwell hardness of C40-45 converted from Brinnell.
- D. Gasket material: BUNA S.
- E. Minimum pressure rating - 150 psi.
- F. Provide adapter flanges with a minimum of a 2 to 1 safety factor.
- G. Provide adapter flanges with MEGA-BOND Restraint Coating System.
 - 1. Wash all adapter flanges and appurtenances in a phosphate wash prior to coating.
 - 2. Coat with a minimum of two coats of liquid Xylan fluoropolymer coating with heat cure to follow each coat.
- H. Provide Series 2100 Megaflange Restrained Flange Adapter by EBAA Iron or approved equal.

2.6 SERVICE SADDLE

- A. Provide of the following materials:

Pipe Diameter	2 – 24 in	2 – 30 in
Pressure	150 psi	350 psi
Outlet Size	0.75 – 3 in	0.5 – 2.5 in
Body	Type 304 Stainless Steel	Nylon Coated Ductile Iron
Bales and Strips	Type 304 Stainless Steel	Type 304 Stainless Steel
Studs	Type 304 Stainless Steel	Type 304 Stainless Steel
Hardware	Type 304 Stainless Steel	Type 304 Stainless Steel

- B. Provide Romac 305 and 306 or approved equal for all pipe sizes 24 inches or less and have 150 psi or less operating pressure.
- C. Provide Romac 101 NS or 202 NS or approved equal for sizes greater than 24 inches and/or with greater than 150 psi operating pressure.
 - 1. Provide double straps for sizes 6" and larger.
- D. Connect to pipeline using a 6" long stainless steel nipple.
 - 1. Do not use a threaded PVC connection.

2.7 COUPLINGS, BURIED PIPING

- A. Provide couplings where needed to make piping connections and where located on the plans.
- B. Provide cast iron mechanical joint sleeve, full length, minimum 12" long.
- C. Provide ductile iron ASTM A-536 followers.
- D. Provide high strength low alloy steel bolts with heavy semi-finished hexagon nuts to AWWA/ANSI C111/A21.11 standards.
- E. Gaskets to be Grade 30.
- F. Provide Cor-Ten steel tee head bolts for use on mechanical joints complying with ASTM A242, galvanized in accordance with ASTM A-123.
- G. Provide restrained joints where indicated or specified herein.

2.8 QUICK CONNECT COUPLINGS

- A. Furnish in CF-8M stainless steel with stainless steel arms.
- B. Provide Viton gaskets unless otherwise indicated or specified.
- C. Cam arm finger rings and pins are to be stainless steel.
- D. Provide recess in sizes 4" and larger to hold gasket in place.
- E. Conform to MIL-C-27487 for interchangeability.
- F. Hydrostatic performance:
 - 1. 3/4" through 4" - 300 psi, no leakage.
 - 2. 5" and larger - 200 psi, no leakage.
- G. For dust caps and plugs, provide No. 10 stainless steel jack chain with stainless steel "S" hooks connected to coupling and permanent fixture.
 - 1. Length to be adequate to avoid interference with the operation of the coupling.
- H. Provide end connections to match application shown on the plans.
- I. Provide a pipe nipple of necessary length where required to obtain adequate clearance for operation of cam arms.
 - 1. Provide Type 316 Schedule 40 stainless steel nipple.
- J. Acceptable manufacturer - OPW or approved equal.

2.9 METALLIC DETECTION TAPE

- A. Provide 2" wide metallic detection tape on all buried PVC or CPVC piping.
 - 1. Provide 5.0 mil overall thickness with no less than a 50 gauge solid aluminum foil core.
 - 2. Foil to be visible from both sides.

3. No inks or printing extended to the edges of the tape.
 4. Encase printing to avoid ink rub-off.
 5. Tensile strength - 28 lbs/inch.
 6. Use heat set mylar inks.
- B. Locate 12" below ground surface in pipe trench.
- C. Color to be as indicated below:
1. Chemical lines - High visibility safety yellow.
 2. Potable water lines - Safety precaution blue.
 3. Sanitary sewer - Safety green.
 4. Force mains, non-potable water and all other lines - Safety brown.
- D. Wording on tape to indicate pipe contents and repeated a minimum of every 24".

2.10 PIPE HANGERS AND SUPPORTS

- A. All pipe hangers and supports must comply with IBC, Latest Edition.
- B. Small piping (smaller than 3"):
1. Fabricate hangers and supports from "Unistrut" channels and fittings as specified in Section 05990.
 2. Provide uni-cushion insulated fittings for copper, PVC and stainless steel piping.
- C. Large piping (3" and larger):
1. Hangers:
 - a. Provide Type 316 stainless steel Clevis hangers, McMaster Carr 3037T666 or equal, for lines 16" and smaller.
 - b. Provide Grinnell Figure 260 (Figure 300 for insulated lines) or equal hangers with hot dipped galvanized finish for lines 18" and larger.
 - c. Provide stainless steel rods, coupling nuts, inserts and fasteners.
 2. Pipe stands:
 - a. Provide 304 stainless steel Standon Model S92 Saddle Support by Material Resources, Inc. or equal with Schedule 40 Type 304 stainless steel pipe extension and stainless steel floor flange or approved equal.
 - b. Mount flange to floor with stainless steel expansion anchors.
- D. Riser clamps:
1. Provide stainless steel riser clamps on vertical pipes through sleeves, McMaster Carr 2989 or equal.
- E. All exposed piping shall be provided with supports and hangers of adequate size and configuration to support the piping system.
- F. Inserts, bolts and anchors shall be set into form work for new concrete. Where hanger and anchors are to be supported by existing structures, wedge anchors shall be installed. Anchors shall be Type 316 stainless steel with stainless steel coupling nuts.
- G. Pressure lines shall be secured with straps or reaction blocking to prevent movement.

- H. Provide at all bends each side of couplings.
- I. The maximum distance between supports or hangers shall not exceed:

	Stainless Steel Tubing, PVC	Copper, Stainless Steel, Steel or Ductile Iron
3/8" diameter and smaller	2-1/2'	4'
1/2" diameter	2-1/2'	6'
3/4" and 1" diameter	3'	8'
1-1/4" to 2" diameter	3-1/2'	10'
2-1/2" diameter to 5" diameter	4'	12'
6" diameter and larger	5'	12'

2.11 PIPE INSULATION

- A. Provide pipe insulation where indicated on the drawings or as specified below.
 - 1. Insulate all exposed exterior potable water and non-potable water lines 3" or smaller.
- B. Provide 2" thick Owens/Corning Fiberglass "25 ASJ/SSL-II" or equal.
- C. Provide smooth aluminum jacketing over insulation, Pabco Surefit Metal Products or equal.

2.12 GATE VALVES

- A. General:
 - 1. End connections as required for the piping in which they are installed.
 - 2. Suitable for working pressure of not less than 250 psi.
 - 3. Open by turning counter clockwise.
 - 4. Provide stem extensions, if required, to bring operating nut to within two (2') feet of finished grade.
 - 5. Fully coat all internal ferrous metal surfaces with two part thermosetting epoxy.
- B. Gate valves 1-1/2" and smaller:
 - 1. Where gate valves of this size are indicated on plans, use ball valves.
 - 2. Above ground: use stainless steel ball valves.
 - 3. Below ground:
 - a. Use 1/4 turn all bronze ball valves with stop" suitable for working pressure of not less than 150 psi.
 - b. Provide 2" square operating nut for valves larger than 1" and a shut-off rod for valves 1" and smaller.
 - c. Provide a valve box.
 - d. Provide Ford Series B11 or approved equal.
- C. Gate valves 2" and larger:
 - 1. Use resilient seated wedge valves complying with ANSI/AWWA C509.
 - 2. Provide integral bronze stem nut on resilient seated wedge valves.

3. Suitable for working pressure of not less than 250 psi.
 4. Design for external stem failure outside of the valve body or bonnet when excessive closing torque is applied with no failure of the pressure retaining parts per AWWA Section 3.2.
 - a. Factory test with no leakage from either side of the disc.
 - b. Test shell to 500 psig.
 5. Provide certified to NSF 61.
 6. Completely encapsulate resilient iron wedge by an elastomer, without thin spots or voids.
 7. Provide polymer wedge guide bearing caps bearing surface between the encapsulated wedge and the interior epoxy coating, lowering operation torque and extending service life of the valve.
 8. The manufacturing plant to have ISO9001 certification.
 9. Valve stuffing box to align parallel to the direction of pipe being laid.
- D. Buried service: Mechanical joint, restrained, non-rising stem with 2" metal operating nut with arrow indicating direction of opening.
- E. Exposed: Flanged with outside yolk and screw with handwheel operator.
- F. Provide bypass valve where required for pressure and valve size.
- G. Valve operator:
1. Provide one T-handle operator for each four (4) buried valves with nut operator.
- H. Provide valve boxes for all buried service valves and operators.

2.13 CHECK VALVES

- A. Valves, 3" and larger:
1. Provide valve body of a one-piece casting, globe pattern, constructed of ASTM A126 Class B cast iron with minimum strength of 30,000 psi.
 2. Provide flanged end connections per ANSI B16.1.
 3. Provide full pipeline flow area with disc at 23° open position and allow for a minimum of 60° total disc travel.
 4. Provide a circular flanged cover of adequate size to permit field inspection, maintenance, and/or replacement of all internal valve components.
 - a. Secure cover to body with 316 SS fasteners
 5. Design working pressures to 250 psi.
 6. Body seat:
 - a. Material to be Type 316 stainless steel.
 - b. Design seat to permit field replacement.
 7. Disc construction:
 - a. Construct of ASTM A126 Class B cast iron with minimum strength of 30,000 psi.
 - b. Provide disc with resilient seat ring for tight shut-off.
 - 1) Disc seat ring shall be of BUNA-N.
 - 2) Attach disc seat ring to disc by means of Type 316 stainless steel follower ring and 18-8 stainless steel fasteners.
 - 3) Design disc seat ring to permit field replacement.
 - c. Attach disc to disc arm by means of a single attachment point.
 - 1) Attachment design shall permit a controlled amount of disc articulation to provide uniform compression of disc seat ring under any pressure condition, up to the maximum working pressure.

- 2) Rotation of the disc around the attachment point shall not be permitted.
- d. Construct disc arm of one-piece, ductile iron casting with minimum strength of 60,000 psi.
8. Shaft construction:
 - a. Construct of non-hardened, Type 316 stainless steel.
 - 1) Hardened stainless steel or chrome-plated steel shafts shall not be permitted.
 - b. Support shaft in the body by solid bronze bearings mounted in the valve body.
 - 1) Locate shaft and bearings completely out of flowpath through valve.
 - 2) Bearing material shall be UNS C93200 bronze, with minimum strength of 20,000 psi.
 - 3) Bearing/shaft design shall provide sufficient bearing area to prevent bearing wear, deformation, or excessive friction. Use of oil impregnated bearings, grease or oil lubrication, or synthetic bearing materials shall not be permitted.
 - c. Shaft design shall employ stainless steel keys for attachment of disc arm and externally mounted counterweight arm.
 - 1) Use of set screws or clamps shall not be permitted.
 - d. Extend shaft through one (1) side of valve body to allow attachment of external counterweight arm and cushion chamber.
 - e. Seal shaft where it passes through the valve body by means of an externally adjustable packing gland and Teflon packing.
 - 1) O-ring shaft seals shall not be permitted.
 - f. Shaft design shall employ a mechanical locking device for maintaining proper shaft and disc arm alignment within the valve body. The shaft bearings and/or disc arm shall not be used to maintain shaft alignment.
 - g. Provide minimum shaft diameters for each size as follows:

<u>Valve Size</u>	<u>Shaft Diameter</u>
2-1/2"	3/4"
3"	3/4"
4"	7/8"
6"	1"
8"	1-1/4"
10"	1-1/4"
12"	1-1/2"
14"	2"
16"	2"
18"	2"
20"	2"
24"	2-3/4"
30"	4"
36"	5"
9. Cushion chamber construction:
 - a. Attach a cushion chamber to machined pads on the exterior of the valve body with Type 316 fasteners and mechanical linkage connecting the cushion chamber piston to the valve shaft.
 - b. Construct the cushion chamber cylinder tube and piston of bronze.
 - c. Cushioning shall be accomplished by using air as the cushioning media. Use of hydraulic oil or pre-charged air cylinders shall not be permitted.
 - d. The degree of cushioning shall be easily adjustable.
10. Counterweight arm and counterweight construction:
 - a. Attach a single counterweight arm to the valve shaft.
 - b. The counterweight arm shall employ a stainless steel key to

- prevent rotation around the valve shaft.
- 1) Use of set screws or clamps to connect the counterweight arm to the valve shaft shall not be permitted.
- c. The counterweight arm shall be positioned on the shaft to provide the maximum amount of closing force when the valve is in the seated position, and the minimum amount of closing force when the valve is in the open position.
- d. Sufficient counterweight(s) shall be provided to prevent or minimize slamming of the check valve immediately following shut-down of the pump.
 - 1) The position of the counterweight(s) shall be adjustable on the counterweight arm.
 - 2) The counterweight(s) shall have provision to be locked into position on the counterweight arm.
- 11. Valve shall be completely serviceable in the line, and all internal parts shall be removable through the top cover.
- 12. The valve shall be Figure 250-DS as manufactured by G.A. Industries, Inc. or Engineer approved equal.

B. Ball check valves, smaller than 2":

- 1. Furnish stainless steel bodied valve.
- 2. Valve ends to be female NPT.
- 3. Provide threaded bronze cap.
- 4. Provide hollow stainless steel ball.
 - a. Specific gravity greater than 1.0.
- 5. Provide rubber seat.
- 6. Maximum working pressure - 150 psi.
- 7. Maximum working temperature - 185°F.
- 8. Provide Flygt Model HDL Type 2002 or approved equal.

2.14 PVC AND CPVC BALL VALVES

- A. Provide true union PVC or CPVC ball valves to match pipe material where shown on the plans.
- B. Provide valves with the following features:
 - 1. Full port design.
 - 2. Reversible PTFE seats.
 - 3. Adjustable seat retainer.
 - 4. Viton double O-ring stem seals unless indicated otherwise.
 - 5. Provide stem extension where indicated.
 - 6. Provide Hayward True Union ball valves or equal.
 - 7. Valves for hypochlorite service:
 - a. Provide CPVC full port, full flow design.
 - b. Provide upstream vented port.
 - c. Compatible with 15% hypochlorite solution.
 - d. Provide flanged connections with Teflon gaskets.
 - e. Provide "Z-Ball" type Hayward True Union ball valves or equal.
 - 8. Provide two seat adjustment tools for every ten valves installed.

2.15 STAINLESS STEEL BALL VALVES

- A. Provide the following for sizes under 3":
 - 1. Full port Type 316 stainless steel ball valves where indicated on the plans or otherwise specified herein.

2. Lever handle operator. T-handle operator where space does not allow use of lever.
 3. Three piece body that is in-line serviceable without removing the valve from the line.
 4. Acceptable manufacturers:
 - a. Series "60" as manufactured by Whitey.
 - b. Apollo Series 86A as manufactured by Conbraco.
 - c. V3P-1000 as manufactured by Velan.
 - d. Approved equal.
- B. Provide quarter turn valves.
- C. Provide with standard locking devices.
- D. Provide with pre-tapped actuator mounting holes.
- E. Provide blowout-proof stem.
- F. Provide stem with RPTFE live load thrust washer.
- G. Support valve seats by a small stainless steel coned disc spring which provides a positive sealing force at high and low pressures.
1. Seats are to automatically compensate for wear and thermal expansion.
- H. Materials of construction:

Body and body cover	316 SS (CF8M)
Ball	316 SS
Stem	316 SS
Seats	PTFE
Stem packing	PTFE
Stem thrust washer and bushing	RPTFE
Body seal	316 SS Graphite
Gland follower	304 SS
Grounding spring	302 SS
Packing Flange	316 SS (CF8M)
All bolts and nuts	B8M Cl.2, 8M, or 304 SS
Handle	304 SS
Handle grip	Vinyl

2.16 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER

- A. General:
1. 3/4" through 2": Provide Apollo 40-200 Series reduced pressure backflow preventer, or approved equal.
 2. Must be on the approved list published by SCDHEC and tested by a certified tester before placing into service and two (2) copies provided to Owner.
 3. Bypasses not allowed unless equipped with an equal backflow protection.
 4. Provide with attached air gap drain.
- B. 3/4" through 2" reduced pressure backflow preventers to consist of the following:

1. Two (2) independently operating, spring-loaded, "Y" pattern check valves and one (1) hydraulically dependent differential relief valve.
2. Designed to automatically reduce the pressure in the zone between check valves to at least 5 psi lower than inlet pressure.
3. The differential relief valve will open and maintain proper differential should differential between upstream and the zone drop to 2 psi.
4. Mainline valve body and caps including relief valve body and cover to be Bronze, ASTM B 584-78.
5. Center stem guided check valve moving member.
6. All springs to be stainless steel, 300 series.
7. Internally locate all hydraulic sensing passages within mainline relief valve bodies and relief valve cover.
8. Diaphragm to seal area ratio to be 10:1 minimum, nitrile, fabric reinforced.
9. Removable seat ring on relief valve.
10. Construct check valve and relief valve components so they may be serviced without removing the valve body from the line.
11. Reversible, nitrile ASTM D 2000 seats.
12. Provide full ported ball valves for shut-off valves and test locks complying with this Section.
13. Rate assembly to 175-psi water working pressure and water temperature range from 32°F to 180°F
14. Assemblies to meet requirements of ASSE Standard 1013; AWWA Standard Code C511-92, or latest revision; and USC Foundation of Cross Connection Control and Hydraulic Research, latest edition.

2.18 AIR RELEASE AND VACUUM VALVES

- A. Provide air release valves where indicated on the drawings and not specified in other sections of these specifications.
- B. Water application:
 1. Provide automatic air release valve to suit the pumping conditions.
 2. Locate on pump discharge head if possible; if not, locate valve in first section of piping after the discharge head, or as shown on the drawings.
 3. Provide inlet stainless steel ball valve meeting the requirements of Stainless Steel Ball Valves specifications herein for valves up to 4-inch size.
 4. All piping, nipples, etc., to be Schedule 40, Type 316 stainless steel.
 5. Deep well (Vertical turbine) style valves.
 - a. Design valves to employ the Kinetic principle to exhaust the air in the column at pump start up at up to sonic velocity, closing only when all the air has been discharged.
 - 1) Provide throttle device to permit control of the rate of air discharge.
 - 2) Provide surge check, if required, to close during the transition from air to water, reduce the flow of water and slow the valve's closing speed to minimize slam and return to the open position upon closure of the air and vacuum valve.
 - 3) Design the air and vacuum valve to re-open at pump shutdown to allow the water column to fall without excessive vacuum.
 - b. Provide size shown on the plans
 - c. Conform to the requirements of AAWWA C512 (latest revision) and be of the "Kinetic" design capable of exhausting air at up to sonic velocity without blowing shut.

- d. Construct body and cover of ASTM A126 Class B cast iron with a type 316 stainless steel float meeting the requirements of AWWA C512, and a replaceable seat of Buna-N or other suitable material.
- e. Provide valves 3-inch size and smaller with a threaded inlet connection and larger valves with a flanged inlet faced and drilled per ANSI B16.1, Class 125. Provide a threaded outlet on valves 4" and smaller and a Class 125 flanged outlet connection on larger sizes.
- f. Provide 4" and smaller valves with a throttle device installed on the outlet to regulate the exhaust rate of air.
- g. Provide larger valves with a surge check installed on the inlet to reduce the flow of water during closing to minimize slam and shock.
- h. Construct surge check of ASTM A126 Class B cast iron with the same size flanged or threaded connections as the air and vacuum valve inlet connection and have lead-free bronze or 316 stainless steel internals.
- i. Rate of final closure of valves with surge checks to be adjustable by means of an external hand valve.
- j. Provide G.A. Industries Model 933-T Deep Well Style with Throttling Valve or approved equal.

2.19 TAPPING SLEEVE AND VALVE

A. Tapping sleeve:

- 1. Provide Type 304L stainless steel per ASTM A240.
- 2. Provide rolled thread stainless steel bolts per ASTM A153, Type 304.
- 3. Provide Type 304 stainless steel hex head nuts, coated to prevent galling.
- 4. Virgin SBR gaskets, compounded for water and wastewater service.
- 5. Provide 3/4" NPT stainless steel test plug.
- 6. Maximum working pressure of 200 psi.
- 7. Provide ROMAC Industries Model SST or approved equal.

B. Tapping valve:

- 1. Construct of material compatible with tapping sleeve.
- 2. Provide gate valve as specified.
- 3. Joints - Flange to tapping sleeve, Furnish Connection as required for pipe end.

C. Tie rods:

- 1. Provide steel rods complying with ASTM Designation A242, galvanized in accordance with ASTM Designation A123.
- 2. Acceptable products: Super Star Tierod Figure No. SS12 and Tiebolt Figure No. SST7 as manufactured by Star National or approved equal.

2.20 VALVE BOXES

- A. Provide at each buried valve.
- B. Cast iron extension type, suitable for minimum cover of 3'6" over the pipe.
- C. Minimum inside diameter at the top of 5", minimum riser wall thickness 1/4" and thickness at the top of 11/16".
- D. Have the word "WATER"; "SEWER"; "SLUDGE", etc., as applicable, cast into the cover.

- E. Provide Tyler Series 6850 or approved equal.
- F. Where depth requires more than a two piece box use adjustable cast iron extensions.
- G. Coat box and cover with two (2) shop coats of bitumastic paint.

2.21 VALVE BOX PROTECTION RING

- A. Provide at each valve box a precast concrete protection ring.
- B. Provide two rings of No. 3 reinforcing steel, one 14" in diameter, and one 23" in diameter.
- C. Inside dimensions to be 9-1/4".
- D. Outside diameter to be 27".
- E. Provide 5" thickness at interior with a continuous slope to 2" thickness at the outside.
- F. Minimum weight of 110 lbs.

2.22 METER BOXES

- A. Provide cast iron boxes in traffic areas.
- B. Minimum dimensions: 19-1/2" long by 10" wide by 13" deep.
- C. Coat with two (2) shop coats of water based bitumastic paint.
- D. Provide MS-19 Rome meter box and cover by Opelika Foundry/Bingham and Taylor or approved equal.

2.23 PRESSURE GAUGES

- A. Provide pressure gauges where indicated on the drawings and not otherwise specified in separate sections of these Specifications.
 - 1. Provide solid front rounded type, 4 or 4-1/2" phenolic or stainless steel case with blow-out back, Type 316 stainless steel bourdon tube, glycerin fill, 1/2" NPT bottom male threaded connection, Teflon coated 400 series, stainless steel rotary movement, black micro-adjusted corners and black figures with white plastic dials, and a threaded ring.
 - 2. Provide gauge accurate to within 1/2% of the total scale range.
 - 3. Provide glycerin filled diaphragm isolators on all gauges except for those used on potable water systems.
 - a. Provide diaphragm material resistant to chemicals in the process line being measured.
 - b. Type 316L stainless steel housing and components.
 - c. 1/2" connection.
 - d. Provide fill/bleed connection.
 - e. Viton o-rings with Teflon back-up ring.
 - 4. Select gauge at the range indicated on the drawings or at the nearest standard range which provides a top limit above the pump shutoff head at the operating conditions but no greater than 10% above the shut off head.

5. Each gauge connection to consist of a shutoff valve and 1/2" stainless steel piping connections.
 - a. Shutoff valve to be Type 316 stainless steel ball valve with T-handle operator.
6. Provide gauges manufactured by Ametek, Ashcroft, McDaniel, Wika or approved equal.

2.24 CLEANOUTS

A. General:

1. Provide Josam, J. R. Smith or equal.
2. Provide cleanouts of the same diameter as lines in which they are installed up to 4", and not less than 4" for larger pipe diameters.
3. Comply with the latest adopted version of the International Plumbing Code or local codes where applicable.

B. Exterior:

1. Provide the following for gravity lines:
 - a. Smith #4253S-G (taper thread, bronze plus, cast iron top), Josam 58860-22-5 or approved equal.
2. Provide the following for pressure lines
 - a. Companion flange with 4" NPT bronze plug.
 - b. Cast iron cover, East Jordan Iron Works Model 8201 with hinged grate and Ultrawear Plus finish, or approved equal.
3. Fiber reinforced concrete pad set at grade.

C. Provide cleanout plugs of extra heavy bronze.

2.25 HOSE BIBBS

A. Interior:

1. Provide field testable model conforming to ASME/ANSI A112.21.3M.
2. Provide brass backflow protection/anti-siphon connector.
 - a. Woodford Nidel Model 50 HF with 3/4" male hose thread, equal by Watts or Apollo or Chicago, or approved equal.
3. Provide adjustable brass nut with deep stem guard, EPDM packing, and standard "O" size washer.
4. Finish to be rough brass.
5. Provide grey polycarbonate wheel handle.
6. Provide Model 26 by Woodford or Engineer approved equal.

B. Exterior:

1. Provide field testable, ASSE 1052 approved model that drains as the handle is shut off even if the hose is attached.
 - a. Drains automatically when hose is removed.
2. Provide Model 50HA backflow preventer.
3. Provide brass finish.
4. Provide Model 27 by Woodford or Engineer approved equal.

2.26 CHEMICAL INJECTION ASSEMBLY

- A. Provide chemical injection assemblies where indicated on the Drawings.
- B. Provide chemical injection assemblies comprised of the following components:

1. Inlet connection: 1/2", male.
 2. Spring loaded ball check valve.
 - a. Ball valve material: match material of solution tube for service.
 - b. Seal material:
 - 1) Viton: sodium hypochlorite, lime.
 - 2) EPDM: polyphosphate.
 3. Type 316 stainless steel limit safety chains.
 4. CPVC compression compression gland.
 5. CPVC ball valve.
 6. Main connection: 1", male.
 7. Solution tube:
 - a. Insertion length: three (3) inches.
 - b. Provide a standard tip configuration.
 - c. Material:
 - 1) PVC: Polyphosphate
 - 2) CPVC: Sodium hypochlorite, lime
- C. Provide components capable of withstanding the maximum pressure in the process line to which the assembly is connected.
- D. Provide chemical injection assemblies which allow for the withdrawal or insertion of the solution tube into the connecting process line while under pressure and without having to shut down the process line.
- E. Provide a flexible hose assembly for connecting the injection assembly to the corresponding chemical feed line.
1. Hose/Tube Material: Clear braided reinforced PVC.
 2. Insider diameter: 1/2".
 3. Ball valve:
 - a. PVC: Polyphosphate.
 - b. CPVC: Sodium hypochlorite, lime
 4. Seal:
 - a. Viton: sodium hypochlorite, lime
 - b. EPDM: polyphosphate.
 5. Provide hose/tube of sufficient length to allow safe removal of the injector for inspection.
- F. Provide Saf-T-Flo EB-164 Series or approved equal.

2.27 MISCELLANEOUS PARTS AND ACCESSORIES

- A. Use standard commercial grade suitable for the type of installation or system involved and conforming to the applicable standards and specifications of the AWWA and approved by the Engineer.

PART 3 - EXECUTION

3.1 HANDLING

- A. Handle pipe accessories so as to ensure delivery to the point of installation in sound, undamaged condition:
1. Carry pipe into position - do not drag.
 2. Use pinch bars or tongs for aligning or turning the pipe only on the bare end of the pipe.

- 3. Use care not to injure pipe linings.
- B. Thoroughly clean interior of pipe and accessories before installation. Keep clean during installation operations by plugging or other method approved by the Engineer.
- C. Before installation, inspect each piece of pipe and each fitting for defects:
 - 1. Material found to be defective before or after installation: Replace with sound material meeting the specified requirements, and without additional cost to the Owner.
- D. Rubber gaskets: Store in a cool dark place until just prior to time of installation.

3.2 PIPE CUTTING

- A. Cut pipe neatly and without damage to the pipe.
- B. Unless otherwise recommended by the pipe manufacturer, and authorized by the Engineer, cut pipe with mechanical cutter only.
 - 1. Use wheel cutters when practicable for ductile iron pipe.
 - 2. Cut plastic pipe square, using handsaw, and remove all burrs.

3.3 LOCATING

- A. Where possible, locate water line at least 10' away, horizontally, from sewer pipes.
- B. Should 10' separation not be practical, then the water main may be located closer provided:
 - 1. It is laid in a separate trench.
 - 2. It is laid in the same trench with the water main located at one side on a bench of undisturbed earth.
 - 3. In either of the above cases, crown elevation of the sewer shall be at least 18" below invert elevation of water line.
- C. Where water lines cross over sewers, maintain 18" minimum clearance between crown of sewer and invert of water line.
- D. Where water lines cross under sewers, each line shall be cast iron or ductile iron.
 - 1. A full length of water line shall be located over the sewer so that joints will be equal distance from the sewer.
- E. No water pipe shall pass through or come in contact with any part of a sewer manhole.
- F. All piping shall be installed in strict accordance with 10 States Standards.

3.4 ALIGNMENT OF PIPE

- A. Pipe lines intended to be straight shall be so laid.
- B. Where vertical or horizontal alignment requires deflection from straight line or grade, such deflection shall not exceed maximum deflection recommended by the pipe manufacturer.

- C. If alignment requires deflection exceeding recommended limits, furnish special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within the allowable limits.

3.5 PLACING AND LAYING

A. General:

1. Comply with pertinent OSHA regulations regarding excavation of utilities.
2. Comply with requirements of local codes.
3. Excavation and backfilling to comply with pertinent provisions of Section 02221.
4. Lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other equipment approved by the Engineer.
5. Do not dump or drop any of the materials of this Section into the trench.
6. Except where necessary in making connections to other lines, lay pipe with the bells facing in the direction of laying.
7. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.
8. Take up and relay pipe that has the grade or joint disturbed after laying.
9. Do not lay pipe in water, or when trench conditions are unsuitable for the work; keep water out of the trench until jointing is completed.
10. Securely close open ends of pipe, fittings, and valves when work is not in progress.
11. Where any part of coating or lining is damaged, repair to the approval of the Engineer and at no additional cost to the Owner.

B. Ductile iron pipe:

1. Install all pipe, fittings and accessories in accordance with ANSI/AWWA C600.
2. Gaskets: Handle, lubricate where necessary and install in strict accordance with manufacturer's recommendations.

C. Plastic pipe, gasketed joints:

1. Clean gasket, bell or coupling interior, especially groove area.
2. Lubricate and insert gasket as recommended by manufacturer.
3. Align spigot to bell, insert spigot into bell until it contacts gasket uniformly.
4. Push pipe "home" until reference mark is at proper location.

D. Flanged joints:

1. Provide true face flanges, field clean and fit with one full face gasket and make bolts up finger tight.
2. Use torque wrench to alternately tighten bolts 180° apart until full gasket flow and seal are secured.
3. Bias cut or unusual refacing of any flange will not be acceptable.

E. Screw thread joints:

1. Make cuts square, with cuts thoroughly reamed and rough edges and burrs removed.
2. Make threads sound, clean out, and well fitting.
3. Use pipe dope on male fittings only.

4. Make screwed joints tight with all necessary wrenches but without handle extensions.
- F. Solvent weld joints:
1. Install solvent weld joints in strict accordance with solvent cement manufacturer's instructions.
 2. Make cuts square, remove burrs from pipe ends and bevel slightly if necessary.
 3. Visually inspect inside of pipe, couplings and fittings removing all dirt and moisture with clean rag.
 4. Apply primer to surface of pipe and socket of fitting if required for cement being used, or lightly sandpaper surfaces.
 5. Apply solvent cement evenly and quickly around the outside of the pipe at a width slightly greater than depth of fitting socket.
 6. Apply a light coat of cement around the inside of the fitting socket.
 7. Quickly insert pipe into fitting socket bottom and give pipe or fitting a 90° turn to evenly distribute the cement, hold in place to prevent fitting rebound.
 8. Remove excess cement from pipe and fitting while cement is still soft.
 9. Allow joints to cure at least 24 hours before applying pressure to the piping system.
- G. Restrained joints:
1. Install in accordance with manufacturer's instructions.
 2. Tighten set screws to the manufacturer's rated torque using a torque wrench. If twist-off nuts are provided, tighten screws until nut breaks loose.

3.6 INSTALLATION OF EXPOSED PIPE

- A. All pipe shall be installed in accordance with details as shown on the Drawings and/or as directed by the Engineer.
- B. Installation and pipe routing details shall be provided by the Contractor.
- C. Pipe shall be run parallel with or at right angles to walls, equipment, ceilings, etc. Forty-five degree (45°) fittings, or angle runs shall be avoided as much as possible and installed only as approved by the Engineer.
- D. Modifications to piping installation based on actual field conditions may be required and shall receive the Engineer's approval. Changes will be provided by the Contractor at no additional cost to the Owner.
- E. Pipe coding shall be provided on all piping exposed to view, including piping in tunnels and floor or wall chases. Comply with Section 10445.

3.7 INSTALLATION OF STAINLESS STEEL PIPE AND FITTINGS

- A. Exercise extreme care to avoid contacting pipe with any ferrous materials.
- B. Use saws, drills, files, brushes, etc. that are specifically designated for use on stainless steel piping only.
- C. Use nylon slings or straps to handle piping.

- D. After installation, wash and rinse all foreign matter from the pipe. Remove manufacturer's identification marking with paint thinner or solvent.
- E. Provide final cleaning with detergent and hot water and rinse clean.
- F. Threaded pipe:
 - 1. Thread cut pipe utilizing dies specifically for stainless steel pipe.
 - 2. Remove all debris and grit and solvent clean cut threads.
 - 3. Apply joint compound to completely fill all voids.
 - 4. Clean excessive joint compound from piping after completing joint.

3.8 LINK SEAL SLEEVE SEAL

- A. Install seal between piping and sleeve.
- B. Tighten bolts to manufacturer's specified torques.
- C. Check for leaks.
- D. Install escutcheon plate at exposed locations.

3.9 ADAPTER FLANGE COUPLING

- A. End of pipe not to exceed 1/4" from mating flange.
- B. Apply "Never-Seize" to stainless steel set screws or approved equal.
- C. Tighten set screws to manufacturer's recommendations using a torque wrench.

3.10 THRUST BLOCKS

- A. General:
 - 1. Provide thrust blocks, or metal tie rods and clamps or lugs, on plugs, caps, tees, hydrants and bends deflecting 11-1/4° or more either vertically or horizontally.
 - 2. Provide concrete thrust blocking with a compressive strength of 3000 psi in 28 days.
 - 3. Size of the blocking will be determined by the Engineer, based on soil bearing capacity.
 - 4. Thrust blocking is not required on restrained joint fittings.
 - 5. Provide 8 mil. polyethylene film between the thrust block and fittings.
- B. Installation:
 - 1. Locate thrust blocking between solid ground and the fitting to be anchored.
 - 2. Unless otherwise shown or directed by the Engineer, place the base and thrust bearing sides of thrust blocking directly against undisturbed earth.
 - 3. Sides of thrust blocking not subject to thrust may be placed against forms.
 - 4. Place thrust blocking so the fitting joints will be accessible for repair.
 - 5. Protect steel rods and clamps by galvanizing or by coating with bituminous paint.

3.11 SETTING VALVE BOXES

- A. Center valve boxes on the valves, setting plumb.
- B. Tamp earth fill around each valve box to a distance of 4' on all sides, or to the undisturbed trench face if less than 4'.
- C. Fully open and close each valve to assure that all parts are in working condition.
- D. Place valve box protection ring around top of valve box as indicated on the plans.
 - 1. Install ring level with top 1" above finished grade.
 - 2. Top of ring to be level with or no more than 1" above the top of the valve box.
- E. Provide valve extension necessary to provide the operating nut within 2' of the top of the valve box.

3.12 INSTALLATION OF REDUCE PRESSURE PRINCIPLE BACKFLOW PREVENTER

- A. General:
 - 1. Minimum clearance of 12" maximum clearance of 30" between port and floor or grade.
 - 2. Install where no discharge is objectionable and can be positively drained away.
 - 3. Must be easily accessible for testing and maintenance and protected from freezing.
 - 4. Eliminate excessive pressure situations to avoid possible damage to system and assemblies.
 - 5. Provide conduit and grounding wire connection per NEC, IBC, and any local applicable electrical code.
 - 6. Install horizontally unless otherwise shown on the plans or Engineer's approval is obtained.

3.13 CLEANOUTS

- A. Secure the Engineer's approval of locations for cleanouts in finished areas prior to installation.
- B. Provide cleanouts of same nominal size as the pipes they serve; except where cleanouts are required in pipes 4" and larger, provide 4" cleanouts.
- C. Make cleanouts accessible. After pressure tests are made and approved, thoroughly graphite the cleanout threads.
- D. Pour 4" concrete protection pad around cleanout at outside locations.

3.14 PIPE HANGERS AND SUPPORTS

- A. Install in accordance with manufacturer's recommendations using stainless steel anchors.
- B. Install plumb and level.

3.15 HYDROSTATIC TESTING - PRESSURE LINES

- A. General:

1. Pressure and leakage testing must be conducted in accordance with AWWA Standards C600 – Installation of Ductile Iron Water Mains and Their Appurtenances.
2. Clean and flush line of air, dirt and foreign material.
3. Do not perform hydrostatic tests until at least five days after installation of concrete thrust blocking.
4. Test pump, pipe connection, pressure gauges, measuring devices and all other necessary appurtenances to conduct tests are to be provided by the Contractor.
5. Install brass corporation cocks at all high points that do not have permanent air vents. Corporation cocks are to be left in place and all costs for providing such cocks are to be borne by the Contractor.
6. Conduct tests on each line or valved section of line.
7. Test pressures to be 150 psi, or 1.5 times the maximum working pressure, whichever is greater, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.
8. Do not test pipe at pressures exceeding manufacturer's recommendations.
9. The Contractor must provide documentation of the pressure and leakage tests. Documentation must include length of lines, diameter of pipe(s), amount of water required to fill line after test was performed, and amount of allowable leakage.
10. The witness to the hydrostatic testing is to be someone other than the Contractor or the utility installing the lines.

B. Pressure tests:

1. After the pipe is laid, the joints completed, and the trench backfilled, subject the newly laid piping and valved sections of the piping to the test pressure specified in Part A above.
2. Open and close each valve within the section being tested several times during the test period.
3. Replace or remake joints showing leakage.
 - a. Remove cracked pipe, defective pipe, and cracked or defective joints, fittings and valves. Replace with sound material and repeat the test until results are satisfactory.
 - b. Make repair and replacement without additional cost to the Owner.

C. Leakage test:

1. Conduct leakage test after the pressure test has been completed satisfactorily.
2. Duration of each leakage test: At least two hours.
3. During the test, subject water lines to the test pressure specified in Part A above.
4. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
 - a. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula(s):

$$L = S \times D \times \sqrt{P} / 148,000; \text{ where}$$

L = allowable leakage in gallons per hour;
 S = length of pipe tested in feet;
 D = nominal diameter of pipe in inches; and
 P = average test pressure psi gauge.

- b. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallons per hour per inch of nominal valve size will be allowed.
 - 1) Should any test of pipe disclose leakage greater than that specified above, locate and repair the defective joint or joints until the leakage is within the specified allowance, and at no additional cost to the Owner.
 - 2) Repair all visible leaks regardless of test results.

3.16 STERILIZATION

- A. Sterilize in accordance with Section 02516 – Disinfection of Potable Water Lines.

3.17 DECHLORINATION OF CHLORINATED STERILIZATION WATER

- A. Dechlorinate in accordance with Section 02516 – Disinfection of Potable Water Lines.

3.18 PAINTING

- A. Paint all exposed piping and hydrants complying with pertinent provisions of Section 09900.

3.19 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the items under this Section and all costs for same shall be included in the unit price for which it pertains.

END OF SECTION

SECTION 02930

GRASSING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide grassing of the areas specified herein, or as indicated, for a complete and proper installation.
 - 1. Treatment plant site: All cleared areas and areas disturbed by the construction operation, all non-wetted, slopes, top, etc. of the treatment basin and all road cut slopes.
- B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Seed: Conform to all State laws and to all requirements and regulations of the South Carolina Department of Agriculture.
 - 1. Deliver to site each variety of seed individually packaged and tagged to show name, net weight, origin and lot number.
- C. Fertilizer: Conform to State fertilizer law.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 180 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Complete materials list of items proposed to be provided under this Section.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. At time of delivery, furnish the Engineer invoices of all materials received in order that application rates may be determined.
- C. Immediately remove from the site materials that do not comply with the specified requirements, and promptly replace with materials meeting the specified requirements.

PART 2 - PRODUCTS

2.1 FERTILIZER

- A. Provide commercial balanced 16-4-12 or 12-4-8 fertilizer delivered to the site in bags labeled with the manufacturer's guaranteed analysis.

2.2 GRASS SEED

- A. Provide grass seed that is:
 - 1. Free from noxious weed seeds, and recleaned.
 - 2. Grade A recent crop seed.
 - 3. Treated with appropriate fungicide at time of mixing.
 - 4. Delivered to the site in sealed containers with dealer's guaranteed analysis.

2.3 LIME

- A. Provide agricultural grade, standard ground limestone conforming to current "Rules, Regulations and Standards of the Fertilizer Board of Control" issued at Clemson University.
- B. Bag tags or delivery slip for bulk loads shall indicate brand or trade name, calcium carbonate equivalent, and other pertinent data to identify the lime.

2.4 WOOD CELLULOSE FIBER

- A. Provide wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer.
- B. Material to be heat processed so as to contain no germination or growth inhibiting factors.
- C. It shall be dyed (non-toxic) an appropriate color to facilitate metering.

2.5 STRAW MULCH

- A. Provide straw or hay material.
 - 1. Straw to be stalks of wheat, rye, barley or oats.
 - 2. Hay to be timothy, peavine, alfalfa, or coastal bermuda.
- B. Material to be reasonably dry and reasonably free from mature seed bearing stalks, roots, or bulblets or Johnson Grass, Nutgrass, Wild Onion and other noxious weeds.

2.6 EXCELSIOR FIBER MULCH

- A. To consist of 4" to 6", average length, wood fibers cut from sound, green timber.
- B. Make cut in such a manner as to provide maximum strength of fiber, but at a slight angle to natural grain of the wood.

2.7 EROSION CONTROL BLANKET

- A. Provide on areas as shown on the plans.

- B. Provide Erosion Control Blanket S150, from North American Green, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Seed these areas immediately upon completion of grading or construction and clean-up operations.
 - 1. Slopes greater than four horizontal to one vertical.
 - 2. Utility rights-of-way adjacent to stream banks.
- B. Areas ready for planting between August 16 and February 28 shall be planted with a temporary cover of Schedule No. 2. At the acceptable seasons for planting Schedule No. 1, the turf shall be destroyed by reworking the soil, and Schedule No. 1 seeding established as specified herein.
- C. Use Rate A lbs. per 1000 sq. ft. on slopes over 5' horizontal to 1' vertical in height and use Rate B lbs. per 1000 sq. ft. on slopes less than 5' horizontal to 1' vertical.

3.2 SEEDING SCHEDULES

- A. Mixtures of different types of seed for the various schedules shall be weighed and mixed in proper proportions in the presence of the Engineer.

- B. Schedule No. 1 - Planting dates March 1 to August 15:

Common Name of Seed	Rate A	Rate B
Rye Grain	4	4
Common Bermuda (hulled)	0	1.5
Sericea Lespedeza (clay soils)	1	0
Weeping Love Grass (sandy soils)	1	0

- C. Schedule No. 2 - Planting dates August 16 - February 28:

Common Name of Seed	Rate A	Rate B
Rye Grain	5	5
Common Bermuda (hulled)	0	1.5
Brown Top Millet	5	0
Common Bermuda (unhulled)	1.5	2.0

3.3 GROUND PREPARATION

- A. Bring all areas to proper line, grade and cross section indicated on the plans.
- B. Repair erosion damage prior to commencing seeding operations.
- C. Loosen seed bed to minimum depth of 3".
- D. Provide and prepare topsoil in accordance with Section 02210.
- E. Conduct soil test to determine pH factor.

1. If pH is not in the range of 6.0 to 6.5, adjust.

3.4 APPLICATION OF FERTILIZER

- A. Spread uniformly over areas to be seeded at:
 1. Rate of 18 lbs. per 1000 sq. ft. when using 16-4-12.
 2. Rate of 25 lbs. per 1000 sq. ft. when using 12-4-8.
 3. Use approved mechanical spreaders.
- B. Mix with soil to depth of approximately 3".

3.5 SOWING METHODS

- A. General:
 1. Perform seeding during the periods and at the rates specified in the seeding schedules.
 2. Do not conduct seeding work when ground is frozen or excessively wet.
 3. Produce satisfactory stand of grass regardless of period of the year the Work is performed.
- B. Seeding, slopes less than four horizontal to one vertical:
 1. Shall conform to Methods EA, WF or WCF as specified hereinafter.
 2. Method EA (Emulsified Asphalt):
 - a. Sow seed not more than 24 hours after application of fertilizer.
 - b. Use mechanical seed drills on accessible areas, rotary hand seeders, power sprayers, etc. may be used on steep slopes or areas not accessible to seed drills.
 - c. Cover seed and lightly compact with cultipacker if seed drill does not.
 - d. Within 24 hours following compaction of seeded areas, uniformly apply 0.2 gallons per square yard of emulsified asphalt over the seeded area.
 3. Method WF:
 - a. Sow seed as specified for Method EA.
 - b. Within 24 hours following covering of seeds, uniformly apply excelsior fiber at the rate of 100 lbs. per 1000 sq. ft.
 - c. Apply material hydraulically.
 - d. Seeded areas to be lightly rolled to form a tight mat of the excelsior fibers.
 4. Method WCF:
 - a. Apply seed, fertilizer and wood fiber mulch using hydraulic equipment.
 - b. Equipment to have built-in agitation system with capacity to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed and water.
 - c. Minimum capacity of slurry tank: 1000 gallons.
 - d. Apply fiber mulch at rate of 35 lbs. per 1000 sq. ft.
 - e. Regulate slurry mixture so that amounts and rates of application will result in uniform application of all materials at not less than the specified amounts.
 - f. Apply slurry in a sweeping motion, in an arched stream, so as to fall like rain, allowing the wood fibers to build upon each other.
 - g. Use color of wood pulp as guide, spraying the prepared seed bed until a uniform visible coat is obtained.

C. Seeding, slopes greater than four horizontal to one vertical:

1. Sow seed as specified for Method EA, unmulched.
2. Cover seeded area with erosion control blanket.

3.6 SECOND APPLICATION OF FERTILIZER

- A. When plants are established and showing satisfactory growth, apply nitrogen at the rate of 1.0 lb. per 1000 sq. ft.
- B. Apply in dry form unless otherwise directed by the Engineer.
- C. Do not apply to stands of temporary grasses.

3.7 MAINTENANCE

- A. Maintain all seeded areas in satisfactory condition until final acceptance of the Work.
- B. Areas not showing satisfactory evidence of germination within six weeks of the seeding date shall be immediately reseeded, fertilized and/or mulched.
- C. Repair any eroded areas.
- D. Mow as necessary to maintain healthy growth rate until final acceptance of the Work.

3.8 ACCEPTANCE

- A. Permanently seeded areas (Schedule No. 1) will be accepted when the grass attains a height of 2".
- B. No acceptance will be made of temporary seeded areas (Schedule No. 2). Rework and seed with Schedule No. 1.

3.9 MEASUREMENT AND PAYMENT

- A. No measurement and payment will be made for the work under this Section and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION
SECTION 02930

GRASSING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide grassing of the areas specified herein, or as indicated, for a complete and proper installation.
 1. Treatment plant site: All cleared areas and areas disturbed by the construction operation.

GRASSING
02930-5

- B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Seed: Conform to all State laws and to all requirements and regulations of the South Carolina Department of Agriculture.
 - 1. Deliver to site each variety of seed individually packaged and tagged to show name, net weight, origin and lot number.
- C. Fertilizer: Conform to State fertilizer law.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 100 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Complete materials list of items proposed to be provided under this Section.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. At time of delivery, furnish the Engineer invoices of all materials received in order that application rates may be determined.
- C. Immediately remove from the site materials that do not comply with the specified requirements, and promptly replace with materials meeting the specified requirements.

PART 2 - PRODUCTS

2.1 FERTILIZER

- A. Provide commercial balanced 16-4-12 or 12-4-8 fertilizer delivered to the site in bags labeled with the manufacturer's guaranteed analysis.

2.2 GRASS SEED

- A. Provide grass seed that is:
 - 1. Free from noxious weed seeds, and recleaned.
 - 2. Grade A recent crop seed.
 - 3. Treated with appropriate fungicide at time of mixing.
 - 4. Delivered to the site in sealed containers with dealer's guaranteed analysis.

2.3 LIME

- A. Provide agricultural grade, standard ground limestone conforming to current "Rules, Regulations and Standards of the Fertilizer Board of Control" issued at Clemson University.
- B. Bag tags or delivery slip for bulk loads shall indicate brand or trade name, calcium carbonate equivalent, and other pertinent data to identify the lime.

2.4 WOOD CELLULOSE FIBER

- A. Provide wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer.
- B. Material to be heat processed so as to contain no germination or growth inhibiting factors.
- C. It shall be dyed (non-toxic) an appropriate color to facilitate metering.

2.5 STRAW MULCH

- A. Provide straw or hay material.
 - 1. Straw to be stalks of wheat, rye, barley or oats.
 - 2. Hay to be timothy, peavine, alfalfa, or coastal bermuda.
- B. Material to be reasonably dry and reasonably free from mature seed bearing stalks, roots, or bulblets or Johnson Grass, Nutgrass, Wild Onion and other noxious weeds.

2.6 EXCELSIOR FIBER MULCH

- A. To consist of 4" to 6", average length, wood fibers cut from sound, green timber.
- B. Make cut in such a manner as to provide maximum strength of fiber, but at a slight angle to natural grain of the wood.

2.7 EROSION CONTROL BLANKET

- A. Provide on areas as shown on the Drawings.

- B. Provide Erosion Control Blanket S150 from North American Green, American Excelsior Curlex II (0.73), or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Seed these areas immediately upon completion of grading or construction and clean-up operations.
 - 1. Slopes greater than four horizontal to one vertical.
 - 2. Utility rights-of-way adjacent to stream banks.
- B. Areas ready for planting between September and February shall be planted with a temporary cover of Schedule No. 2. At the acceptable seasons for planting Schedule No. 1, the turf shall be destroyed by reworking the soil, and Schedule No. 1 seeding established as specified herein.
- C. Use Rate A lbs. per 1000 sq. ft. on slopes over 5' horizontal to 1' vertical in height and use Rate B lbs. per 1000 sq. ft. on slopes less than 5' horizontal to 1' vertical.

3.2 SEEDING SCHEDULES

- A. Mixtures of different types of seed for the various schedules shall be weighed and mixed in proper proportions in the presence of the Engineer.
- B. Schedule No. 1 - Planting dates March to August:

Common Name of Seed	Rate A	Rate B
Rye Grain	4	4
Common Bermuda (hulled)	0	1.5
Sericea Lespedeza (clay soils)	1	0
Weeping Love Grass (sandy soils)	1	0

- C. Schedule No. 2 - Planting dates September to February:

Common Name of Seed	Rate A	Rate B
Rye Grain	5	5
Common Bermuda (hulled)	0	1.5
Brown Top Millet	5	0
Common Bermuda (unhulled)	1.5	2

3.3 GROUND PREPARATION

- A. Bring all areas to proper line, grade and cross section indicated on the plans.
- B. Repair erosion damage prior to commencing seeding operations.
- C. Loosen seed bed to minimum depth of 3".
- D. Provide and prepare topsoil in accordance with Section 02210.
- E. Conduct soil test to determine pH factor.
 - 1. If pH is not in the range of 6.0 to 6.5, adjust.

3.4 APPLICATION OF FERTILIZER

- A. Spread uniformly over areas to be seeded at:
 - 1. Rate of 18 lbs. per 1000 sq. ft. when using 16-4-12.
 - 2. Rate of 25 lbs. per 1000 sq. ft. when using 12-4-8.
 - 3. Use approved mechanical spreaders.
- B. Mix with soil to depth of approximately 3".

3.5 SOWING METHODS

- A. General:
 - 1. Perform seeding during the periods and at the rates specified in the seeding schedules.
 - 2. Do not conduct seeding work when ground is frozen or excessively wet.
 - 3. Produce satisfactory stand of grass regardless of period of the year the Work is performed.
- B. Seeding, slopes less than four horizontal to one vertical:
 - 1. Shall conform to Methods EA, WF or WCF as specified hereinafter.
 - 2. Method EA (Emulsified Asphalt):
 - a. Sow seed not more than 24 hours after application of fertilizer.
 - b. Use mechanical seed drills on accessible areas, rotary hand seeders, power sprayers, etc. may be used on steep slopes or areas not accessible to seed drills.
 - c. Cover seed and lightly compact with cultipacker if seed drill does not.
 - d. Within 24 hours following compaction of seeded areas, uniformly apply 0.2 gallons per square yard of emulsified asphalt over the seeded area.
 - 3. Method WF:
 - a. Sow seed as specified for Method EA.
 - b. Within 24 hours following covering of seeds, uniformly apply excelsior fiber at the rate of 100 lbs. per 1000 sq. ft.
 - c. Apply material hydraulically.
 - d. Seeded areas to be lightly rolled to form a tight mat of the excelsior fibers.
 - 4. Method WCF:
 - a. Apply seed, fertilizer and wood fiber mulch using hydraulic equipment.
 - b. Equipment to have built-in agitation system with capacity to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed and water.
 - c. Minimum capacity of slurry tank: 1000 gallons.
 - d. Apply fiber mulch at rate of 35 lbs. per 1000 sq. ft.
 - e. Regulate slurry mixture so that amounts and rates of application will result in uniform application of all materials at not less than the specified amounts.
 - f. Apply slurry in a sweeping motion, in an arched stream, so as to fall like rain, allowing the wood fibers to build upon each other.
 - g. Use color of wood pulp as guide, spraying the prepared seed bed until a uniform visible coat is obtained.
- C. Seeding, slopes greater than four horizontal to one vertical:

1. Sow seed as specified for Method EA, unmulched.
2. Cover seeded area with erosion control blanket.

3.6 SECOND APPLICATION OF FERTILIZER

- A. When plants are established and showing satisfactory growth, apply nitrogen at the rate of 1.0 lb. per 1000 sq. ft.
- B. Apply in dry form unless otherwise directed by the Engineer.
- C. Do not apply to stands of temporary grasses.

3.7 MAINTENANCE

- A. Maintain all seeded areas in satisfactory condition until final acceptance of the Work.
- B. Areas not showing satisfactory evidence of germination within six weeks of the seeding date shall be immediately reseeded, fertilized and/or mulched.
- C. Repair any eroded areas.
- D. Mow as necessary to maintain healthy growth rate until final acceptance of the Work.

3.8 ACCEPTANCE

- A. Permanently seeded areas (Schedule No. 1) will be accepted when the grass attains a height of 2".
- B. No acceptance will be made of temporary seeded areas (Schedule No. 2). Rework and seed with Schedule No. 1.

3.9 MEASUREMENT AND PAYMENT

- A. No measurement and payment will be made for the work under this Section and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 03250
CONCRETE SPECIALTY ITEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide all labor and materials necessary to provide and install concrete accessories, specialties, and related materials as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and sections in Division 1 of these specifications.
 - 2. Section 03300 - Cast-in-Place Concrete.
 - 3. Section 03600 - Non-Shrink Grout.
 - 4. Section 05990 - Miscellaneous Metals.
 - 5. Section 07920 - Sealants and Caulking.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B. Follow the manufacturer's instructions for preparation and use of proprietary items.

1.3 SUBMITTALS

- A. Comply with the pertinent provisions of Section 01340.
- B. Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit manufacturer's literature, including a statement of compliance with any referenced standards and any manufacturer's instructions for use as may be necessary.

PART 2 - PRODUCTS

2.1 WATERSTOP MATERIALS

- A. General: Provide waterstops at all joints in structures containing liquid or resisting hydrostatic pressure, including structures below grade, tanks, basins, etc., and as shown on the drawings.
 - 1. Use PVC waterstops unless otherwise indicated on the drawings.
- B. PVC waterstops:
 - 1. In expansion joints, use minimum 9" wide x 3/8" thick polyvinyl chloride lock rib waterstop with a 7/8" minimum outside diameter center bulb unless otherwise shown on the Drawings.
 - a. Greenstreak Style 735; or,

- b. Vinylex RB9-38H; or,
 - c. Horn Type 10; or,
 - d. Approved equal.
- 2. In construction joints, use minimum 6" wide x 3/8" thick lock rib type polyvinyl chloride waterstop.
 - a. Greenstreak Style 679; or,
 - b. Vinylex R6-38; or,
 - c. Wirestop FR-6380, or
 - d. Horn Type 11; or,
 - e. Approved equal.
- 3. Where shown on the Drawings, use a polyvinyl chloride labyrinth type waterstop.
 - a. Overall length: 4-7/16" minimum
Overall depth: 1-5/8" minimum
Minimum wall or rib thickness: 3/16"
Three rib type.
 - b. Greenstreak Style 790; or,
 - c. Horn Type 26; or,
 - d. Approved equal.
- 4. All PVC waterstops shall conform to the U.S. Corps of Engineer's specification CRD-C572.

C. Expanding Hydrophilic Rubber (EHR) waterstop:

- 1. Provide pre-formed expanding hydrophilic rubber and hydrophilic paste adhesive and related accessories.
 - a. Provide Adeka Ultra Seal by Asahi Denka Kogyo; or
 - b. Hydrotite and Leakmaster by Greenstreak Plastic Products Company, Inc; or
 - c. Approved equal.
- 2. Provide pre-formed rubber strip.
 - a. Provide Adeka MC-2010M; or
 - b. Hydrotite CJ1020-2K by Greenstreak Plastic Products Company, Inc; or
 - c. Approved equal.
- 3. Provide paste type hydrophilic waterstop compound to be used in conjunction with the rubber strip in accordance with the manufacturer's instructions.
 - a. Provide Adeka MC-201; or
 - b. Hydrotite and Leakmaster LV-1 by Greenstreak Plastic Products Company, Inc; or
 - c. Approved equal.
- 4. Provide adhesive bonding agent for installation as recommended by the manufacturer.
- 5. Provide other materials as recommended by the manufacturer for a complete and proper installation.

D. Provide other waterstops as indicated on the Drawings.

2.2 PREMOLDED JOINT FILLERS

- A. Provide self-expanding cork joint fillers complying with ASTM D 1752, Type III.

2.3 MOISTURE BARRIER

- A. Where so indicated on the Drawings, provide a moisture barrier consisting of:
 - 1. Clean gravel base of thickness as indicated on the drawings, but not less than 4".

2. Six mil thick plastic sheeting, with all joints taped and sealed.
3. One inch of clean dry sand evenly spread on top of the installed plastic sheeting.

2.4 NEOPRENE BEARING PADS

- A. Use bearing pads composed of high quality elastomeric neoprene with a hardness of 50 durometer unless otherwise indicated on the Drawings. Thickness and size shall be as shown on the drawings.

2.5 ANCHORING AND BONDING MATERIALS

- A. Epoxy adhesive: Use a two component, solvent free moisture-insensitive, high modulus, high strength epoxy adhesive conforming to ASTM C 881.
 1. Provide Sikadur 32 Hi-Mod by Sika Corporation, Epobond by L&M Construction Chemicals, Inc., Bond-1 by Permagile Industries, Inc. or approved equal.
 2. Mix epoxy components with clean sand fine aggregate conforming to ASTM C 33 as recommended by the epoxy manufacturer when required by the use intended.
- B. Bonding agents: Use polyvinyl acetate homopolymer liquid bonding agent.
 1. Use Weld Crete by Larsen; or
 2. Everweld by L&M Construction Chemicals, Inc.; or
 3. Approved equal.
- C. Bonding admixtures: Use acrylic latex or acrylic polymer liquid bonding admixtures.
 1. Use Acryl 60 by Thoro System Products; or
 2. Everbond by L&M Construction Chemicals, Inc.; or
 3. Sikabond by Sika Corporation; or
 4. Approved equal.
 5. Mix in accordance with manufacturer's instructions.

2.6 CONCRETE SEALER

- A. Where concrete sealer is indicated on the drawings, provide a penetrating silane-siloxane sealer.
- B. Use Aquapel+Plus™ by L&M Construction Chemicals, Inc. or approved equal.

2.7 PREFORMED CONTROL JOINT

- A. Provide, where indicated on the drawings, a continuous one-piece flexible PVC control joint former.
 1. Use Kold-Seal Zip-Per Strip KSF-150-38-58 by Vinylex Corporation, Zip Cap Control Joint Number 832 by Greenstreak Plastic Products Company, or approved equal.
 2. Form control joint to a depth of 1-1/2".

2.8 COMPRESSION SEALS

- A. Provide preformed compression seals in expansion joints where indicated on the drawings.

B. Materials:

1. Compression seal material shall be extruded neoprene conforming to ASTM D 3542.
2. Adhesive shall be one part polyurethane conforming to ASTM D 4070 or other adhesive as recommended by the manufacturer.

C. Provide Series WE seals by Watson Bowman, Acme Corporation Series AR by Erie Metal Specialties, or approved equal.

D. Use compression seals of the size most suitable for the joint width indicated on the drawings.

2.9 BENTONITE SEALANT (WATERSTOP)

- A. Provide 1" x 3/4" Volclay Waterstop RX as manufactured by American Colloid Company, Skokie, IL, 1" x 3/4" Greenstreak Swellstop as manufactured by Greenstreak Group, Inc. 800-325-9504, or equal where indicated on the drawings.

2.10 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 WATERSTOPS

- A. General: Provide waterstops in construction or expansion joints of all structures subject to hydrostatic pressure and as indicated on the drawings.

1. Use 6" wide PVC waterstops in construction joints unless another type of waterstop is shown on the Drawings.
2. Use 9" wide PVC center bulb waterstop in expansion joints.

B. Installation of PVC waterstops:

1. Install waterstops such that they are continuous along the entire length of the joint and around all corners and intersections.
2. Use waterstops in maximum practicable lengths to minimize splicing.
3. Splicing: Butt splice PVC waterstops by heat welding with a thermostatically controlled electric splicing iron in accordance with the manufacturer's recommendations.
 - a. Use factory formed corners, and intersections where angle intersections occur, making only straight splices in the field. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.
 - b. Provide watertight splices that are free from voids, pinholes or defects and develop not less than 50% of the mechanical strength of the unspliced waterstop.
 - c. At the discretion of the Engineer, splices will be tested with a corona discharge testing unit or other method recommended by the

manufacturer and any deficiencies shall be corrected by the Contractor.

4. Place waterstops in the joints in such a manner that will ensure the watertightness of the joint.
 - a. Center the waterstop in the joint unless shown otherwise.
 - b. Support and hold waterstops securely in position using grommets or pre-punched holes spaced at 12 inches on center to prevent displacement or injury to the waterstop during concrete placement.
- C. Installation of bentonite waterstops:
1. Clean all debris, dirt and rocks from dry concrete surface. Concrete to be free of large voids and projections.
 2. Keep from freezing.
 3. Do not install waterstop within 2" of the outer edge of a wall or exposed surface of a slab.
 4. Apply to prepared concrete surface a minimum 5 mil. thick, 1-1/4" wide coating of adhesive and allow to dry black.
 5. Remove release paper. Press the entire length of waterstop firmly against primed surface. Verify minimum concrete coverage will be maintained over entire placement of waterstop. Place in maximum practicable lengths to minimize coil end joints.
 6. Tightly butt coil ends together to form continuous waterstop. DO NOT OVERLAP COIL ENDS. Where required, cut coils with sharp knife or utility blade to fit coil ends together without overlapping.
 7. Pour and vibrate concrete. Whenever possible, do not pour concrete directly on waterstop or allow vibrator to come in direct contact with waterstop.
 8. Do not use any waterstop in a hydrated condition. Allow hydrated waterstop sufficient time to dehydrate before placing concrete against it.
- D. Installation of expanding hydrophilic rubber waterstops
1. Provide clean surface, free of dust, dirt and honeycombed or loose concrete for application of the waterstop.
 2. Secure the rubber strip in place with adhesive or by nailing in accordance with the manufacturer's instructions.
 3. When applying to a rough surface, set rubber strip in continuous bead of paste type waterstop and allow to cure one (1) day.
 4. Splice waterstop by lapping 2" and apply paste over the joint.
 5. Place waterstop material so that it will have a minimum concrete cover of 2" in any direction.
 6. Comply with manufacturer's installation instructions.

3.2 PREMOLDED JOINT FILLERS

- A. Install joint fillers in accordance with the manufacturer's recommendations.
1. Fasten the joint filler to previously cast concrete using compatible adhesives.
 2. Precut joint fillers to fit snugly against any waterstop if present.
 3. Tape butt splices to prevent the intrusion of concrete into the joint.
 4. Precut joint filler as necessary to provide enough recess to accommodate any required sealants and backer rod.

3.3 MOISTURE BARRIER

- A. Place and level the gravel base.
- B. Place polyethylene sheet over the base and continuously tape all joints.
- C. Spread a 1" thick layer of clean sand uniformly over the polyethylene sheet.

3.4 CONCRETE SEALER

- A. Preparation: Remove all surface dirt, oils, dust and other contaminants from the surface to be sealed and leave it clean and dry.
- B. Apply the sealer in accordance with the manufacturer's directions.
 - 1. Do not dilute or thin the sealer.
 - 2. Apply by brush, spray or roller.
 - 3. Apply at a rate of 100 sq. ft. to 125 sq. ft. per gallon.

3.5 PREFORMED CONTROL JOINT

- A. Install control joint formers straight and flush with or slightly below the concrete surface.

3.6 OTHER MATERIALS

- A. Mix, place, apply or install all other proprietary materials in strict accordance with the manufacturer's directions.

3.7 MEASUREMENT AND PAYMENT

- A. No measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide cast-in-place concrete, including formwork and reinforcement, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 03250 - Concrete Specialty Items.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Reference standards: Comply with the following codes, specifications and standards, except as otherwise shown or specified:
 - 1. American Concrete Institute (ACI) Publications:
 - ACI 301 Specification for Structural Concrete for Buildings
 - ACI 305 Recommended Practice for Hot Weather Concreting
 - ACI 306 Recommended Practice for Cold Weather Concreting
 - ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures
 - ACI 318 Building Code Requirements for Reinforced Concrete
 - ACI 347 Recommended Practice for Concrete Framework
 - 2. American Society for Testing and Materials (ASTM) Publications:
 - A185 Welded Steel Wire Fabric for Concrete Reinforcement
 - A615 Deformed and Plain Billet Steel Bars for Concrete Reinforcement
 - C31 Making and Curing Concrete Test Specimens in the Field
 - C33 Concrete Aggregates
 - C39-72 Compressive Strength of Cylindrical Concrete Specimens
 - C94 Ready-Mixed Concrete
 - C150 Portland Cement
 - C260 Air-Entraining Admixtures for Concrete
 - 3. Concrete Reinforcing Steel Institute (CRSI):
 - "Manual of Standard Practice"
 - 4. American Welding Society (AWS) Publication:
 - D12.1-61 Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete
- C. Testing agency: A testing laboratory will be retained by the Contractor to perform material evaluation tests required by these specifications.

- D. Qualifications of contractors performing concrete work: Minimum of two (2) years experience on comparable concrete projects.
- E. Plant qualification: Plant equipment and facilities shall meet all requirements of the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C94.

1.3 SUBMITTALS

- A. Comply with the pertinent provisions of Section 01340.
- B. Within 15 calendar days after receiving the Owner's Notice to Proceed, submit proposed mix designs for approval.
 - 1. Proportions shall be determined by means of laboratory tests of concrete made with the cement and aggregate proposed for use.
 - 2. Provide report in detail from an approved testing laboratory showing 7-day and 28-day strengths obtained using materials proposed.
 - 3. Required average strength above specified strength:
 - a. Determinations of required average strength above specified strength (f'_c) shall be in accordance with ACI 318 and ACI 301.
 - b. Establish the required average strength of the design mix using the materials proposed to be employed. Standard deviations shall be determined by thirty tests. Average strength used for selecting proportions shall exceed specified strength (f'_c) by at least:

400 psi	Standard deviation is less than 300
550 psi	Standard deviation is 300 to 400
700 psi	Standard deviation is 400 to 500
900 psi	Standard deviation is 500 to 600
1200 psi	Standard deviation is above 600 or unknown
 - c. When the ready-mix producer does not have a record of past performance, the combination of materials and the proportions selected shall be selected from trial mixes having proportions and consistencies suitable for the work using at least three (3) different water/cement ratios which will produce a range of strengths encompassing those required. Average strength required shall be 1200 psi above specified strength.
 - 4. Cost of this work shall be borne by the Contractor.
- C. Manufacturer's data: Submit manufacturer's specification with application instructions for proprietary materials and items, including curing compound, form release agents, admixtures, patching compounds, and others as required by the Engineer.
- D. Shop drawings: Submit the following shop drawings to the Engineer for approval before work is started:
 - 1. Reinforcing steel drawings: Prepare in accordance with ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, dimensions and details of bar reinforcing and accessories.
 - 2. Cementitious coating.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

- B. Store reinforcement in a manner that will avoid excessive rusting or coating by grease, oil, dirt and other objectionable materials.
- C. Keep reinforcement in separate piles or racks so as to avoid loss of identification after bundles are broken.

PART 2 - PRODUCTS

2.1 FORMS

- A. Use form materials conforming to ACI 347.
- B. Form lumber: Use lumber of sufficient quality and grade, size and stiffness to adequately support the work and ensure dimensional accuracy.
- C. Form ties: Use form ties which do not leave an open hole through the concrete and which permit neat and solid patching at every hole.
 - 1. Use ties with cones that allow a 1" break back and facilitate patching.
 - 2. On structures containing water or other liquid or below grade structures, use embedded rod ties with integral waterstops in addition to cones.
 - 3. Through-bolts that utilize a removable tapered sleeve in water containing and below grade applications: Use mechanical EPDM rubber plugs to seal holes made after removal of taper ties. Acceptable product is X-Plug by the Greenstreak Group, Inc. 800-325-9504. Follow manufacturers' instructions for installation. Friction fit plugs are not allowed. Or approved equal.
 - 4. Wire ties and wood spreaders will not be permitted.
- D. Form coatings: Form release coating shall be neat oil with surface wetting agent or chemical release agent which effectively prevents absorption of moisture, prevents bonding with concrete, is non-staining to concrete and leaves the concrete with a paintable surface.
 - 1. On surfaces to receive an applied coating, use a residual free chemical form release agent which is compatible with the applied coating and will not prevent the applied finish from satisfactorily bonding to the concrete.
- E. Chamfer strips: Chamfer strips shall be wood or polyvinyl strips or approved equal, designed to be nailed in the forms to provide a 3/4" chamfer (unless indicated otherwise) at all exposed edges and corners of concrete members.

2.2 REINFORCEMENT

- A. Comply with the following as minimums:
 - 1. Bars: ASTM A615, Grade 60, unless otherwise shown on the Drawings, using deformed bars for Number 3 and larger.
 - 2. Welded wire fabric: ASTM A185.
 - a. Use sheet (mat) welded wire fabric only.
 - b. Welded wire fabric supplied in rolls will not be accepted.
 - 3. Bending: ACI 315 and ACI 318.
- B. Fabricate reinforcement to the required shapes and dimensions, within fabrication tolerances stated in the CRSI "Manual of Standard Practices".
- C. Do not use reinforcement having any of the following defects:

1. Bar lengths, depths, or bends exceeding the specified fabricating tolerances.
 2. Bends or kinks not indicated on the Drawings or required for this Work.
 3. Bars with excessive rust, scale, dirt, oil or other defects which will reduce the bond or the effective cross section of the bar.
- D. Furnish all support bars, tie bars, chairs, bolsters, etc. required for properly supporting and spacing bars in the forms.
1. For slabs on grade, use supports with stand plates or horizontal runners where wetted base materials will not support chair legs. Other supports must be approved by the Engineer.
 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are hot-dip galvanized, plastic protected or stainless steel.
 3. Supply supports for welded wire fabric as follows:

Welded Wire Fabric Support Spacing

Welded Wire Reinforcement (diameter)	Welded Wire Spacing (inches)	Maximum Support Spacing (feet)
W9 or larger	12 and greater	4
W5 to W8	12 and greater	3
W9 and larger	Less than 12	3
W4 to W8	Less than 12	2
Less than W4	Less than 12	1.5

- E. Tie wire: FS QQ-W-461, annealed steel, black, 16 gauge minimum.
- F. Welding electrodes: AWS A5.1, low hydrogen, E70 series.
- G. Splice devices: Shall be sized to develop one hundred twenty-five (125%) percent of yield strength of bar.

2.3 CONCRETE MATERIALS

- A. Cement: Use portland cement: ASTM C150, Type I, Type I-P or Type II, low alkali.
1. Where concrete will be exposed to sewage, use Type II or I-P cement.
 2. Fly ash shall conform to ASTM C618, Class C or F.
 3. Fly ash content shall not exceed 20% by weight of the total amount of cementitious materials (portland cement plus fly ash).
- B. Aggregates:
1. Fine aggregate: Conform to ASTM C33.
 2. Coarse aggregate: Conform to ASTM C33, Size #57.
- C. Water: Clean and potable and free from injurious amounts of deleterious materials.
- D. Admixtures:
1. Air entraining admixture: ASTM C260.
 2. Water reducing, set controlling admixture: Conform to ASTM C494.
 - a. Type A - water reducing.

- b. Type D - water reducing and retarding.
 - 3. Superplasticizers: Conform to ASTM C494, Types F and G.
 - a. Use superplasticizers in thin section placements and in areas of congested reinforcing and/or embedded items, or where otherwise approved by the Engineer.
 - b. Use where conventional consolidation techniques are impractical.
 - 4. Do not use admixtures containing calcium chloride.
- E. Fiber reinforcing:
 - 1. Use fiber reinforcing where indicated on the drawings.
 - 2. Provide polypropylene or co-polymer fibers as manufactured by High Tech Fibers, Inc., Fibermesh Company or an approved equal.
 - 3. Where required, use fiber reinforcing at a rate of 2.0 lbs. per cubic yard unless another rate is indicated on the drawings.
- F. Curing compounds:
 - 1. On all vertical and formed surfaces, construction joints, basin slabs, surfaces to receive an applied coating or finish, and other surfaces except as otherwise indicated or specified, use a non-residual, non-staining curing compound conforming to ASTM C309 Type 1 and 1D. Acceptable products are:
 - a. L&M Cure by L&M Construction Chemicals, Inc.
 - b. Horn WB-75 by A.C. Horn Company.
 - c. Sonosil by Sonneborn, Inc.
 - d. Approved equal.
 - 2. On building floor slabs not otherwise receiving an applied coating or finish and on other flatwork as indicated on the Drawings, provide an acrylic copolymer curing and sealing compound conforming to ASTM C309 Type 1 and the following:
 - a. Non-yellowing.
 - b. Minimum 20% solids.
 - c. Maximum unit moisture loss in accordance with ASTM C156 - 0.40 kg./sq.m at 72 hours.
 - d. Acceptable products are Dress & Seal by L&M Construction Chemicals, Inc., Clear Seal Standard by A. C. Horn Company, Kure-N-Seal 0800 by Sonneborn, Inc., or approved equal.

2.4 CONCRETE MIXES

- A. Provide concrete with the compressive strengths shown on the Drawings. When such strengths are not shown on the Drawings, provide the following 28-day strengths as minimum:

1. All structural concrete except as indicated in Nos. 2 and 3 below	4000 psi
or as noted otherwise on the plans	
2. All sidewalks, curbs and gutters, and unreinforced foundations	4000 psi
	With fiber
	reinforcing
3. Thrust blocking, backfill or encasement for piping, and concrete fill	2500 psi
4. Prestressed or precast concrete:	5000 psi
- B. Maximum water cement ratios:

4000 psi concrete	0.5
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- | | | |
|--|-------------------|------|
| | 3000 psi concrete | 0.53 |
| | 2500 psi concrete | 0.67 |
- C. Entrained air:
- | | | |
|--|----------------------------|--------------|
| | 3000 and 4000 psi concrete | 5% ± 1% |
| | 2500 psi concrete | Not Required |
- D. Slump:
- | | | |
|--|----------------------------|---------|
| | 3000 and 4000 psi concrete | 4" ± 1" |
| | 2500 psi concrete | 5" ± 1" |
- E. Production of concrete:
1. General: Concrete shall be ready mixed and shall be batched, mixed and transported in accordance with ASTM C94 except as otherwise indicated.
 2. Monitor time and mix proportions by plant delivery slips.
 3. Air entraining admixtures: Add air entraining admixture into the mixture as a solution and measure by means of an approved mechanical dispensing device.
 4. Water reducing and retarding admixture: Add water reducing and retarding admixture and measure as recommended by the manufacturer.
 5. Addition of water to the mix upon arrival at the job site shall not exceed that necessary to compensate for a 1" loss in slump, nor shall the design maximum water-cement ratio be exceeded. Water shall not be added to the batch at any later time.
 6. Weather conditions: Control temperature of mix as required by ACI 306 "Cold Weather Concreting" and by ACI 305 "Hot Weather Concreting".

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- 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.
- B. Water, mud, organic, and other detrimental material shall be removed from excavations before concrete is deposited.
- C. Notify the Engineer prior to placing concrete and place no concrete until the formwork, reinforcing and embedded items have been observed by the Engineer.

3.2 FORMWORK

- A. General:
 1. Construct forms in conformance with ACI 347.
 2. Design, erect, support, brace and maintain formwork so it will safely support vertical and lateral loads which might be applied until such loads can be supported safely by the concrete structure.
 3. Construct forms to the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in the finished structure.

4. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and prevent fins.
- B. Form construction and erection:
1. Construct forms in conformance with ACI 347.
 2. Provide for openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts and other embedded items as required.
 3. Hold inner and outer forms for vertical concrete together with combination steel ties and spreaders approved by the Engineer.
 4. Unless specifically stated otherwise, provide 3/4" chamfer at all exposed edges of concrete.
 5. Provide temporary openings in the formwork where necessary to facilitate cleaning and inspection of the formwork.
 6. Coat form contact surfaces with approved form coating compound prior to placing reinforcing steel.
 7. Do not allow excess form coating material to accumulate in the forms or to come in contact with reinforcing surfaces which will bond to fresh concrete.
 8. Side forms for footings may be omitted, and concrete may be placed directly against excavation only when requested by the Contractor and approved by the Engineer.
 9. Provide a positive means of adjustment of shores and struts and ensure that all settlement is taken up during concrete placing.
 10. Construct blockouts and formed openings of sufficient size and proper location to permit final alignment of items within it or passing through it.
 - a. Allow sufficient space for grouting, packing or sealing around any items penetrating the opening as may be required to ensure watertightness.
 - b. Provide openings with continuous keyways with waterstops where required, and provide a slight flare to facilitate grouting and the escape of entrapped air during grouting.
 - c. Provide only blockouts or openings that are shown on the drawings or otherwise approved by the Engineer.
- C. Formwork reuse: Reuse only forms that are in good condition and which maintain a uniform surface texture on expose concrete surfaces.
1. Apply a light sanding as necessary to obtain a uniform texture.
 2. Plug unused tie holes and penetrations flush with the form surface.
- D. Removal of forms:
1. Do not disturb or remove forms until the concrete has hardened sufficiently to permit form removal with complete safety. Do not remove shoring until the member has acquired sufficient strength to support its own weight, the load upon it, and the added load of construction.
 2. Do not remove forms before the following minimum times without prior approval from the Engineer:

a. Sides of footings or slabs on grade	24 hrs
b. Walls not supporting load	48 hrs
c. Vertical sides of beams	48 hrs
d. Columns not supporting load	48 hrs
e. Suspended slabs or beam bottoms (forms only)	10 days
 3. In determining the minimum stripping times, consider only the cumulative time during which the ambient temperature of the air surrounding the concrete is above 50°.

4. Do not remove shoring for suspended slabs or beams until the concrete has reached 75% of the specified 28 day strength.
5. When reshoring or backshoring is permitted or required, plan the operations in advance and submit procedures to the Engineer for approval.
 - a. Design and plan all reshoring operations to support all construction loading and in accordance with ACI 347.
6. Exercise care in removing forms from finished concrete surfaces so that surfaces are not marred or gouged and that corners are true, sharp and unbroken.
7. Do not permit steel spreaders, form ties, or other metal to project from or be visible on any concrete surface except where so shown on the drawings.
8. Whenever the formwork is removed during the curing period, continue to cure the exposed concrete by one of the methods specified herein.

3.3 EMBEDDED ITEMS

- A. Embedded items: Set anchor bolts and other embedded items accurately and securely in position in the forms until the concrete is placed and set.
 1. Use templates where practical for all anchor bolts.
 2. Check locations of all anchor bolt and special castings prior to placing concrete and verify locations after concreting.
- B. Piping cast in concrete:
 1. Install and secure sleeves, wall pipes and pipe penetrations before placing concrete.
 2. Do not weld or otherwise attach piping to reinforcing steel.
 3. Support piping to be encased in concrete securely and on firm foundation so as to prevent movement or settlement during concreting.
- C. Locate electrical conduit so that it will not impair the strength of the construction.
 1. Do not use conduits running within (not passing through) a slab, wall or beam that are larger in outside diameter than 1/3 overall concrete thickness unless otherwise approved by the Engineer.
 2. Do not space conduits closer than three conduit diameters apart unless otherwise approved by the Engineer.

3.4 REINFORCEMENT

- A. General: Comply with the specified codes and standards and Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for details and methods of reinforcement placement and supports and as herein specified.
 1. Clean reinforcement and remove loose dust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
 2. Position and secure reinforcement against displacement by forms, construction, and the concrete placement operations.
 3. Use adequate number of ties to secure reinforcing.
 4. Do not weld or field bend reinforcing without prior approval by the Engineer.
- B. Placing reinforcing:
 1. Provide and install all chairs, runners, bolsters, standees and other accessories in sufficient quantities to satisfactorily position the reinforcing and hold it in place during concrete placement.

2. Support reinforcing for slabs on ground on chairs or bolsters with stand plates or a properly sized concrete cube.
 - a. Use concrete bricks as supports only as approved by the Engineer.
 3. Secure and tie dowels in place prior to placing concrete. Do not press dowels into wet concrete.
- C. Concrete cover: Unless otherwise indicated on the drawings or specified herein, install reinforcing with clear concrete coverage in conformance with ACI 318.
1. All reinforcement, regardless of size, exposed to water or sewage shall have 2" cover.
 2. Place reinforcement a minimum of 2" clear of any openings or metal pipe or fittings.
- D. Splicing reinforcement: Splice reinforcement steel in accordance with the latest revisions of ACI 318 "Building Code Requirements for Reinforced Concrete" unless shown otherwise on the drawings.
1. All splices at wall corners or intersections and at wall and foundation intersections shall be Class B tension splices per ACI 318, Sections 12.2.2 and 12.15.
 2. All other splices of vertical or horizontal steel in walls shall be Class B tension splices as per ACI 318, Sections 12.2.2 and 12.15.
 3. Horizontal ring steel in circular, non-prestressed concrete tanks shall be Class B tension splices and the splices shall be staggered so that no more than 50% of the bars are spliced at any one location.
 4. All welded or mechanical splicing devices shall develop 125% of the yield strength of the bar.
 5. Column vertical bars shall lap 30 bar diameters with dowels at the base of the column unless otherwise noted. Dowels shall be the same size and quantity as column vertical bars unless otherwise noted.
 6. All splices not otherwise shown or specified shall be Class B tension lap splices per ACI 318, Sections 12.2.2 and 12.15.
- E. Tolerances: Place bars in the locations indicated within the tolerances conforming to the CRSI "Manual of Standard Practice".
- F. Welded wire mesh: Install welded wire fabric in as long of a length as practicable and lay flat before placing concrete.
1. Use only mat welded wire fabric. Do not use welded wire fabric from rolls.
 2. Support and tie mesh to prevent movement during concrete placement.
 3. Lap adjoining pieces at least one full mesh and lace splices with wire.
 4. Provide, at a minimum, supports for welded wire fabric according to the Table in Section 2.2.D.3. Confirm the adequacy of the support spacings listed therein for the anticipated construction loads. Increase the number of supports, if necessary, to assure that the final position of the welded wire fabric will conform to that shown on the drawings.
 5. Do not place welded wire fabric on the subbase surface and then hook or "pull up" the reinforcement during concrete placement.
 6. Do not lay welded wire fabric on top of the freshly placed concrete and then "walk it" into place.

3.5 PLACING CONCRETE

A. Preparation:

1. Remove foreign matter accumulated in the forms.

2. Rigidly close openings left in the formwork.
 3. Wet wood forms sufficiently to tighten up cracks. Wet other material sufficiently to maintain workability of the concrete.
 4. Use only clean tools.
 5. Provide and maintain sufficient tools and equipment on hand to facilitate uninterrupted placement of the concrete.
 6. Before commencing concrete, inspect and complete installation of formwork, reinforcing steel and all items to be embedded or cast-in.
- B. Conveying:
1. Transport and handle concrete from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete.
 2. Provide equipment for lifting, dumping, chuting, pumping or conveying the concrete, of such size and design as to ensure a practically continuous flow of concrete at the delivery and without separation of materials.
 3. Use hoppers and elephant trunks where necessary to prevent the free fall of concrete for more than 4'.
 4. Do not use concrete that is not placed within 1-1/2 hours after water is first introduced into the mix unless the slump is such that it meets the specified limits without the addition of water to the batch.
- C. Placing:
1. Deposit concrete as nearly as practicable in its final location so as to avoid separation due to rehandling and flowing.
 2. Deposit concrete in horizontal layers not deeper than 2', avoiding inclined layers.
 3. Place concrete at such a manner that concrete upon which fresh concrete is deposited is still plastic.
 4. Bring slab surfaces to the correct level with screeds set to the proper elevation.
- D. Hot weather placement: Place concrete in hot weather in accordance with ACI 305 "Hot Weather Concreting" and as specified herein.
1. Do not place concrete whose temperature exceeds 100°F.
 2. Thoroughly wet forms and reinforcing prior to placement of concrete.
 3. Use additional set retarder as necessary to increase set time.
 4. Limit the size of the pour where it may reduce the likelihood of cold joints due to reduced set time.
 5. Shade the fresh concrete as soon as possible after placing.
 6. Start curing as soon as the concrete is sufficiently hard to permit without damage.
- E. Cold weather placement: Place concrete in cold weather in accordance with ACI 306 and as specified herein.
1. Except when authorized specifically by the Engineer, do not place concrete when the atmospheric temperature is below 40°F.
 2. When cold weather placement is approved by the Engineer, heat either the mixing water or aggregate or both so that the concrete temperature is between 65°F and 85°F.
 3. Protect the freshly placed concrete by adequate housing or covering and provide heat to maintain a temperature of not less than 50°F for not less than four days.

4. Do not add salts, chemicals, or other materials to the concrete mix to lower the freezing point of the concrete.
- F. Consolidation:
1. Consolidate each layer of concrete immediately after placing, by use of internal concrete vibrators supplemented by hand spading, rodding, or tamping.
 - a. Use vibrators having a 2" head diameter and a minimum frequency of 8000 vibrations per second.
 - b. Provide sufficient number of vibrators to properly consolidate the concrete, keeping up with placement operations.
 - c. Provide at least one spare vibrator on site.
 2. Insert and withdraw vibrators at points approximately 18" apart.
 3. Do not vibrate forms or reinforcement.
 4. Do not use vibrators to transport concrete inside the forms.

3.6 PROTECTION

- A. Protect the surface finish of newly placed concrete from damage by rainwater or construction traffic.
- B. Do not apply design loads to structures until the concrete has obtained the specified strength.
1. Do not backfill against walls until they have reached the specified strength and all supporting or bracing walls, slabs, etc. have also reached the specified strength, unless otherwise permitted by the Engineer.
 2. Protect structures from construction overloads.

3.7 CURING

- A. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures and mechanical injury.
- B. Continuously cure concrete for a period of not less than 7 days after placement.
1. When seven-day cylinder breaks indicate, in the opinion of the Engineer, the possibility of low strength concrete, provide additional curing as per the request of the Engineer.
 2. When temperatures during the curing period fall below 40°F, provide additional curing time as directed by the Engineer.
- C. Unless otherwise directed by the Engineer, cure concrete not in contact with forms in accordance with one of the following procedures:
1. Ponding or sprinkling: Keep entire concrete surface wet by continuously sprinkling or by allowing water to pond, covering all surfaces.
 2. Wet burlap: Thoroughly wet and cover all concrete surfaces with wet burlap mats as soon as the concrete has set sufficiently to avoid marring the surface.
 - a. Keep the burlap continuously wet during the curing period.
 3. Curing blankets: Thoroughly wet concrete surfaces to be cured and cover with curing blankets as soon as the concrete has set sufficiently to avoid marring the surface.
 - a. Weight the blankets down to maintain close contact with the concrete surface.

- b. Use sheets of waterproof kraft paper with the joints between sheets taped continuously; or
 - c. Use sheets of 4 mil or thicker polyethylene with the joints between sheets continuously taped.
- 4. Wet sand: Apply a layer of sand over the entire surface and keep it continuously wet.
- 5. Curing compound: Apply curing compound immediately after completion of the finish on unformed surfaces and within two hours after removal of forms on formed surfaces.
 - a. Spray the entire surface with two coats of liquid curing compound, applying the second coat in the direction of 90° to the first coat.
 - b. Apply compound in accordance with the manufacturer's instructions to cover the surface with a uniform film which will seal thoroughly.
- D. Hot weather: When necessary, provide wind breaks, shading, fog spraying, sprinkling, ponding or wet covering with a light colored material applying as quickly as concrete hardening and finishing operations will allow.

3.8 CONCRETE FINISHING

- A. Finish schedule: Unless otherwise indicated on the drawings, finish all concrete surfaces in accordance with the following schedule:
 - 1. Form finish: Formed surfaces not ordinarily exposed to view, including:
 - a. Interior walls of open tanks below a line one foot lower than the lowest normal water level.
 - b. The underside of slabs not exposed to view.
 - c. Walls below grade.
 - 2. Cementitious coating: All formed surfaces exposed to view including:
 - a. Interior walls of tanks above a line one foot lower than the lowest normal water level.
 - b. The underside of slabs, soffits, etc. exposed to view.
 - 3. Float finish: Slab surfaces not exposed to view or not receiving an applied thin finish, including:
 - a. Bottom slabs of tanks or structures containing water sewage or other liquid.
 - b. Foundations not exposed to view.
 - c. Roof slabs to be covered with insulation and/or built-up roofing.
 - 4. Trowel finish: Interior slab surfaces exposed to view or to receive an applied thin film coating or floor finish, including:
 - a. Interior, indoor slabs and floors of buildings.
 - b. Surfaces on which mechanical equipment moves.
 - c. Floors receiving vinyl tile, resilient flooring, carpet, paint, etc.
 - 5. Broom finish: Exterior, outdoor slabs exposed to view including:
 - a. Outdoor floor slabs and walkways.
 - b. Other floors which may become wet or otherwise require a non-skid surface.
 - c. Sidewalks and concrete pavements.
 - 6. Scratch finish: Surfaces which are to receive a thick topping or additional concrete cast against them including:
 - a. Surfaces receiving concrete equipment pads.
 - b. Floors receiving concrete topping.
 - c. Construction joints not otherwise keyed.
 - 7. Edge finish: Exposed edges of slabs not receiving chamfer including:
 - a. Sidewalk edges and joints.
 - b. Pavement edges and joints.
 - c. Other slab edges not chamfered.

B. Finishing procedures:

1. Form finish:
 - a. Repair defective concrete.
 - b. Fill depressions deeper than 1/4".
 - c. Fill tie holes.
 - d. Remove fins exceeding 1/8" in height.
2. Cementitious finish:
 - a. Patch all tie holes and defects and remove all fins.
 - b. Within one day of form removal, fill all bug holes, wet the surfaces and rub with carborundum brick until a uniform color and texture are produced; or
 - c. Dampen surfaces, brush apply a grout slurry consisting of 1 part portland cement to 1-1/2 parts sand, and rub the surface vigorously with a stone. Remove all excess grout.
 - d. Provide a two coat cement base waterproofing, sealing finish of Thoroseal and Thoroseal Plaster Mix as manufactured by Standard Dry Wall Products, Inc. or an approved equal.
 - 1) Patch all tie holes and defects and removal all fins, and clean surface of all dirt, laitance, grease, form treatments, curing compounds, etc.
 - 2) Key coat: Apply key coat of Thoroseal at a rate of two (2) lbs. per sq. yd. by fiber brush. Mix material using one part of Acryl 60 to three parts clean water. Should material start to drag during application, dampen surface with water. During hot weather periods, dampen surfaces with water prior to application of key coat material. Key coat shall be allowed to cure for five (5) days before applying finish coat.
 - 3) Apply a finish coat consisting of a four (4) to six (6) lbs. per sq. yd. application of Thoroseal Plaster Mix using steel trowel or spray gun. Color to be selected by the Owner. Mix dry material using one (1) part Acryl 60 to three (3) parts clean water. Firmly press the mix into all voids and level with a steel trowel. When surface is set so that it will not roll or lift, float it uniformly using a sponge float.
3. Float finish:
 - a. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
 - b. Cut down all high spots and fill all low spots and float the slab to a uniform sandy texture.
4. Trowel finish:
 - a. Float finish as specified herein.
 - b. Power trowel to a smooth surface free of defects.
 - c. After the surface has hardened sufficiently, hand trowel until a ringing sound is produced as the trowel is moved over the concrete surface.
5. Broom finish:
 - a. Float finish as specified herein.
 - b. Provide a scored texture by drawing a broom across the surface.
6. Scratch surface:
 - a. Screed the surface to the proper elevations.
 - b. Roughen with rakes or stiff brushes.
7. Edge finish: Tool slab edges and joints with a 1/4" radius edging tool.

3.9 SURFACE REPAIR

A. Patching mortar:

1. Make a patching mortar consisting of 1 part portland cement to 2-1/2 parts sand by damp loose volume.
 2. Mix the mortar using one part acrylic bonding admixture to two parts water.
- B. Tie holes: Clean and dampen all tie holes and fill solidly with patching mortar.
- C. Surface defects:
1. Remove all defective concrete down to sound solid concrete.
 2. Chip edges perpendicular to the concrete surface or slightly undercut, allowing no feather edges.
 3. Dampen surfaces to be patched.
 4. Patch defects by filling solidly with repair mortar.
- D. Allow the Engineer to observe the work before placing the patching mortar.
- E. Repair defective areas greater than 1 sq. ft. or deeper than 1-1/2" as directed by the Engineer using materials approved by the Engineer at no additional expense to the Owner.

3.10 JOINTS

- A. Construction joints:
1. Unless otherwise approved by the Engineer, provide construction joints as shown on the drawings.
 2. If additional construction joints are found to be required, secure the Engineer's approval of joint design and location prior to start of concrete placement.
 3. Continue all reinforcing across construction joints and provide 1-1/2" deep keyways unless indicated otherwise on the drawings.
 - a. Form keyways in place.
 4. Provide waterstops in all construction joints of liquid containing structures, structures below grade or other structures as shown on the drawings.
- B. Expansion joints:
1. Provide expansion joints of size, type and locations as shown on the drawings.
 2. Do not permit reinforcement or other embedded metal items that are being bonded with concrete (except smooth dowels bonded on only one side of the joints, where indicated on the drawings) to extend continuously through any expansion joint.
 3. Provide waterstops where required.
- C. Control or contraction joints:
1. Locate and construct control and contraction joints in accordance with the Drawings.
 2. Where no specific joint pattern is indicated in slabs on grade or concrete pavements, submit a proposed joint layout to the Engineer for approval.
 3. Where no specific joint details are shown on the drawings, joints may be tooled, preformed or saw-cut.
 4. Saw-cut joints as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw.

3.11 FIELD QUALITY CONTROL

A. Concrete cylinder tests:

1. During construction, prepare test cylinders for compressive strength testing, using 6" diameter by 12" long single use molds, complying with ASTM C31.
 - a. Make a set of three test cylinders from each pour of 50 cubic yards or less, plus one additional set of cylinders for each additional 50 cubic yards or fraction thereof.
 - b. Identify each and tag cylinder as to date of pour and location of concrete which it represents.
 - c. Deliver cylinders to testing lab selected by the Owner.
 - d. Cost for preparation and delivery of cylinders shall be borne by the Contractor. Cost for testing cylinders will be borne by the Contractor.
2. Should strengths shown by test cylinders fail to meet specified strengths for the concrete represented, then:
 - a. Engineer shall have the right to require changes in the mix proportions as he deems necessary on the remainder of the work.
 - b. Additional curing of those portions of the structure represented by the failed test cylinders shall be accomplished as directed by the Engineer.
 - c. Upon failure of the additional curing to bring the concrete up to specified strength requirements, strengthening or replacement of those portions of the structure shall be as directed by the Engineer.
 - d. The Engineer may require additional testing of concrete in question by either non-destructive methods such as the Swiss Hammer, Windsor Probe or Ultrasonics or by coring and testing the concrete in question in accordance with ASTM C42. Such testing shall be performed at no additional cost to the Owner.

B. Other field concrete tests:

1. Slump tests: Either the Engineer or a testing laboratory representative will make slump tests of concrete as it is discharged from the mixer.
 - a. Slump test may be made on any concrete batch at the discretion of the Engineer.
 - b. Failure to meet specified slump requirements (prior to addition of any superplasticizers) will be cause for rejection of the concrete.
2. Temperature: The concrete temperature may be checked at the discretion of the Engineer.
3. Entrained air: Air content of the concrete will be checked by a representative of the testing laboratory at the discretion of the Engineer.

C. Coordination of laboratory services: The Contractor shall be responsible for coordination of laboratory services.

1. Maintain a log recording quantities of each type of concrete placed, date and location of pour.
2. Inform the testing laboratory of locations and dates of concrete placement and other information as required to be identified in the laboratory's test reports.

D. Tests required because of extensive honeycombing, poor consolidation of the concrete or any suspected deficiency in the concrete will be paid for by the Contractor.

E. Dimensional tolerances:

1. Dimensional tolerances for allowable variations from dimensions or locations of concrete work, including the locations of embedded items shall be as given in ACI 301.
2. Where anchor bolts or other embedded items are required for equipment installation, comply with the manufacturer's tolerances if more stringent than those stated in ACI 301.

F. Watertight concrete:

1. All liquid containing structures, basements or pits below grade shall be watertight.
2. Any visible leakage or seepage shall be repaired as instructed by the Engineer at no expense to the Owner.
3. Where physical evidence of honeycombing, cold joints or other deficiencies which may impair the watertightness of a structure exists, the Engineer may at his discretion call for leak testing of the structure.
 - a. Fill the structure with water and allow to stand for not less than 48 hours.
 - b. Make repairs on the structure until all visible leaks are sealed and the leakage rate of the water in the structure is less than 0.1% of the volume held in the structure per day.
 - c. The cost of testing and repairs shall be performed at no expense to the Owner.

- G. Concrete which fails to meet strength requirements, dimensional tolerances, watertightness criteria, or is otherwise deficient due to insufficient curing, improper consolidation or physical damage shall be replaced or repaired as instructed by the Engineer at no expense to the Owner.

3.12 MEASUREMENT AND PAYMENT

- A. No measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the price bid for the item in which the concrete work is an integral part.

END OF SECTION

SECTION 03600
NON-SHRINK GROUT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide non-shrink grout for structural grouting, equipment bases, etc. as indicated and needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Other provisions concerning non-shrink grout may also be stated in other Sections of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 90 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. Prevent damage to or contamination of non-shrinking grouting materials during delivery, handling and storage.
- C. Deliver grout to site in polyethylene lined paper bags, not larger than one cubic foot in capacity.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Non-shrink grout:
 - 1. Provide non-metallic, non-shrink grout.

2. Grout shall evidence no shrinkage when tested in the plastic state, in accordance with ASTM C 827, or in the hardened state, in accordance with ASTM C RD588.
 3. Initial setting shall not occur in less than 60 minutes.
 4. Compressive strength in 24 hours shall not be less than 3000 psi, when tested in accordance with ASTM C 109.
 5. Acceptable products: U.S. Grout Corporation's Five Star Grout; Sonneborn's SonogROUT; W.R. Bonsal Company's Type A Construction Grout; or equal.
- B. Water: Potable grade.
- C. Gravel: Comply with ASTM C 33 for coarse aggregate graded so that 90% passes 3/8" sieve and 90% is retained by No. 4 sieve.

2.2 MIXES

- A. Less than 2" clearance or for difficult grouting locations mix shall consist of grout material and water.
- B. Greater than 2" clearance where coarse aggregate will not obstruct free passage, extend grout by adding 1/2 pound of gravel to one pound grout material, except where prohibited by manufacturer's recommendations.
- C. Use the minimum amount of water necessary to produce a flowable grout without causing segregation or bleeding.

2.3 MIXING

- A. Mix non-shrink grouting material and water in a mechanical mixing for no less than 3 minutes, unless otherwise approved by the Engineer.
- B. Mix as close to work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.
- C. Retempering of grout will not be permitted.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Build leak proof forms that are strong and securely anchored and shored to withstand grout pressures.
- B. Provide ample clearance between formwork and the area to be grouted to permit proper placement of grout.

3.2 SURFACE PREPARATION

- A. Remove all defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by bush-hammering, chipping, or other similar means, until a sound, clean concrete surface is achieved.
- B. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout.
- C. Remove foreign materials from all steel surfaces in contact with grout.

- D. Align, level and maintain final positioning of all components to be grouted.
- E. Take special precautions during extreme weather conditions according to the manufacturer's written instructions.
- F. Saturate all concrete surfaces with clean water; remove excess water and leave none standing.

3.3 PLACING

- A. Place non-shrink material quickly and continuously by the most practical means permissible: pouring, pumping or under gravity pressure.
- B. Apply grout from one side only to avoid entrapping air.
- C. Final installation shall be thoroughly compacted and free from air pockets.
- D. Do not vibrate the placed grout mixture, or allow it to be placed if the area is being vibrated by nearby equipment.
- E. Do not remove leveling shims for at least 48 hours after grout has been placed.
- F. After shims have been removed, fill voids with plain cement-sand grout.

3.4 CURING

- A. Cure grout for 3 days after placing by keeping wet and covering with curing paper or by another approved method.

3.5 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 03730
CONCRETE REHABILITATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Rehabilitation of interior and exterior surfaces of tank walls, including joint/crack repairs, all as indicated on the Drawings, specified herein, and as needed for a complete and proper installation.
 - 1. Existing concrete structures to be rehabilitated include:
 - a. Chemical Containment Area.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 01060 - Regulatory Requirements.

1.2 QUALITY ASSURANCE

- A. All work shall be performed by experienced personnel who are familiar with waterproofing work and with the materials specified herein.
 - 1. To assure proper application and results, the Contractor shall confer with the manufacturer's representative, at the project site, regarding proper methods and techniques for mixing and application of coatings.
- B. Surfaces shall be protected to prevent rapid drying where heavy wind or hot sun exists.
- C. Rapid changes in temperature should be avoided during curing to prevent thermal shock cracks in finish materials.
- D. During cold weather, temperatures should be maintained within a temperature range of 40°F to 50°F minimum throughout curing of coating system.
- E. Coating materials shall not be applied when temperatures fall below 40°F within a 24-hour period.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

- B. All manufactured materials to be delivered in their original packages, containers and bundles bearing name of manufacturer and brand.
- C. Store all materials off the ground, under watertight cover and away from damp surfaces until ready for use.
- D. Remove damaged or deteriorated materials from the site immediately.

PART 2 - PRODUCTS

2.1 BENTONITE SEALANT (WATERSTOP)

- A. Provide 1" x 3/4" Volclay Waterstop RX as manufactured by American Colloid Company, Skokie, IL or equal.

2.2 HYDRAULIC CEMENT

- A. Provide impervious, non-shrinking, non-metallic, quick setting hydraulic cement.
- B. Use "Waterplug" as manufactured by Standard Dry Well Products, Inc., New Eagle, PA or equal.

2.3 COATING MATERIALS

- A. Bonding agent: Acryl 60 as manufactured by Thoro System Products, 7800 N.W. 38th Street, Miami, FL or equal.
- B. Leveling and finish material: Thoroseal Plaster Mix as manufactured by Thoro System Products, 7800 N.W. 38th Street, Miami, FL or equal.
 - 1. Color to be selected by Owner.
- C. Finishing material: Thoroseal (color: Pearl Gray) as manufactured by Thoro System Products, 7800 N.W. 38th Street, Miami, FL or equal.

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

- A. Concrete surfaces to be coated must be clean, free of all dust, dirt, grease, laitance, form oils and other foreign materials.
- B. Clean all surfaces by waterblast using water at pressure of not less than 1500 psi.
- C. Honeycombs, tie holes, etc. deeper than 1/4" shall be grouted, prior to coating operations.
- D. If extreme heat is encountered, cool surfaces with water prior to application.
- E. Do not apply material in direct heat of sun.

3.2 MIXING SOLUTION

- A. Prepare a mixing solution of one part Acryl 60 and three parts water. Enough solution should be prepared to perform several days' work and the solution will remain usable if kept in tightly covered containers.

3.3 MIXING

- A. Mix in strict accord with printed instructions of manufacturer. Mechanical mixers of an approved type shall be used for mixing of all materials. Frozen, caked or lumped materials shall not be used. Mechanical mixers and containers shall be cleaned after mixing, each batch kept free of materials from previous mixes.
- B. Thoroseal, Thoroseal Plaster Mix, or equal materials shall be thoroughly mixed using proper amounts of mixing solution until uniform in color and consistency.
- C. Thoroseal Brush and Float Finish (2 coat system), or equal.
 - 1. A pancake batter consistency is to be achieved.
 - 2. Let material set for 15 minutes, then temper back with mixing solution.
 - 3. The material may be tempered one more time.
- D. Thoroseal Plaster Mix Trowel and Float Finish (1 coat system) or equal.
 - 1. Mix to a good trowellable consistency.
 - 2. Let material set for fifteen minutes, then temper back with mixing solution.
 - 3. The material may be tempered one more time.

3.4 APPLICATION - THOROSEAL BRUSH AND FLOAT FINISH (2 COAT SYSTEM) OR EQUAL

- A. Dampen wall prior to and during application. Do not apply while wall is excessively wet.
- B. For the first coat, apply a heavy brush or broom coat of Thoroseal (or equal) to the surface at the rate of 225 sq. ft. per 50 lb. bag.
- C. Using a wet and clean brush or broom, finish the first coat in a horizontal manner. Do not let the material set or harden before beginning finishing.
- D. Let the first coat sit for a 24-hour period of good curing time.
- E. Apply a second coat to a dampened surface at the rate of 225 sq. ft. per 50 lb. bag.
- F. Using a clean, wet brush or broom, finish at right angles to the first coat. Do not let material set up or harden prior to finishing.
- G. When surface is set so it will not roll or lift, float surface to a uniform texture with a wet, soft sponge float. Do not wet surface. Keep sponge float wet. Use circular motion in one direction.
- H. Allow material to cure on its own for 24 hours. If hot and windy conditions exist, cure by spraying after the time has lapsed.

3.5 APPLICATION - THOROSEAL PLASTER MIX TROWEL AND FLOAT FINISH (1 COAT SYSTEM) OR EQUAL

- A. Place the material with a steel trowel, apply a tight coat pressing material into all voids. Doubleback with more material to build up and level wall. The surface

may be uniformly leveled not showing buildup. Do not exceed 3/8ths of an inch at any point. A darby or slicker may be used.

- B. After the material has taken its initial set, using a soft sponge or soft sponge float, rotate in a circular motion, in one direction over the surface bringing the aggregate out in a sand finish.

3.6 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this section and all costs for same shall be included in the lump sum price bid for the item to which it pertains.

END OF SECTION

SECTION 04220
CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide concrete unit masonry where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements of the work of this Section.
- B. Workmanship, material and practices shall conform to the following standards:
 - 1. NCMA "Specification for the Design and Construction of Load-Bearing Concrete Masonry".

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
- C. Mock-ups:
 - 1. At an area on the site where approved by the Engineer, provide mock-up concrete unit masonry panels.
 - a. Make each mock-up panel approximately 4'0" high and 6'0" long.
 - b. Provide one mock-up panel for each combination of concrete masonry unit, bond pattern, mortar color, and joint type used in the Work.
 - c. The mock-up panels may be part of the Work, and may be incorporated into the finished Work, when so approved in advance by the Engineer.
 - d. Revise as necessary to secure the Engineer's approval.
 - 2. If the mock-up panels are not permitted to be part of the finished Work, completely demolish and remove them from the job site upon completion and acceptance of other work of this Section.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

- B. Store masonry units above ground on level platforms that allow air circulation under the stacked units.
- C. Cover and protect against wetting prior to use.

PART 2 - PRODUCTS

2.1 SPLIT-FACED CONCRETE MASONRY UNITS

- A. Provide architectural load-bearing concrete masonry units complying with ASTM C90, Grade N, with minimum compressive strength (F'm) of 2000 psi and minimum average net area compressive strength of 2000 psi.
- B. Provide units having nominal dimensions of 16" long by 8" high by bed depth as shown on the Drawings.
- C. Provide accessory shapes as indicated or otherwise required.
- D. Provide color as selected by the Owner.

2.2 STANDARD CONCRETE MASONRY UNITS

- A. Provide standard weight hollow load-bearing concrete masonry units complying with ASTM C90, Grade N, Type I, in color "natural gray", with minimum compressive strength (F'm) of 2000 psi and minimum average net area compressive strength of 2000 psi.
- B. Dimensions: Provide units having nominal face dimensions of 16" long by 8" high by bed depth as shown on the Drawings.
- C. Provide necessary shapes as indicated or otherwise required.

2.3 SMOOTH-FACED CONCRETE MASONRY UNITS

- A. Provide architectural load bearing concrete (pigmented) masonry units complying with ASTM C90, Grade N, with minimum compressive strength (F'm) of 2000 psi and minimum average net area compressive strength of 2000 psi.
- B. Provide units having nominal dimensions of 16" long by 8" high by bed depth as shown on the Drawings.
- C. Provide accessory shapes as indicated or otherwise required.
- D. Provide color as selected by the Owner.

2.4 REINFORCEMENT AND ACCESSORIES

- A. Horizontal joint reinforcement:
 - 1. Fabricate reinforcement from steel wire complying with ASTM A951.
 - 2. Joint reinforcement shall be ladder type with minimum longitudinal wire sizes of 9 gauge. Longitudinal wires shall be spaced at a distance of 1-1/4" to 1-3/4" less than the actual wall thickness.
 - 3. Cross wires shall be a minimum size of 9 gauge and shall be welded to the longitudinal wires at a maximum spacing of 16".
 - 4. Zinc-coat or copper clad after fabrication.

5. Provide in flat sections, 10' in length, except corner or other special shapes that may be shorter.
- B. Anchors and ties:
 1. Provide zinc-coated steel, or non-corrosive metal with equivalent strength of steel type, either of approved design.
 2. Zinc coated materials to be hot dipped after fabrication.
- C. Fastenings: Provide galvanized bolts, Type 316 stainless steel bolts, or other approved metal fastenings as necessary.

2.5 MORTAR

- A. Ingredients:
 1. Portland cement: Comply with ASTM C150, Type I.
 2. Provide hydrated lime complying with ASTM C207, Type S.
 3. Masonry cement shall not be used.
 4. Sand: Provide clean, sharp, well graded sand free from injurious amounts of dust, lumps, alkali, surface coatings, and organic matter, and complying with ASTM C144.
 5. Admixtures: Do not use admixtures unless specifically approved in advance by the Engineer.
 6. Water: Provide water free from deleterious amounts of acids, alkalis, and organic materials.
- B. Mixing:
 1. Mechanically mix in a batch mixer for not less than three minutes, using only sufficient water to produce a mortar which is spreadable and of a workable consistency.
 2. Provide Type S mortar of the following proportions:
 - a. By volume, use approved measuring containers. Measuring by shovels will not be permitted.
 - b. Cements and lime:
 - 1) One part portland cement to 2 - 3 parts hydrated lime; or
 - 2) One part Type N masonry cement to 2 parts portland cement.
 - c. Sand:
 - 1) Use not less than 2-1/4 times nor more than 3 times the sum of the volumes of cements and lime used.
 3. Retemper mortar with water as required to maintain high plasticity.
 - a. On mortar boards, retemper only by adding water within a basin formed with mortar, and by working the mortar into the water.
 - b. Discard and do not use mortar which is unused after 1-1/2 hours following initial mixing.
- C. Color to be selected by the Owner.

2.6 GROUT

- A. Grout fill for CMU cells, bond beams and lintels shall achieve a compressive strength of 3000 psi at 28 days. Slump shall be 8" to 11".
- B. Ingredients:
 1. Portland cement: Comply with ASTM C150, Type I.

2. Fine aggregate: Provide clean, sharp, well graded sand as specified for mortar above.
3. Coarse aggregate: Comply with ASTM C33, Number 8 stone.
4. Admixtures: Do not use admixtures unless specifically approved in advance by the Engineer.
5. Water: Provide water free from injurious amounts of acids, alkalis, and organic materials.

C. Mixing:

1. Mechanically mix grout for CMU cells, bond beams and lintels in a batch mixer for not less than 5 minutes with enough water to produce the specified slump.
2. Proportions:
 - a. For "fine grout", provide one part portland cement to 2-1/4 parts minimum to 3 parts maximum of damp loose sand.
 - b. For "coarse grout", provide one part portland cement to 3 parts maximum of damp loose sand to two parts coarse aggregate.

- D. Use "fine grout" where the grout space is less than 3" in its least dimension. Use "coarse grout" where the grout space is 3" or greater in its least dimension.

3.1 SURFACE CONDITIONS

- 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.

3.2 ENVIRONMENTAL CONDITIONS

- A. Do not place masonry units when air temperature is below 40°F, or with falling thermometer when it appears probably that temperatures below 40°F will be encountered before the mortar has set.
- B. Start placing units at 34°F on a rising thermometer.
- C. Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperature of 99°F in the shade, with relative humidity less than 50%.
- D. Protect tops of exposed walls with a waterproof membrane, well secured in place when not being worked on.

3.3 MASONRY INSTALLATION

A. General:

1. Do not commence installation of the work of this section until horizontal and vertical alignment of foundation is within 1" of plumb and the lines shown on the Drawings.
2. Lay only dry masonry units.
3. Use masonry saws to cut and fit masonry units.
4. Set units plumb, true to line, and with level courses accurately spaced.
5. Clean the top surface of foundation free from dirt, debris, and laitance, and expose the aggregate prior to start of installing first course.
6. Accurately fit the units to plumbing, ducts, openings, and other interfaces, neatly patching all holes.
7. Keep the walls continually clean, preventing mortar stains.

- B. Unless otherwise shown on the Drawings, provide running bond with vertical joints located at center of masonry units in the alternate course below.
- C. Do not use chipped or broken units. If such units are discovered in the finished wall, the Engineer may require their immediate removal and replacement with new units at no additional cost to the Owner.
- D. Laying up:
1. Place units in mortar with full shoved bed and head joints.
 2. Align vertical cells of hollow units to maintain a clear and unobstructed system of flues.
 3. Carry up level and plumb all around.
 4. Check heights with instrument at each floor, at sills and heads of openings to maintain the level of the walls.
 5. Maintain mortar joints uniform in thickness, average thickness of any three consecutive joints shall be 3/8" to 1/2".
 6. Step back unfinished work for joining with new work, toothing will not be permitted.
 7. Corners and intersections of load bearing walls shall be laid with true masonry bond.
- E. Horizontal joint reinforcement:
1. Provide horizontal joint reinforcement at 16" maximum vertical spacing and in the two courses immediately above and below wall openings.
 2. Extend reinforcement at openings not less than 24" each side of the opening.
 3. Overlap splices in reinforcement a minimum of 12".
 4. Provide corner assemblies, not less than 40" x 48".
 5. Provide wall intersection assemblies not less than 32" x 32".
 6. Embed reinforcement fully in the mortar joint.
- F. Accessories:
1. Place bolts, anchors, inserts, etc. in position as the work progresses.
 2. Do not grout accessory items into hardened mortar.
- G. Tooling:
1. Tool joints to a dense, smooth surface.
 2. Unless otherwise shown on the Drawings, provide flush joints throughout.
 3. Point all holes in joints, cut out defective joints and tuck point with mortar which has been retempered one hour after original mixing.

3.4 REINFORCED MASONRY - INSTALLATION

- A. General:
1. General installation requirements of unit masonry shall be as specified above.
 2. Provide formwork, shores, and bracing as required for temporary support of reinforced masonry elements. Formwork shall be made sufficiently tight to prevent leakage of grout.
 3. Do not remove bracing and shores until reinforced masonry member has hardened sufficiently to carry its own weight and all other reasonable temporary loads that may be placed on it during construction.

B. Placing reinforcement:

1. Reinforcement shall be cleaned of loose rust, mill scale, earth or other materials which will reduce bond to mortar or grout. Reinforcement bars with kinks or bends not shown on Drawings or final shop Drawings, or bars with reduced cross section due to excessive rusting or other causes shall not be used.
2. Reinforcement shall be accurately positioned at the spacing shown. Vertical bars shall be supported and secured against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, a clear distance between bars of not less than the nominal bar diameter or 1", whichever is greater, shall be provided.
3. Where splices are required, provide lap splices in accordance with ACI 318, and tie lapped bars with wires.

C. Grouting - general requirements:

1. Cavities to be grouted shall be clean and free of mortar droppings. Webs and face shells shall be bed solidly in mortar.
2. The Contractor may use either low lift or high lift grouting techniques subject to the requirements which follow.
3. Low-lift grouting:
 - a. A minimum clear dimension of 2" and clear area of 8 sq.in. in vertical cores to be grouted shall be provided.
 - b. Vertical reinforcement shall be placed prior to laying of CMU. Vertical reinforcement shall be extended above elevation of maximum pour height as required to allow for splicing and supported in position at vertical intervals not exceeding 192 bar diameters not 10'.
 - c. CMU shall be laid to maximum pour height. Pour height shall not exceed 5'. If bond beams occurs below 5' in height, pour shall be stopped at course below bond beam.
 - d. Grout shall be poured using container with spout or by chute and shall be rodded or vibrated during placing. Grout pours shall be terminated 12" below top course of pour.
 - e. Bond beams: Grout shall be stopped in vertical cells 12" below bond beam course. Horizontal reinforcement shall be placed in bond beams with corners and intersections lapped with corner bars. Vertical reinforcing shall extend into bond beam. Grout shall be placed in bond beam course before filling vertical cores above bond beam.
4. High lift grouting:
 - a. High lift grouting technique for grouting of CMU shall not be used unless minimum cavity dimension and area is 3" and 10 sq.in., respectively.
 - b. Cleanout holes shall be provided in first course at all vertical cells which are to be filled with grout. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
 - c. Masonry shall be constructed to full height of maximum grout pour specified prior to placing grout.
 - d. Maximum pour height shall be 20', unless otherwise indicated.
 - e. Preparation of grout spaces: Prior to grouting, the grout spaces shall be inspected and cleaned out. Dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials shall be

removed from grout spaces. Reinforcement shall be cleaned and adjusted to proper position. Top surface of structural members supporting masonry shall be cleaned to ensure bond. After final cleaning and inspection, cleanout holes shall be closed and closures shall be braced to resist grout pressures.

- f. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Shores and bracing, if required, shall be installed before starting grouting operations.
- g. Grout shall be placed by pumping into grout spaces, unless alternate methods are approved by the Engineer.
- h. Grout pours shall be limited to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Grout shall be placed in lifts which do not exceed 5'. Each grout lift shall be rodded or vibrated during pouring operation.

3.5 CLEANING

- A. Protect bases of walls from splash stains by covering adjacent foundation with sand, sawdust or polyethylene.
- B. Remove excess joint materials as tooling progresses with fiber brush and/or wooden paddles.
- C. Clean surfaces of masonry as required for proper application of the specified finishes.

3.6 CAULKING AND SEALANTS

- A. Rake exposed joints where masonry abuts other construction approximately 1/2"
- B. Caulk joints complying with Section 07920.
- C. Seal exterior of masonry with spray applied sealant.

3.7 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 05990
MISCELLANEOUS METALS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide all miscellaneous metal work as indicated, specified or as needed to provide a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 09900 - Painting.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
- C. Shop drawings shall show size of components, materials of construction, connection to other components and anchorage.
- D. Samples shall be submitted at the Engineer's request.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Finished and machined faces shall be true to line and level.
- B. Welding shall conform to applicable requirements of:
 - 1. Steel products: American Welding Society Standard D1.0-63.
 - 2. Aluminum alloy products: Recommended practices as published in "Welding Aluminum" by the American Welding Society.

C. Unless otherwise specified, materials shall conform to the following:

Structural Steel	ASTM A 36
Welded and Seamless Steel Pipe	ASTM A 53
Gray Iron Castings	ASTM A 48, Class 30
Galvanizing, General	ASTM A 123
Galvanizing, Hardware	ASTM A 153
Galvanizing, Assemblies	ASTM A 386
Aluminum (Extruded Shapes)	6063 T5 (Alum alloy)
Aluminum (Extruded Pipe)	6063 T6 (Alum alloy)
Aluminum Bars and Shapes (Structural)	6061 T6 (Alum alloy)
Bolts and Nuts	ASTM A 307
Stainless Steel Bolts, Fasteners	AISI Type 304
Stainless Steel Plate and Sheet, Wire	AISI Type 316
Welding Rods for Steel	AWS Spec for Arc Welding

D. Workmanship and finish shall be equal to the best practices of modern shops for the respective work.

1. Exposed surfaces shall have smooth finish and sharp, well defined lines and arises.
2. Sections shall be well formed to shape and size with sharp lines and angles.
3. Curved work shall be sprung evenly to curves.
4. Metal work shall be countersunk properly to receive hardware and provided with the proper bevels and clearance.
5. Cutting shall be done by shearing, sawing or flame cutting; if flame cut, the metal shall be ground back to smooth sound material.
6. Holes for bolts and screws shall be drilled.
7. Conceal fastenings where practicable.

2.2 STEEL AND IRON SHAPES

- A. Provide standard, well finished, structural shapes or commercial grade bar stock.
1. Structural steel shall conform to ASTM A 36.
 2. Rolled shapes shall conform to dimensions and weights of Regular Series Shapes of AISC.
- B. Pipe shall be Schedule 40, unless otherwise indicated.

2.3 ALUMINUM SHAPES

- A. Provide extruded shapes of 6063-T5 alloy unless another alloy is better suited for the intended purpose.
- B. Furnish structural shapes conforming to dimensions and weights of the Standard Structural Shapes of the Aluminum Association of 6061-T6.

2.4 ANCHOR BOLTS AND MISCELLANEOUS FASTENINGS

- A. General:
1. Provide as indicated, or as necessary for securing work in place, and anchoring equipment in place.

2. Sizes and spacing of anchor bolts not indicated shall be as required for the intended purpose.
- B. Provide anchor bolts, expansion anchors, epoxy adhesive anchors, nuts, washers and other fasteners of the materials indicated below unless otherwise specified or indicated on the drawings.
1. Fastening structural steel shapes and plates to each other - ASTM A 325 bolts.
 2. Anchoring structural steel to concrete - ASTM A 307 anchor bolts, galvanized.
 3. Fastening or anchoring stainless steel or aluminum to any material - Type 316 stainless steel.
 4. Anchoring process or mechanical equipment regardless of material to concrete - Type 316 stainless steel.
 5. Anchoring or fastening any materials that will be submerged in water or wastewater - Type 316 stainless steel.
 6. Any anchors or fasteners in contact with potable water - Type 316 stainless steel.
 7. Fastening or anchoring wood or timber - Type 316 stainless steel.
 8. Other fasteners and anchor bolts not otherwise specified - Type 316 stainless steel.
 9. In contact with chlorine solution - Type 2205 duplex stainless steel.
- C. Expansion anchors:
1. Use stud type with one-piece wrap around expansion sleeve.
 2. Provide complete unit manufactured from 316 series stainless steel.
 3. Acceptable products: Phillips "Wedge-Anchors", Ramset "Trubolt Stud Anchors"; or Hilti "Kwik-Bolt" or approved equal.
 4. Do not use expansion anchors in masonry.
- D. Epoxy adhesive anchors:
1. Provide injected epoxy adhesive anchors, consisting of screen tube and anchor rod.
 2. Anchor rod and nut to be Series 316 stainless steel.
 3. Acceptable products: Hilti "HIT" or equal.
 4. Use in masonry and where otherwise indicated.

2.5 INSERTS AND SLEEVES

- A. Provide as required and needed for support of piping, equipment and apparatus, or where passages through walls, floors, etc. are required.
- B. Size and material shall be as indicated, or as approved by the Engineer.

2.6 UNISTRUT CHANNELS

- A. Channels shall be accurately and carefully extruded to size from aluminum, except as noted otherwise.
- B. Channels embedded in concrete shall be Type 304 stainless steel.
- C. Provide a continuous slot with intumed clamping ridges on one side of channel.
- D. Fittings to be stainless steel or aluminum.

- E. Unless otherwise indicated on the drawings, channels to be 1-5/8" x 1-5/8" x .105" thick.
- F. Make all cuts square and free from burrs.
- G. Provide end caps on channels.
- H. Nuts, pipe hangers, clamps, etc. shall be units specifically intended and manufactured for use with "Unistrut" channels or approved equal.
- I. All nuts, bolts and clamps shall be stainless steel.
- J. Provide flexible elastomer material, "Uni-cushion" or equal, between all pipe clamps or hangers and PVC, copper or stainless steel pipe.

2.7 GALVANIZING

- A. Galvanizing of structural steel, where indicated on the drawings, shall be done in accordance with standard specification for zinc coating (hot-dip) ASTM designation A 123, A 153, A 143, A 384, A 386 and A 386 latest revision.
 - 1. Provide a minimum of 3 ounces of zinc per sq. ft. for members 1/4" thick and larger.
 - 2. Provide a minimum of 2 ounces of zinc per sq. ft. for members less than 1/4" thick.
 - 3. Fasteners - Comply with ASTM A 325 and ASTM A 153.
 - 4. Pickling is required prior to galvanizing.
 - 5. Test zinc thickness in accordance with ASTM A 123 and submit test results for approval prior to shipment.

2.8 SHOP PAINTING

- A. Clean and prime all ferrous metal surfaces with primer compatible with finish coats specified in Section 09900.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install all items, plumb, square and level as intended.

3.2 ANCHOR BOLTS

- A. Drill holes to depth recommended by manufacturer.
- B. Apply "Never-Seize" or equal to bolts.
- C. Tighten nuts to manufacturer's recommendations using a torque wrench.
- D. Maximum protrusion of bolt from top of nut - 3/8".

3.3 UNISTRUT CHANNELS

- A. Mount on wall or floor using stainless steel expansion or masonry anchors or embed in concrete where indicated.
- B. Install channels level and plumb.

- C. Install end caps.
- D. Attach securely to support structure with stainless steel wedge anchors.

3.4 REPAIR OF HOT-DIPPED GALVANIZED SURFACES

- A. Comply with ASTM A 780.
- B. Repair using sprayed zinc coating, minimum dried film of 95% zinc by weight.
- C. Clean, dry and remove oil, grease, and corrosion products from surfaces.
- D. If the area to be reconditioned includes welds, first remove all flux residues and weld spatter by mechanical means, that is, chipping, etc.
- E. Wire brush clean the surface to be reconditioned in accordance with SSPC-SP3.
- F. Extend surface preparation into the surrounding undamaged galvanized coating.
- G. Apply the sprayed coating as soon as possible after surface preparation and before visible deterioration of the surface has occurred.
- H. Provide the surface of the sprayed coating with uniform texture, free of lumps, coarse areas, and loosely adherent particles.
- I. Provide dry mill thickness of 1 mil greater than specified for the hot-dipped galvanized material.
- J. Take thickness measurements with either a magnetic or electromagnetic gage to ensure that the applied coating is as specified.

3.5 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for work under this Section, and the cost of same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 07920
SEALANTS AND CAULKING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Throughout the Work, seal and caulk joints where shown on the Drawings and elsewhere as required to provide a positive barrier against passage of moisture and passage of air.
- B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 120 days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 2. Color charts.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. Prevent subjection to temperatures exceeding 90°F.
- C. Do not retain at the job site material that has exceeded the shelf life recommended by its manufacturer.

PART 2 - PRODUCTS

2.1 SEALANTS

- A. Joint sealant:
 - 1. Provide two-component polyurethane base elastomeric sealant complying with Federal Specification TT-S-00227E and ASTM C 920 and the following:

Material and Curing Conditions 73°F and 50% R.H.			
Service Range	-40° to 167° F		
Property	Non-sag	Self-Leveling	Test Method
Application life	3-4 hr	3-4 hr	TT-S-00227E
Tack-free Time	6-8 hr	6-8 hr	ASTM C-679
Final Cure	3 day	3 day	
Shore A Hardness	25±5	40±5	ASTM D-2240
Tensile Strength at Break	200 psi	200 psi	ASTM D-412
Tensile Elongation	650%	650%	ASTM D-412
100% Modulus	75 psi	100 psi	ASTM D0412
Tear Strength	125 lb/in	125 lb/in	ASTM D-624

Adhesion in Peel				TT-S-00227E
Substrate	Peel Strength	% Adhesion Loss	Peel Strength	% Adhesion Loss
Aluminum	30 lb	Zero	30 lb	Zero
Glass	30 lb	Zero	30 lb	Zero
Concrete	25 lb	Zero	30 lb	Zero

Weathering Resistance	Excellent
Ozone Resistance	Excellent
Chemical Resistance	Good resistance to water, diluted acids, diluted alkalines and residential sewage. Consult Technical Service for specific data.

2. Acceptable product: Sikaflex 2c by Sika Corporation or approved equal.

B. Building sealant:

1. Provide premium grade moisture cured one component polyurethane base elastomeric sealant complying with the following:

Material and Curing Conditions 73°F and 50% R.H.			
Service Range	-40° to 167° F		
Curing Rate	Tack-free Time	6 - 8 hours (TT-S-00340C)	
	Tack-free to Touch	3 hours	
	Final Cure	5 - 8 days	
Recovery	>90%		
Shore A Hardness (ASTM D-2240)			
21 day	40±5		
Tensile Properties (ASTM D-412)			
21 day	Tensile Stress		140 psi
	Elongation at Break		700%
	Modulus of Elasticity	25%	40 psi
		50%	60 psi
		100%	80 psi
Lap-Shear Strength (ASTM D-1002), modified, glass substrate			
21 day	50°F		120 psi
	73°F		125 psi
	122°F		125 psi
Adhesion in Peel (TT-S-00230C)			

Substrate	Peel Strength	Adhesion Loss
Aluminum	25 lbs	10%
Glass	20 lb	5%
Concrete	20 lb	0%
Weathering Resistance	Excellent	
Ozone Resistance	Exceptional	
Chemical Resistance	Good resistance to water, diluted acids and diluted alkalines. Consult Technical Service for specific data.	

2. Acceptable product: Sikaflex 1a by Sika Corporation or approved equal.
- C. Do not install when the ambient or substrate temperature will be below 41° F or above 100° F for 24 hours.
- D. Color will be selected by the Engineer from standard colors normally available from the specified manufacturer.

2.2 PRIMERS

- A. Provide in accordance with recommendations of the manufacturer of the sealant used.

2.3 BACKUP MATERIALS

- A. Use closed cell neoprene cord, closed cell polyethylene foam rod, or closed cell sponge of vinyl or rubber.

2.4 BOND PREVENTATIVE MATERIALS

- A. Use only one of the following as best suited for the application, and as recommended by the manufacturer of the sealant use:
 1. Polyethylene tape, pressure sensitive adhesive, with the adhesive required only to hold tape to the construction materials as indicated.
 2. Aluminum foil complying with MIL-A-148E.
 3. Wax paper complying with Federal Specification UU-P-270.

2.5 MASKING TAPE

- A. For masking around joints, provide masking tape complying with Federal Specification UU-T-106c.

PART 3 - EXECUTION

3.1 GENERAL

- A. Caulk all concrete expansion joints.
- B. Caulk where indicated on the drawings.

3.2 PREPARATION

- A. Clean all surfaces to receive caulking of all loose particles, dirt, dust, oil, grease and other foreign matter.

3.3 INSTALLATION OF BACKUP MATERIAL

- A. Install backup material so that joint depth will not exceed one half joint width, except minimum depth shall be $\frac{1}{4}$ ".
- B. Compress material 25% to 50% to achieve a positive and secure lift.
- C. When using backup of tube or rod stock, avoid lengthwise stretching of the material. Do not twist or braid hose or rod backup stock.

3.4 PRIMING

- A. Use only the primer recommended by the manufacturer of the sealant, applying in strict accordance with the manufacturer's recommendations.

3.5 BOND BREAKER INSTALLATION

- A. Provide an approved bond breaker where recommended by the manufacturer of the sealant, and where directed by the Engineer, adhering strictly to the installation recommendations.

3.6 INSTALLATION OF SEALANTS

- A. Equipment:
 - 1. Apply non-sag sealants under pressure with power actuated or handgun, or by other appropriate means.
 - 2. Use guns with nozzle of proper size, and providing sufficient pressure to completely fill the joints as designed.
- B. Thoroughly and completely mask joints where the appearance of sealant on adjacent surfaces would be objectionable.
- C. Install the sealant in strict accordance with the manufacturer's recommendations as approved by the Engineer, thoroughly filling joints to the recommended depth.
- D. In horizontal joints, pour self-leveling sealant into joint slot moving in one direction and allow sealant to flow and level out.
- E. In vertical or sloped joints, place non-sag sealant using bulk gun or follower plate loading system and tool joint to a slight concave profile.
- F. Cleaning up:
 - 1. Remove masking tape immediately after joints have been tooled.
 - 2. Clean adjacent surfaces free from sealant as the installation progresses, using solvent or cleaning agent recommended by the manufacturer of the sealant used.

3.7 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for work under this section, and cost of same shall be included in the price bid for the structure in which the work is incorporated.

END OF SECTION

SEALANTS AND CAULKING
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SECTION 08400
ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide aluminum doors and aluminum door frames which are not specifically described in other Sections of these Specifications, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 08710 - Finish Hardware.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Referenced manufacturer is Cline Aluminum Doors, Inc. of West Bradenton, Florida and is named to establish standards of quality. Products by other manufacturers may be provided upon approval by the Engineer.
- C. Unless specifically otherwise approved by the Engineer, provide all products of this Section from a single manufacturer.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Shop Drawings showing details of each frame type, elevations of door designs, details of openings, and details of construction, installation and anchorage.
 - 4. Show door swings as LH, RH, LHR or RHR.
 - 5. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

1.5 WARRANTY

- A. The manufacturer is to provide a ten (10) year warranty against defect in workmanship and materials, including warping, rotting, decaying and bowing.
- B. The manufacturer is to provide a ten (10) year warranty against the finish fading.

PART 2 - PRODUCTS

2.1 ALUMINUM DOORS

A. Materials:

1. Provide full flush design, in dimensions and types shown on the Drawings.
2. Face skins to be smooth 5005-H14 stretcher leveled aluminum alloy.
 - a. Provide 0.040" skin thickness.
 - b. Facings to be bonded edge-to-edge to one-piece glass-reinforced polypropylene backer.
 - c. Bonding agent to be commercial bonding adhesive with a strength buildup of 350 psi.
3. Provide continuous nonspecific hardware reinforcement with full internal perimeter aluminum tube measuring 4-1/4" wide x 1-3/8" deep x 1/8" thick.
4. Provide an organic based marine grade honeycomb core with high compression strength of 94.8 psi.
5. Provide internal framing members mechanically joined with #10 stainless steel threaded.
6. Provide a one-piece 0.085" oil tempered hardboard the full width and height of the door.
 - a. Pegboard or non-tempered hardboard not accepted
7. Provide wall thickness of 0.050" for beads and trim.
 - a. Lock stile door edge constructed of 6063-T5 extruded aluminum alloy with special beveled edge cap design and integral wool-pile weather stripping to be provided.
 - b. Hinge stile to be prepared for standard template 4.5" x 4.5" butt hinges.
8. Top and bottom edging to be a beveled aluminum extrusion of 6063-T5 alloy in a channel shape of 0.125" throughout.
9. Provide 0.1875" hinge and strike plate mounted in integral channel with no expose fasteners.
10. Sealants to be fully compatible with all other materials and non-staining.
 - a. Sealants to meet or exceed TT-S-001-657, ASTM C834-76 and TT-S-001-54A.
11. Reinforce doors for hardware with minimum 1/4" aluminum alloy.
 - a. Provide true mortise for hinges.
12. Louvers where indicated are to be 6063-T5 extruded aluminum blade type construction, 0.062" thickness.
 - a. Louver blades should be inverted "Y" type
 - b. Provide exterior doors with aluminum insect screen.
 - 1) Insect screen should be 18-16 mesh, 0.011" diameter all clad aluminum set in a 0.050" extruded frame.
13. For double leaf door, provide continuous astragal on active leaf with pile weatherstripping.
14. All fasteners to be 18-8 stainless steel.

B. Fabrication:

1. Provide monolithic facings with no pieces or lap joints, butt joints, lock joints, or any other type of manufactured joint.
2. Make all cutouts from the solid sheet without distorted edges.
3. Provide sufficient size facing so that it will be concealed under the door edging a minimum of 1/2".
4. The honeycomb core shall be fully expanded and set by heat at temperatures necessary for full performance requirements.
5. All laminating shall be done under controlled production conditions.
6. Metering of adhesive, uniform bonding pressure and mechanically sized components shall be representative of continuous processing that is capable of bonding a homogenous sandwich.
7. The completed sandwich shall be a structural laminate which shall meet or exceed the U. S. Forest Products Laboratory HHFA Delamination Test, as done in compliance with ASTM D1037-60T, Accelerated Aging Cycle.
8. Overall door tolerance shall be plus or minus 1/16".
9. Extrusion tolerances shall be as set by the American Aluminum Manufacturer's Association.
10. Provide snap-in type glazing stops with vinyl inserts.
11. Cut all edging to proper door size.
12. Die notch and hinge edging to receive top and bottom edging.
 - a. Provide clearance for hardware.
13. Apply edging to door with adhesive.
 - a. Edging to be non-removable and watertight.

2.2 ALUMINUM FRAMES

A. Materials:

1. Provide 6063-T5 extruded aluminum alloy frames, .125" wall thickness, of the types and dimensions shown on the Drawings.
2. Provide minimum 1/4" aluminum hardware reinforcement for hinges, lock strikes and closures.
3. Provide 1/2" wide door stops.
4. Punch three silencer holes in latch jamb of single frames and one silencer hole per leaf in head jamb of double frames.
5. Provide dust boxes over strikes and protection for tapped holes.
6. Provide adjustable, aluminum, clip-angle type jamb anchors, not less than 1/4" thick, securely attached to the bottom of each jamb.
7. On removable transom panels, provide door stop and panel stop.
8. Unless otherwise shown, provide 1-3/4" x 5" wide open back frame with applied stop.

2.3 FINISH

- A. Provide high performance organic coating: Kynar/Polyvinylidene Fluoride (PVDF) in accordance with AAMA 605.2.
- B. Color to be selected by the Owner.
- C. Provide one coat of coal tar epoxy on unexposed portion of door frames.

2.4 FINISH HARDWARE

- A. Secure templates from the finish hardware supplier and accurately install, or make provision for, all finish hardware at the factory.

2.5 GLAZING

- A. Provide 1/4" clear sheet glass, flat drawn, Type I, tempered, "B" quality, unless otherwise indicated.
- B. Provide snap-in, non-removable type stops, 6063-T5 aluminum alloy, 0.050" thick.
- C. Provide vinyl insert seals.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- 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.

3.2 INSTALLATION

- A. Placing frames:
 - 1. Place frames after completion of all masonry, painting and finish work.
 - 2. Set frames accurately into position, plumbed, aligned, and braced securely until permanent anchors are set.
 - 3. Protect frames from mortar, concrete and paint splatter.
 - 4. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - 5. Anchor bottom of frames to floors with expansion bolts and power fasteners.
 - 6. At in-place construction, set frames and build wall anchors into adjacent walls or secure to adjacent construction with machine screws and suitable anchorage devices. Provide "Z" fillers at each screw hole.
 - 7. When installed in prepared openings in concrete or masonry construction, provide sealant between frame and concrete in accordance with provisions of Section 07920 of these Specifications.
- B. Hanging doors:
 - 1. Provide metal doors in locations as required.
 - 2. Install all finish hardware and adjust as necessary for proper operation.
 - 3. Protect doors from mortar, concrete and paint splatter.

3.3 ADJUST AND CLEAN

- A. Final adjustments:
 - 1. Check and readjust operating finish hardware items in hollow metal work just prior to final inspection.
 - 2. Leave work in complete and proper operating condition.
 - 3. Remove defective work and replace with work complying with the specified requirements.

3.4 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for this work and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION
ALUMINUM DOORS AND FRAMES
08400-4

SECTION 08710
FINISH HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included:

1. Furnish finish hardware required to complete the Work as shown on the Drawings and as specified herein.
2. Furnish trim attachments and fastenings, specified or otherwise required, for proper and complete installation.
3. Deliver to the job site those items of finish hardware scheduled to be installed at the job site.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.
2. Installation of finish hardware is described in other Sections of these Specifications.
3. Section 08400 - Aluminum Doors and Frames.

C. Definitions:

1. "Hardware sets" described in the Hardware Schedule in Part 3 of this Section are as shown on the Drawings.

1.2 QUALITY ASSURANCE

A. Referenced hardware listed herein is from the following catalogs:

1. Locksets and cylinders - Corbin Russwin.
2. Butts - Stanley Works.
3. Thresholds and weatherstripping - Pemko.
4. Closers - Norton.
5. Overhead holders - Glynn Johnson.
6. Surface bolts, flush bolts, door and wall stops, silencers, and kick, push and pull plates - H. B. Ives.

B. Comparable hardware of other manufacturers will be acceptable, provided a complete list is submitted for approval by the Engineer.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. Product data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section.
 - a. Approval of this list by the Engineer will not relieve the Contractor of the responsibility to provide all finish hardware items required for

the Work, even though such required items may not have been shown on the approved list.

- C. Templates: In a timely manner to assure orderly progress of the Work, deliver templates or physical samples of the approved finish hardware items to pertinent manufacturer's of interfacing items such as doors and frames.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. Individually package each unit of finish hardware, complete with proper fastenings and appurtenances, clearly marked on the outside to indicate contents and specific locations in the Work.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Fasteners:
 - 1. Furnish necessary screws, bolts, and other fasteners of suitable size and type to anchor the hardware in position for long life under hard use in accordance with the hardware manufacturer.
 - a. Anchor bolts to be Type 316 stainless steel.
 - 2. Provide fasteners which harmonize with the hardware as to finish and material.
 - a. Fasteners to be aluminum or stainless steel.

2.2 MASTER KEYING

- A. Provide all locks equipped with an interchangeable core, removable by the Owner's master (control) key.
- B. Master key all permanent (security) cores to the Owner's grand master keyed system as directed by the Owner.
- C. Cores to have a figure eight face and six-pin tumbler locking core.
- D. All locks shipped to the Contractor shall have temporary construction cores with two control keys and three master keys.
- E. Upon completion of all items on final "punch list" and as final act in turning the project over to the Owner:
 - 1. In the presence of the Owner's representative, replace all temporary cores with the master keyed permanent cores.
 - 2. Provide Owner with no less than:
 - a. Four master keys.
 - b. Six keys for each different set of locks.

2.3 FINISH

- A. Unless otherwise indicated, all hardware shall have US32D stainless steel finish.

2.4 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.
- B. Provide adequate mounting hardware to install closure on interior of buildings.

PART 3 - EXECUTION

3.1 LOCATION

- A. Hardware on hinged doors shall be located as follows, unless otherwise indicated:
 - 1. Locks - Knobs shall be installed at the same height, approximately 37" above the finish floor, throughout the buildings.
 - 2. Hinges - Locate as follows:
 - a. Top Hinge: Not over 9-3/4" from the inside of frame rabbet at head to center of hinge.
 - b. Bottom Hinge: Not over 10-3/8" from finished floor to center of hinge.
 - c. Center Hinge: Midway between top and bottom hinges.

3.2 FINISH HARDWARE SCHEDULE

- A. Furnish the following hardware groups in the amounts indicated on the Drawings.
- A. Furnish the following hardware groups in the amounts indicated on the Drawings.
 - 1. Hardware Set #1 - (Single leaf doors, opening to outside)

Each door to have:

3 each	Butts - 4-1/2 x 4-1/2 - US32D - NRP
1 each	Exit Device - ED 8200 - A655 - 626
1 each	Floor Stop w/holder - 444-626
3 each	Silencers - SR64
1 each	Closer - 7500SS - 689 - SN
1 each	Closer Arm (w/stop/holder) - 6870T-8 600 x 689
1 each	Threshold - 181AT x length required
1 each	Weatherstrip - 315SSR x length required

- 2. Hardware Set #2 - (Double leaf doors, opening to outside)

Each pair of doors to have:

6 each	Butts - 4-1/2 x 4-1/2 - US32D-NRP
2 each	Flush Bolts - 458-626 (inactive leaf)
1 each	Closer - 7500SS 689-SN (active leaf)
1 each	Closer Arm (w/stop/holder) - 6870T-8 600 x 689
2 each	Exit Device - ED 8200 - A655 - 626
1 each	Threshold - 181AT x length required
1 set	Weatherstrip - 315SSR x length required
1 each	Astragal - 355CP x length required (active leaf)
1 each	Floor Stop w/holder - 446-626
6 each	Silencers - SR64

3.3 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for work under this Section, and the cost of same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Prepare, paint and finish the exterior and interior surfaces indicated or specified, and as needed for a complete and proper installation.
 - 1. Paint existing surfaces as indicated on the drawings.
 - 2. Paint all newly provided surfaces unless specially excluded.
- B. Work not included: Unless otherwise indicated, painting of following surfaces will not be required.
 - 1. Concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces, and duct shafts.
 - 2. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper (except piping), bronze and similar non-ferrous materials.
 - 3. Moving parts of operating units, mechanical or electrical parts such as valve operators, linkages, sensing devices, and motor shafts.
 - 4. Exterior concrete surfaces, including interior walls of treatment tanks.
 - 5. PVC piping systems.
 - 6. Instruments, control panels, chlorinators, etc. having factory applied finishes.
 - 7. Roof and wall panels of pre-engineered buildings.
 - 8. Do not paint over required labels or equipment identification, performance rating, name, or nomenclature plates.
- C. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Priming or priming and finishing of certain surfaces may be specified to be factory performed or installer performed under pertinent other Sections.
- D. Definitions: "Paint", as used herein, means coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers and other applied materials whether used as prime, intermediate or finish coats.

1.2 QUALITY ASSURANCE

- A. Referenced manufacturers are the Tnemec Company, Inc. and Ameron, Protective Coatings Division, and are named to establish standards of quality. Equal products of other manufacturers may be provided for the project upon approval by the Engineer.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- C. Paint coordination:

1. Provide finish coats which are compatible with the prime coats actually used.
2. Review other Sections of these Specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrata.
3. Upon request, furnish information on the characteristics of the specific finish materials to assure that compatible prime coats are used.
4. Provide barrier coats over noncompatible primers, or remove the primer and reprime as required.
5. Notify the Engineer in writing of anticipated problems in using the specified coating systems over prime coatings supplied under other Sections.

D. Subcontractor qualifications:

1. Paint subcontractor to have a minimum of three years practical experience and successful history in the application of specified products to surfaces of wastewater treatment plants.
2. Furnish a list of references and job completions.
3. Paint subcontractor to provide certification from the paint supplier to his knowledge and experience in applying the specified coatings.
4. Paint subcontractor shall provide a site mock up of the coating systems for the masonry walls, concrete floors, and concrete launders for approval by the engineer before any work is started. The approved mock ups shall be the quality standard for the project.

E. Technical services:

1. The coatings manufacturer shall provide a NACE certified manufacturer's representative to visit the work to verify compliance with these specifications, to assure coatings are properly applied, and the proper equipment is being used.
2. Provide for a minimum of two (2) interim site visits between initiation and completion of painting or as needed.
3. Provide a NACE certified manufacturer's representative at completion of painting to verify painting was installed according to specifications.
 - a. Provide Holliday mils thickness testing of all metal surfaces.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 90 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 1. Materials list of items proposed to be provided under this Section.
 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
- C. Subcontractor qualifications.
- D. Color chips: Provide for each type of finish coat required.
- E. Schedule:
 1. Submit schedule listing of all surfaces to be painted, name, generic type, trade or brand name, system for each surface including number of coats and total dry film thickness.

2. Secure Engineer's approval of schedule, in writing, prior to ordering any materials.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. Deliver all material to site in original, new, unopened containers, labeled and bearing manufacturer's name and stock number, product and brand name, contents by volume for major constituents, instructions for mixing and reducing, and application instruction.
- C. Provide adequate storage facilities designed exclusively for the purpose of paint storage and mixing.
- D. Facility area shall be located away from open flames, be well ventilated, and be capable of maintaining ambient storage temperature of no less than 45°F.
- E. Paint, coatings, reducing agents, and other solvents must be stored in original containers until opened. If not resealable, then must be transferred to UL approved safety containers.
- F. Provide proper ventilation, personal protection and fire protection for storage and use of same. Comply with requirements set forth by Occupational Safety and Health Act for storage and use of painting materials and equipment.
- G. All waste materials shall be disposed of by the Contractor in accordance with South Carolina Department of Health and Environmental Control (SCDHEC).

1.5 REFERENCES

- A. SSPC - Steel Structures Painting Council
- B. SSPC-SP 1 – Solvent Cleaning.
- C. SSPC-SP 2 – Hand Tool Cleaning.
- D. SSPC-SP 3 – Power Tool Cleaning.
- E. SSPC-SP11 – Power Tool Cleaning to Bare Metal
- F. SSPC-SP 6/NACE 3 – Commercial Blast Cleaning.
- G. SSPC-SP 10/NACE 2 – Near-White Metal Blast Cleaning
- H. SSPC-SP 13/NACE 6 – Surface Preparation of Concrete.
- I. SSPC-PA2 Measurement of Dry Coating with Magnetic Gauges.

1.6 EXTRA STOCK

- A. Upon completion of the work of this Section, deliver to the Owner at least one gallon of each color, type, and gloss of paint used in the Work, tightly sealing each container and clearly labeling with contents and location where used.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS

- A. Source of all paint material is subject to approval by the Engineer.
- B. All paint material that will be in contact with potable water shall have the approval of the South Carolina Department of Health and Environmental Control for such use.
- C. All paint materials to be used in any one system shall be the products of one manufacturer.
- D. Where products are proposed other than those specified by name and number in the Painting schedule, provide under the product data submittal required by Article 1.3 of this Section a new painting schedule compiled in the same format used for the Painting Schedule included in this Section.
- E. Use only the thinners recommended by the paint manufacturer, and use only to the recommended limits.

2.2 COLOR SCHEDULE

- A. The Engineer will prepare a color schedule for guidance in the painting.

2.3 APPLICATION EQUIPMENT

- A. Use only such equipment as is recommended by the paint manufacturer.

2.4 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- 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.

3.2 ENVIRONMENTAL CONDITIONS

- A. Do not work under unfavorable weather conditions.
 - 1. Air and surface temperatures must be above 45°F, dew point not within 5° of surface temperature, and relative humidity less than 85% unless approved by engineer.

3.3 SURFACE PREPARATION

A. General:

1. Prepare and clean all surfaces to be painted in a workmanlike manner with the objective of obtaining a smooth, clean and dry surface, free from cracks, ridges, nail holes, etc.
2. Remove or mask items not to be painted.
3. Schedule cleaning and painting so that dust and other contaminants from cleaning operations will not fall onto newly painted surfaces.

B. Ferrous metals:

1. Remove all rust, dust, scale and other foreign substances.
2. Give welded joints special attention, removing all welding flux, slag and weld spatter.

C. Non-ferrous metals: Solvent clean prior to shop or field application of pretreatment and/or primer.

D. Concrete:

1. In accordance with SSPC-SP13/NACE 6 Surface Preparation of Concrete clean surface free of curing compounds, oil, grease, dirt, chalk or previously applied coatings.
2. Surface to be dry unless otherwise indicated in printed instructions from the paint manufacturer.

E. Masonry surfaces: In accordance with SSPC-SP13/NACE 6 Surface Preparation of Concrete clean surface free of curing compounds, oil, grease, dirt, chalk or previously applied coatings.

F. Wood surfaces:

1. Clean until free from dirt, oil, and other foreign substances.
2. Smooth finished wood surfaces exposed to view, using the proper sandpaper. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.

G. Factory finished components: Solvent clean prior to field application of pretreatment and/or primer.

3.4 MATERIALS PREPARATION

A. General:

1. Mix and prepare paint materials in strict accordance with the manufacturer's recommendations as approved by the Engineer.
2. When materials are not in use, store in tightly covered containers. Ensure storage conditions are within the manufacturer's recommendations.
3. Maintain containers used in storage, mixing, and application of paint in a clean condition, free from foreign materials and residue.

B. Mixing:

1. Mix materials in strict accordance with the manufacture's data sheet.
2. Do not stir into the material any film which may form on the surface, but remove the film and, if necessary, strain the material before using.

3.5 PAINT APPLICATION

A. General:

1. Touch-up shop applied prime coats which have been damaged, and touch-up bare areas prior to start of finish coats application (see subsection 3.7 of this Section).
2. Slightly vary the color of succeeding coats.
 - a. Do not apply additional coats until the completed coat has been inspected and approved.
 - b. Only the inspected and approved coats of paint will be considered in determining the number of coats applied.
3. Sand and dust between coats to remove defects visible to the unaided eye from a distance of five (5') feet.
4. On guards, covers, removable panels and hinged panels:
 - a. Remove fasteners before painting and re-install after paint is completely dry.
 - b. Remove or open guard, cover or panel for painting.
 - c. Paint the back sides to match the exposed sides.

B. Drying: Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suit adverse weather conditions.

C. Brush or roller applications:

1. Brush or roll coats onto the surface in an even film.
2. Cloudiness, spotting, holidays, laps, brush or roller marks, runs, sags, ropiness and other surface imperfections will not be acceptable.

D. Spray application:

1. Except as specifically otherwise approved by the Engineer, confine spray application to metal framework and similar surfaces where handwork would be inferior.
2. Where spray application is used, apply each coat to provide the hiding equivalent of brush coats.
3. Do not double back with spray equipment to build up film thickness of two coats in one pass.
4. Cloudiness, spotting, holidays, lap, runs, sags, ropiness, overspray and other surface imperfections will not be acceptable.

3.6 PAINTING SCHEDULE

A. Provide one prime coat (shop or field) and two finish coats, unless otherwise specified, in accordance with the following:

B. Systems:

1. In the schedules following, the type of paint system is identified by symbol in parenthesis immediately behind the manufacturer's name:
 - a. Alkyd (A)
 - b. Acrylic (AC)
 - c. Acrylic Latex (ACL)
 - d. High Build Urethane (HBU)
 - e. High Solids Epoxy (HSE)
 - f. High Build Coal Tar Solution (HBCT)
 - g. Alkyd Gloss (AG)

- h. Epoxy Polyamide (EP)
- i. Silicone (S)
- j. Silicone Aluminum (SA)
- k. Modified epoxy (ME)

C. Ferrous metal submerged, non-potable water and interior:

1. Surface preparation: SSPC-SP10/NACE 2 Near-White Blast Cleaning.
2. System: Tnemec (HSE):

Prime coat	Series 1 Omnithane, 2.5 - 3.5 dry mils, or approved equal
2nd coat	Series N69-1255 Beige Hi-Build Epoxoline II, 4.0 - 6.0 dry mils, or approved equal
3rd coat	Series 104-Color H.S. Epoxy, 8.0 -10.0 dry mils, or approved equal

3. System: Ameron (HSE):

Prime coat	Amercoat 385P, 4.0 dry mils, or approved equal
2nd coat	Amercoat 385, 4.0 dry mils, or approved equal
3rd coat	Amerlock 400 or 400FD, 8.0 dry mils, or approved equal

4. Type finish: Semi-gloss.

D. Ferrous metal, including D.I. pipe, non-immersion and exterior:

1. Surface preparation: SSPC-SP6/NACE 3 Commercial Blast Cleaning (fabrications) or SSPC-SP3 Power Tool Cleaning.
2. For ductile iron, "MC-FerroClad Primer, 3.0 - 5.0 dry mils", by Wasser High-Tech Coatings, may be substituted for the prime coat.
3. System: Tnemec (HBU):

Prime coat	Series 1 Omnithane, 2.5 - 3.5 dry mils, or approved equal
2nd coat	Series 135 Chembuild , 4.0 – 6.0 dry mils, or approved equal
3rd coat	Series 740 UVX, 3.0 – 5.0 dry mils, or approved equal

4. System: Ameron (HBU):

Prime coat	Amercoat 385P, 4.0 dry mils, or approved equal
2nd coat	Amercoat 385, 4.0 dry mils, or approved equal
3rd coat	Amershield, 5.0 dry mils, or approved equal
4th coat	Clear Polyurethane, 1.5 dry mils, or approved equal

5. Type finish: Gloss.

E. Concrete walls and ceilings and concrete masonry block walls, interior:

1. Surface preparation: SSPC-SP13/NACE 6 Surface Preparation of Concrete. Surface to be clean, dry and cured for a minimum of 28 days.
2. System: Tnemec (HSE):

1st coat	Series 104-Color H.S. Epoxy 8.0 - 10.0 dry mils, or approved equal
2nd coat	Series 104-Color H.S. Epoxy, 8.0 - 10.0 dry mils, or approved equal

3. System: Ameron (HSE):

1st coat	Amerlock 400, 175 sq. ft./gal. or approved equal
2nd coat	Amerlock 400, 175 sq. ft./gal. or approved equal

4. Type finish: Semi-gloss.
- F. Cast iron or ductile iron pipe, bituminous coated:
1. Surface preparation: SSPC -SP3 power tool cleaning.
 2. Provide one prime coat as specified below and finish with two coats of appropriate metal finish as specified in paragraphs 3.6C or 3.6D above.
 3. Tnemec Series 1 Omnithane, 2.5 - 3.5 dry mils. Or approved equal.
 4. Amercoat 385, 4.0 dry mils. Or approved equal.
- G. Non-ferrous metals:
1. Treat with manufacturer's recommended wash primer or pretreatment.
 2. Provide finish coats as specified in paragraphs 3.6C or 3.6D above.
- H. Galvanized surfaces:
1. Surface preparation: SSPC-SP1 Solvent Cleaning. Remove all soluble and insoluble contaminants and corrosion. Remove any storage stains per Section 6.2 of ASTM D6386. Sweep (Abrasive) Blasting per ASTM D 6386 to achieve a uniform anchor profile (1.0 - 2.0 mils).
 2. System: Tnemec
 - a. One coat: Series N69-1255 Beige Hi-Build Epoxoline Primer, 2.0 - 4.0 dry mils. Or approved equal.
 3. System: Ameron
 - a. Amercoat 385, 3.0 dry mils. Or approved equal.
 4. Finish with final coat as specified in Paragraph 3.6C or 3.6D above.

3.7 TOUCH-UP OF APPLIED COATINGS

- A. Prior to any touch-up, the area is to be SP-3 brush cleaned.
- B. Shop applied coatings:
1. Shop applied coatings with specified primer, as listed in Part 3.6 above, shall be touched up with the same listed primer before any topcoat(s) are applied.
 2. Shop applied coatings with manufacturer's standard paint shall be touched up with a compatible barrier coating, Tnemec Series 135 Chembuild or Ameron Amercoat 385 or approved equal.
 - a. Manufacturer shall notify the Engineer in writing if the manufacturer's standard paint is unable to receive the specified top coat(s) or if problems are anticipated due to incompatible coating systems.
- C. Field applied coatings: After cleaning, apply specified primer followed by specified finish coats.

3.8 COLOR CODING, PIPING

- A. General:
1. Paint all exposed piping complying with color schedule herein.
 2. Where schedule shows "color with contrasting band", the bands shall be approximately six inches in width, spaced at five-foot intervals along the pipe, at valves, and where pipe passes through a wall.

3. Install piping markers complying with Section 10445.

B. Color schedule:

Water Lines

Potable

Dark Blue

Non-potable

Safety Red

Chemical Lines

Sodium Hypochlorite

Yellow

Lime slurry

Light green

Polyphosphate

Orange

Waste Lines

Drains

Black

Other

Other lines

Light gray

3.9 COATING THICKNESS

A. General:

1. In all cases, the value stated for dry film thicknesses are average, based upon application to a smooth surface.
2. Dry film thickness gauges will be used as the application of each coat proceeds, to check the film thickness as applied.
3. Failure to obtain the proper dry thickness will require the application of additional coats until proper dry thickness is obtained.

3.10 INSPECTION AND ACCEPTANCE

A. Examination of overall appearance and measurement of dry film thickness.

B. Correct defects and/or deficiencies to satisfaction of the Engineer.

C. Observation by the Engineer will be required at the following intervals:

1. At the end of each surface cleaning operation before paint is applied.
2. After each coat of paint is applied.
3. The Contractor shall be responsible to contact and coordinate the time of each observation with the Engineer.

3.11 HOLIDAY DETECTION OF FERROUS SURFACES

A. General:

1. After the immediate and/or finish interior coating has been completed, the thickness measurements taken and results approved, test for pinholes, voids and thin places in the presence of the Engineer.
2. Use a Tinker Razor low voltage wet sponge holiday detector or approved equal for testing.
3. Recoat areas failing to test per manufacturer's instructions until proper results are obtained.

3.12 CLEAN-UP

- A. Upon completion, painting contractor shall clean-up and remove from site all surplus materials, tools, appliances, empty cans, cartons, and rubbish resulting from painting work. Site shall be left in neat, orderly condition.
- B. Remove all protective drop cloths and masking from surfaces not being painted. Provide touch-up around same areas as directed by the Engineer.
- C. Remove all misplaced paint splatters or drippings resulting from this work.

3.13 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 10445
PIPING IDENTIFICATION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide piping identification systems as specified herein, and as needed for a proper and complete installation for the following piping systems:
 - 1. Process piping.
 - 2. Potable water piping.
 - 3. Chemical piping.
 - 4. Valves.
- B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 90 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Valve tag designation schedule and color schedule.
 - 4. Valve and gate marker designation schedule.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

PART 2 - PRODUCTS

2.1 PIPE MARKERS

- A. All pipe markers shall conform to ANSI/OSHA pipe marking specifications.
- B. Each marker must show:
 - 1. Approved color coded background.
 - 2. Proper color of legend in relation to background color.
 - 3. Approved legend letter size.
 - 4. Approved marker length.

- C. Provide direction of flow arrows at each pipe marker.
- D. Provide wrap-around snap on type for piping 5" and smaller.
 - 1. Provide "Setmark" pipe markers as manufactured by Seton Name Plate Corporation, New Haven, CN or approved equal.
- E. Use pressure sensitive, adhesive backed, vinyl markers for piping 6" and larger.
 - 1. Provide "Opti-Code" pipe markers as manufactured by Seton Name Plate Corporation, New Haven, CN or approved equal.
- F. Working/Color Combinations:
 - 1. Provide markers in the required number for the following services:

LEGEND WORDING	MARKER COLOR	LEGEND WORDING	MARKER COLOR
Acid	Y	Primary Effluent	G
Air - Caution Hot	BL	Primary Sludge	G
Alum	Y	Propane Gas	Y
Ammonia	Y	Raw Sewage	G
Caustic	Y	Raw Water	G
Chlorine	Y	Recir. Sludge	G
Cold Water	G	Roof Drain	G
Drain	G	Sanitary Sewer	G
Electrolyte	W	Scum	G
Filtered Water	G	Storm Sewer	G
Filtrate	BR	Sulfur Dioxide (gas and solution)	O
Grit and Screenings	G	Thickened Sludge	BR
Hot Water	Y	Treated Water	G
Lime	B	Vacuum	Y
Non-Potable Water	G	Waste Activated Sludge	BR
Polymer	W	Wastewater	G
Potable Water	G		

- 2. Provide ANSI standard for other piping.
- G. Pump piping:
 - 1. Provide one each of the following markers at each pump. Locate at the piping connection to the pump.

LEGEND WORDING	MARKER COLOR
Suction	Y
Discharge	GW

2.2 VALVE IDENTIFICATION TAGS

- A. Provide an identification tag for each exposed valve, or buried valve with exposed actuator.
- B. Provide anodized aluminum tag, .032" thick, 2" diameter with 3/16" top hole.

- C. Engrave one side.
- D. Provide color to match material for valve service from schedule in 2.1 above.
- E. Include the following information on each valve:
 - 1. Valve number.
 - 2. Contents
 - 3. Normal position
 - a. "Normally Open" or "Normally Closed"
- F. Attach to valve with stainless steel "S" hook and No. 16 stainless steel jack chain.

2.3 VALVE AND GATE IDENTIFICATION MARKERS

- A. Provide 3-1/2" diameter identification markers with 1/2" diameter aluminum stem suitable for setting into concrete.
 - 1. 6000 series aluminum.
 - 2. Domed top set such that marker top is flush with concrete surface.
 - 3. Markers shall be factory stamped and characters shall be a minimum of 3/16" high or as indicated on the drawings.
- B. Provide identification markers at all buried valves.
 - 1. Set markers in 12" x 12" x 6" thick concrete pad or as indicated on the drawings and locate adjacent to valve box.
 - 2. Markers shall indicate:
 - a. Valve size and type (i.e., 8" GATE VALVE).
 - b. Contents of pipe (i.e., NON-POTABLE WATER).

PART 3 - EXECUTION

3.1 LOCATION FOR MARKERS

- A. Adjacent to each valve and fitting.
- B. At each branch and riser take-off.
- C. At each pipe passage through wall, floor or ceiling.
- D. At each pipe passage to underground.
- E. On all horizontal pipe runs, mark every thirty (30') feet.

3.2 PIPE MARKER INSTALLATION

- A. Clean pipe surface and apply markers in accordance with manufacturer's instructions.
- B. When applied to insulated or siliconed surfaces:
 - 1. Use pressure sensitive bonding type around both ends of the marker, being sure to overlap the tape onto itself.

3.3 VALVE AND GATE MARKER INSTALLATION

- A. Cast in concrete adjacent to valve or valve box cover or countersink into existing concrete.
- B. Utilize manufacturer's approved anchoring cement for all markers installed in existing concrete.
- C. Install top flush with concrete with no edges of marker exposed.

3.4 INSPECTION

- A. Correct defects and/or deficiencies to satisfaction of the Engineer.

3.5 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 11245

LIME SLURRY STORAGE AND FEED EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide a lime slurry storage and delivery system with storage tanks, metering pumps, piping, instrumentation, controls and other associated appurtenances as specified herein, indicated on the contract drawings, or as needed to provide a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 02751 – Plant Piping, Valves and Appurtenances.
 - 3. Division 13–Instrumentation and Controls.
 - 4. Division 16 – Electrical.

1.2 QUALITY ASSURANCE

- A. Referenced manufacturer is the Burnett Lime Company and is named to establish standards of quality.
- B. Technical services: Provide service of equipment manufacturer's service engineer, complying with Section 01660 and the following:
 - 1. Installation, prior to foundation pad construction – One day, one trip.
 - 2. Start-up – Six days, two trips.
 - 3. Training – One day, one trip.
 - 4. Provide services required for conducting an on-site pilot test to determine system feed rates, pump sizes, tubing sizes, etc. The pilot test is to take place after the new wastewater treatment plant biological treatment process have been completed and are fully operational. The pilot test will be conducted for a minimum of fourteen (14) days.
- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- D. Unit responsibility:
 - 1. The lime slurry storage and feed equipment specified in this section is an integrated system and as such will be furnished by one equipment supplier who shall provide all of the equipment and appurtenances, regardless of manufacturer, and be responsible to the Contractor for the complete and satisfactory operation of the entire system.
 - 2. The Contractor is fully and solely responsible for the work of the systems supplied and solely responsible to the Owner for having supplied the complete lime slurry storage and feed equipment system.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Results and recommendations for feed rates, pump sizes, tubing sizes, etc.
 - 3. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 4. Shop drawings showing materials of construction and plan, elevation, and sectional views of the tanks, pumps and associated equipment.
 - 5. Tank design calculations, including anchoring system, stamped and signed by a registered professional engineer in the state of South Carolina.
 - 6. Names and addresses of the nearest service and maintenance organization that readily stocks repair parts.
 - 7. Submit complete control panel wiring diagrams and panel schematics. Provide panel front and back panel drawings. Submit all control panel component product literature with completed catalog numbers.
- C. Provide Operation and Maintenance manuals complying with Section 01650.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. Each unit shall be carefully transported, stored, handled and set in place in a manner that will prevent distortion, misalignment or other damage to the units.
- C. During storage prior to installation and following installation, the manufacturer's recommendations regarding handling shall be followed.

1.5 JOB CONDITIONS

- A. Install all equipment at the location and within the space allotted on the Contract Drawings.
- B. Structural, piping, wiring or any other modifications necessary to accommodate equipment offered other than that shown or specified shall be made at no additional cost to the Owner.

1.6 SPARE PARTS

- A. Provide one (1) spare metering pump to meet the highest feed rate design condition.

1.7 WARRANTY

- A. Comply with provisions of Section 01650.

PART 2 – PRODUCTS

2.1 STORAGE TANKS

- A. Provide single compartment, welded steel, lime slurry storage tanks designed and fabricated to exceed the minimum requirements of AWWA D100-96.

B. Fabricate with steel as specified by ASTM A36.

C. Storage requirements:

Qty	Volume	Chemical	Conc By Weight	Spec Gravity
1	16,000 gal	Liquid Lime Slurry	5% - 30%	1.06 – 1.18

D. Loading conditions:

1. Gas pressure, design: atmospheric
2. Temperature, operating: ambient
3. Temperature, max: 150 deg F.
4. Roof loading, concentrated: 500 lbs.
5. Wind loading, ANS/ASCE 7-02 100 mph, Exp B
6. Seismic loading, IBC 2003: $S_{DS}=0.40$
 $S_{d1}=0.21$
Importance Factor, $I_E=1.5$
Site Class "C"

E. Dimensional requirements:

1. Provide vertical, flat bottom, cone top, single compartment, cylindrical tanks.
2. Approximate dimensions:
 - a. Inside diameter: 12'-0"
 - b. Standing height: 20'-8"
 - c. Sidewall height: 19'-0"
 - d. Min. sidewall thickness: 3/16"
 - e. Min. top and bottom plate thickness: 1/4"

F. Tank appurtenances: Provide the following appurtenances for each tank.

1. Fitting schedule: (See Drawings for orientation):

Connection	Service	Location
12" Flg. nozzle	Mixer mounting	Top
24" manway	Inspection port	Top
2" Flg. nozzle	Vent	Top
2" Flg. nozzle	Water fill	Top
2" Flg. nozzle	Slurry fill	Top
6" Flg. nozzle	Level sensor	Top, 18" min. from sidewall
3" Flg. nozzle	Recirculation	Top
4" Flg. nozzle	Overflow	Sidewall, 6" below top
24" manway	Inspection port	Sidewall, 3'-6" above bottom
6" Flg. nozzle	Pump suction	Sidewall, 9" above bottom
6" Flg. nozzle	Pump suction	Sidewall, 9" above bottom
3" Flg. nozzle	Drain	Sidewall, 2" above bottom

2. Vents: Provide mushroom type.
3. Baffles: Provide four 10-inch wide by 18 feet long gusseted baffles fabricated from 1/4" steel plate positioned 1-inch off the wall.

4. Anchors lugs: Provide a minimum of four (4) anchor lugs.
5. Anchors: Provide 3/4" x 16" Type 316 stainless steel anchors for each anchor lug.
6. Provide OSHA compliant ladder, ladder cage and full tank perimeter handrail constructed of fiberglass reinforced plastic.
 - a. Comply with Section 06600 – Fiberglass Reinforced Plastic Products and Fabrications.
7. Pipe supports: Provide stand-off pipe supports and clamps with a maximum spacing of 8-feet on-center for overflow line, slurry fill line, and water fill line.
 - a. Provide stand-off pipe supports from 2" x 2" x 1/4" angles x length required welded to the tank.
 - b. Clamp pipe to angles using 316 stainless steel u-bolts.
8. Lifting lugs: Provide a minimum of two (2) lifting lugs.
9. Provide 2-inch fill pipes and 4-inch overflow pipes with quick connects.

G. Painting:

1. Shop painting: Prepare tank dome, wall exterior and appurtenances by SP-6 commercial sandblast followed by one coat of Tnemec Series 1 Omnithane (4 dry mils) or approved equal.
2. Field painting: Comply with Section 09900 – Painting.
3. Provide coal tar epoxy coating (14 mils) on bottom of tank.

2.2 LIME SLURRY EQUIPMENT BUILDING

A. General:

1. Provide a nominal 10'-0" x 8'-0" metal building with the tank shell forming one of the walls.
2. Provide a minimum clear height inside the enclosure of 7'-0".
3. Construct building with 1-1/4" Type 304L stainless steel tube frame with 3" vinyl backed insulation.
4. Provide 26 gauge exterior wall panels, roof panels and flashings.
 - a. Provide a Kynar 500 finish or approved equal.
 - b. Color to be selected by the Owner.
 - c. Provide Type 316 stainless steel hardware.
5. Provide single access door, 36" x 84" with all stainless steel hardware.
6. Furnish building with one (1) 1.5 kw, 120 volt, wall mounted, forced air electric heater with a built in thermostat/on-off switch.
 - a. Heater to be UL rated.
 - b. Furnish with corrosion resistant coating.
 - c. Allow for replacement of the switch or heating elements without having to replace the entire heater or without needing special tools.
 - d. Provide Type 316 stainless steel screws.
 - e. Heater shall be Markel Co. Model 4300 surface mounted wall heater or approved equal.
7. Provide one (1) 12" sidewall propeller exhaust fan with aluminum gravity discharge shutter and aluminum weather hood, thermostat, 120 volt, with a minimum 1600 cfm free air capacity.
 - a. Provide a finger guard.
 - b. Mount high on one of the side walls.
 - c. Provide 12" square aluminum gravity inlet air shutter with aluminum weather hood and insect screen mounted low on the opposite wall from the fan.
 - d. Furnish one (1) weatherproof, exterior mounted, 15 amp, PVC toggle switch for control of the fan.
 - e. Provide Kynar 500 finish on exterior weather hoods for fan and inlet

- shutter to match color of building or approved equal.
 - f. Fan shall be Greenheck Corp. Model No. S1-12-432-A4, 1636 CFM @ 0.0" SP, 1/4 HP, 1750 RPM, 8.7 Sones or approved equal.
 - g. Fan and motor guard shall be furnished with Hi-Pro Poly corrosion protective coating.
 - h. Gravity inlet air shutter shall be Ruskin Mfgr. Co. Model BD2/A2 aluminum gravity shutter with flange frame, vinyl edge seals and rear mounted insect screen. Provide weather hood for inlet shutter to match hood for fan or approved equal.
 - i. Provide Type 316 stainless steel screws.
- 8. Electrical Requirements – All conduits shall be PVC 80. All fittings shall match the conduit material. Refer to 16400 for conduit supports. Additionally, all electrical materials and work shall meet the requirements of Division 16000 of these specifications.
- 9. Provide LED lighting fixtures to achieve at least 30 fc, controlled by a weatherproof switch.
- 10. Provide one (1) 120 volt interior located GFI outlet with gasketed cover
- 11. All lighting, heater, ventilation, switches and outlets are to be pre-wired in PVC schedule 80 conduit and shall be powered from LCP-LS-1.
- 12. Provide liquid lime system tank and building with grounding lugs.

2.3 TANK MIXER

A. General:

- 1. Provide a vertical, flange mounted mixer with two axial flow, and one radial flow impeller sized and positioned to maintain a homogeneous mixture of up to 30% lime slurry at ambient temperature.
- 2. Provide mixer suitable for operation within the storage tank dimensions and service specified.

B. Motor:

- 1. Provide TEFC continuous duty motor with severe duty canopy and the following characteristics.
 - a. Horsepower: 10
 - b. Maximum speed: 1750
 - c. Power: 460, 3-phase, 60 Hz
 - d. Drive: SEW-Euro Drive for direct mounting to gear reducer.
 - e. Frame: DRV - 132M4
 - f. Or approved equal.

C. Local disconnect switch: Provide a NEMA 4X local disconnect switch for the mixer located within visible sight of the mixer motor and entrance man way to the tank.

- 1. Provide conduit and electrical appurtenances complying with Section 16400 – Electrical.

D. Speed reducer:

- 1. Provide speed reducer designed for mixing service and operation in a corrosive outdoor environment. Speed reducer must meet AGMA standards and bear an AGMA nameplate.
- 2. Construct and support speed reducer output shaft so that the shaft deflection, caused by operational loads, does not affect alignment of the anti-friction bearings or cause misalignment of gearing during mixer operation.

3. Reducer output shaft must be self-supporting when the turbine shaft bearings are removed for assembly or disassembly.
4. The locknut and washer, and all adapter type bearings, must be readily accessible from outside the bearing housing.
5. Provide a minimum rated B-10 life of 100,000 hours for the reducer output shaft bearings.
6. Provide severe duty, anti-friction type reducer bearings, oil or grease lubricated.
7. Speed reducer to be splash lubricated, by means of gears or a slinger rotating on a horizontal shaft in an oil bath, to ensure positive displacement of the oil upward for lubrication of critical bearings.
8. Provide a single oil drain at the low point of the speed reducer to allow oil drainage and leave a maximum residual of oil of no more than ¼-inch in the drive housing.

E. Mixing impellers and shaft:

1. Provide carbon steel shaft and impellers.
2. Maximum operating speed of the unit to be 0.5 times the natural frequency of the shaft and impeller assembly.
3. Provide a minimum shaft diameter of 3 inches. Determine diameter required by an analysis of torque and bending moment as well as critical speed.
4. The shaft supporting the turbine must be removable from the speed reducer without disturbing the gears of the speed reducer using a rigid flange coupling on the impeller shaft.
5. Support impeller shaft on two-adaptor type, anti-friction bearings designed to carry the mixer shaft loads and such that a thrust bearing will support the entire weight of the vertical shaft and impellers.

F. Acceptable model: Tesco Model LSM 16-30 with motor and Eurodrive F series gear reducer or approved equal.

2.4 METERING PUMPS

A. Description:

1. Provide two (2) hydraulic, tubular diaphragm type chemical metering pumps.
2. Provide two (2) pumps for operating conditions to be determined by the on-site pilot test. The pumps are to be capable of operating at a service speed of 116 spm.
3. Provide a minimum turndown of 10 to 1 by variation of the stroke length of the pump.
4. Provide automatic stroke adjustment with 4-20 mA input and output.
5. Acceptable model: Pulsafeeder Series PulsaPro 880 or approved equal.

B. Materials of construction:

1. Diaphragm and valve gaskets: PTFE.
2. Pump body: Cast iron.
3. Cover and coupling guard: Cast aluminum.

C. Motor:

1. Provide ½ or ¾ Hp TEFC, 1750 rpm, continuous duty motor, with a 1.15 service factor (size to be verified based upon pilot test results).
2. Motor to be sized by equipment supplier.

3. Provide motor suitable for operation on 460 volt, 3-phase, 60 Hz electrical service.
4. Provide chemical and mill duty rated motor.
5. Provide Baldor Model M8001 or M8002 or approved equal.

D. Control:

1. Provide automatically controlled stroke length via an electric stroke-length controller.
2. Automatically regulate stroke length by a 4-20 mA process variable input signal.

2.5 PIPING, VALVES AND APPURTENANCES

A. Lime slurry feed lines:

1. Provide clear flexible reinforced vinyl tubing..
 - a. Comply with Section 02751.
2. Provide sufficient length of tubing for two feed lines (1 primary and 1 spare) to all feed points.
3. The equipment supplier is responsible for sizing tubing for proper operation of the system based upon the results of the pilot test.

B. Lime slurry isolation valves:

1. Provide 2-inch flanged pinch valves as manufactured by ONYX Controls or equal.
2. Provide one limit switch on all pinch valves.
 - a. Interlock the limit switch in the pump run circuit to assure positive position of the valve for pump protection.

C. PVC piping and valves: Provide Schedule 80 PVC piping and valves in accordance with Section 02751.

D. Water meter:

1. Provide one (1) water meter for measurement of dilution water volume into slurry tank.
2. Provide 2-inch nutating disc, positive displacement water meter complying with ANSI/AWWA standard C700.
3. Operating range: 1.25 to 170 gpm.
4. Sealed register:
 - a. Provide straight reading, permanently sealed magnetic drive register indicating gallons.
 - b. Provide odometer type totalizing display, 360-degree test circle with center sweep hand and flow finder to detect leaks.
 - c. Provide removable register without the need to disrupt water service.
5. Acceptable model: Badger Model 170 or approved equal.

E. Quick connects:

1. Provide hose quick connect couplings for tank fill lines.
2. Provide stainless steel male adaptor coupling with lockable female cap for adaptor.
 - a. Furnish in CF-8M stainless steel with stainless steel arms.
 - b. Cam arm finger rings and pins are to be stainless steel.

3. Provide No. 10 stainless steel jack chain to permanently fix cap to adaptor and of sufficient length to avoid interference with operation of coupling.
 4. Provide standard Buna-N gaskets.
 5. Provide OPW Kamlok or equal.
- F. Water flush valve: Provide an Assured Automation Motorized PVC true union ball valve for automatic flushing of each metering pump.
- G. Hose bib: Provide one (1) ¾" hose bib on water supply header.
1. Comply with Section 02751.

2.6 INSTRUMENTATION

- A. Level sensors:
1. Provide level measurement for one (1) lime slurry storage tank with an ultrasonic level sensor.
 2. Provide a microprocessor based echo-time measuring type consisting of one (1) transmitter and one (1) transducer. The transducer shall be EchoMax XPS-15 as manufactured by Siemens. The level display shall be mounted near the control panel and shall be MultiRanger SITRANS LT500.
 3. Provide in compliance with Section 13320.
- B. Pressure:
1. Provide transducer/indicating transmitter shall be manufactured by Endress-Hausser and provided at each pump discharge line with a Red Lion indicator on the door of the control panel.
 2. Provide in compliance with Section 13320.

2.7 CONTROL AND LEVEL PANELS

- A. Provide control panel to house all motor starters, relays, timers and devices for control and operation of the equipment.
1. Provide terminal strips for remote signal/equipment interface within the panel.
 2. Power supply: 480 VAC, 3-phase.
 3. Provide a flange-mounted circuit breaker in the control panel for termination of power feed. The circuit breaker shall have a minimum AIC rating 30kAIC.
 4. Provide a control power transformer with primary and secondary over current protection and an allowance of 250 VA for spare capacity.
 5. Operate all controls on 120 VAC maximum.
 6. Enclosure: NEMA 4X Type 304L stainless steel, bottom entry, flange-mounted disconnect. Provide a grounding lug within the panel to assure positive grounding system.
 7. Panel Construction: Protect all wiring across panel hinges. Provide numbered terminal strips for all field wiring terminations.
 8. Engraved nameplates: Provide engraved nameplates with white background and black letters on all front panel-mounted devices.
 9. Monitoring and Control: Refer to P&ID for control and remote monitoring signals. Provide required contacts to achieve desired function
 10. Tank level: House level indicator for the tank adjacent to the Control Panel. Contacts for monitoring level will be located in the control panel. Produce a high level alarm and a re-order alarm light. Provide an additional contact for remote monitoring.

11. Provide terminations for remote connections to the auxiliary panel. All contacts shall be in the control panel.
12. Mount all switches and indicator lamps on the outside face of the panel.
13. Surge protection: Protect all analog signal wiring and AC power wiring against lightning spikes and other transient surges at all control panel termination points. Provide Siemens TPS Series surge protection device or approved equal/
14. Circuit breaker: Provide 60 Amp Type M isolation breaker for the Panel. Provide ITED 43B060L or equal.
15. Starters and Motor protection: Control and protect pump motor with Allen Bradley Model AB140MC2E-B16, Type E motor protectors, Allen Bradley Model 1492-EECB and 1492-EEEEB Overload Relays and self-protected manual combination starters Allen Bradley Model 100-C09D10 and 100-C16D10 with adjustable amperage breaker. Motor protection shall conform to circuit breaker requirements as defined by IEC and UL Standards or approved equal.
16. Relays: Provide heavy-duty construction control type relays with 10 amp, 600 volt reversible contacts. Provide Allen-Bradley 700, Type H or approved equal.
17. Selectors: Provide 30.5 mm, heavy duty, NEMA 4X rated selectors with 10 amp rated contacts (continuous), 6 amp breakers at 120 VAC. Provide Allen-Bradley, Type 800H or approved equal.
18. Horn: Provide surface mounted, weatherproof horn with sealable side conduit entry and rated for NEMA 4X. Horn to generate loud audible alarm when activated by 115 VAC power. Provide Federal model 350W, or equal.
19. Running lights: Provide "green" run 30.5 mm transformer type "push to test" indicator lights. Provide Allen-Bradley type 800H for each motor or approved equal.
 - a. Green: Run
 - b. Amber: Fault and Low Level
 - c. Red: High Level and Reorder
 - d. White: 120 VAC Power On
 - e. Blue: 24 VDC Power On
20. Instrumentation circuit breaker: Provide 120V, 20A, 1-pole, molded case type circuit breaker for auxiliary use.
21. Provide PLC for control and SCADA interface.
 - a. Interface with PI&C network via Ethernet IP.
 - b. Provide Ethernet/IP & RS-232 comm. ports.
 - e. Modular I/O units, selected to suit application.
 - f. Rackless I/O platform.
 - g. Provide 10% spare digital and analog I/O.
 - h. Programming will be relay ladder, function block diagram, structured text, or sequential function block.
 - i. Acceptable product is Allen-Bradley CompactLogix L33ER or equal.
 - j. Coordinate with PI&C Systems Integrator.

B. Provide a Tank Level Panel to house the level transmitter and tank level indicator.

1. Provide a NEMA 4X rated, IP65 polycarbonate wall mount unit.
2. Provide contacts for remote monitoring of available signals.
3. Provide terminals for remote connections to auxiliary panel.

C. Local control and monitoring: Provide the following local control and monitoring with the control panel and instrumentation (components to comply with Part 2.7.A.):

1. Metering pumps:
 - a. Refer to P&ID.
 2. Storage tank:
 3. a. Refer to P&ID. Mixer:
 - a. Refer to P&ID.
- D. Remote control and monitoring: Provide the capability of the following remote control and monitoring functions within the local control panel for connection of input/output signals from PI&C system (PCP 2.0).
1. Metering pumps:
 - a. Control start/stop with HOA switch.
 - b. Control pump feed rate via a 4-20 mA input signal.
 - c. Indicate pump run status.
 - d. Indicate local HOA switch position.
 - e. Indicate phase/OL fault alarm.
 - f. Indicate pressure transmitter output via a 4-20 mA signal.
 - h. Indicate pump feed rate.
 - i. Totalize pump feed rate.
 2. Storage tank:
 - a. Indicate continuous level via level transmitter 4-20 mA output.
 - b. Indicate low level and high level alarm.
 - c. Indicate re-order level alarm.
 3. Mixer:
 - a. Control start/stop with a selector switch.
 - b. Indicate run status via starter contact.
 - c. Indicate mixer off alarm.

2.8 OTHER MATERIALS

- A. Provide other materials, products or items not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 COORDINATION

- A. 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.

3.2 INSTALLATION

- A. Storage tank:
 1. Deliver and install tank and pre-constructed pump enclosure at the same time.
 2. Inspect foundations to insure they are flat and smooth with maximum deviation not to exceed 1/8" per 10' in any direction.
 3. Install tank in accordance with manufacturer's written instructions.
 4. Use all hold-down lugs provided, anchoring with properly sized Type 316 stainless steel bolts, etc.
 5. Do not grout tank.
 6. Sequence of anchoring:
 - a. Fill tank.
 - b. Shim beneath lugs.

- c. Tighten bolts.
- 7. After the tank has been set and anchored, perform a leak test to verify that no structural damage has occurred during shipment and installation.
 - a. Blind flange all nozzles and fill the tank with water to 100% capacity.
 - b. Tanks will be considered watertight when there is no measurable drop in the water level, and there are no visual leaks, and the water loss does not exceed an average of 0.1 % of the initial water volume in each 24 hour period over the course of a total test period of 72 hours.
 - c. Drain, clean and dry the tank before it is placed into operation.

B. Metering pumps:

- 1. Locate as shown on the drawings. Anchor with Type 316 stainless steel hardware.
- 2. Mount each pump on a metering pump stand or base.

C. Level transmitters: Mount Level Transmitter using 316 stainless steel hardware.

D. Piping:

- 1. Install suction and discharge tubing and water piping as indicated on the Contract Drawings.
- 2. Locate piping parallel with, or at right angles to, walls, ceilings, equipment, etc. unless otherwise indicated or directed.

E. Electrical and control wiring: Comply with pertinent provisions of Section 16400.

3.3 PAINTING

A. Comply with pertinent provisions of Section 09900.

3.4 TESTING AND INITIAL OPERATION

- A. Manufacturer's service engineer shall test and place all equipment in initial operation and provide training in operation to Owner's personnel.
- B. Replace or remedy to satisfaction of the Engineer any defective materials, equipment, etc.
- C. Pilot testing: The system supplier is responsible for conducting pilot testing for final sizing and set up of the lime system. All costs for the pilot test including, but not necessarily limited to, chemical used, delivery and set up of the equipment and chemical, temporary services for water, power, feed lines, maintenance, etc. are to be included in the price bid for the system.

3.5 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work in this Section and all payment for same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 13401

INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, calibrate, test, start-up, and place in satisfactory integration with the existing Plant Monitoring and Control System (PMCS).
- B. Contractor shall retain the services of a Control System Integrator (CSI) to provide the requirements specified herein.
- C. The CSI and Process Systems Integrators (PSI's) shall coordinate and be responsible for a complete and operational system..

1.2 DEFINITIONS

A. Abbreviations

- 1. CSI – Control Systems Integrator
- 2. HMI – Human Machine Interface
- 3. OIT – Operator Interface Terminal
- 4. P&ID – Piping and Instrumentation Diagrams
- 5. PLC – Programmable Logic Controller
- 6. PMCS – Plant Monitoring and Control System
- 7. PSI – Process Systems Integrator
- 8. RTU – Remote Terminal Unit
- 9. SCADA – Supervisory Control and Data Acquisition

B. Terms

- 1. CSI – A person or company that specializes in bringing together component subsystems into a whole and ensuring that those subsystems function together, a practice known as system integration. CSIs typically work for the Contractor but in some cases will work directly for the Owner.
- 2. HMI – Client software that requests data from a data acquisition server and is the graphical user interface for the operator, collects all data from external devices, creates reports, performs alarming, sends notifications, etc.
- 3. OIT – Computer hardware which presents processed data to a human operator, and through this, the human operator monitors and controls a process via HMI software. Examples of OITs are computer terminals and touch screens.

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4. P&ID – A diagram which shows the piping of the process flow together with the installed equipment and instrumentation. A P&ID also shows the interconnection of process equipment and the instrumentation used to control the process. In the process industry, a standard set of symbols is used to prepare drawings of processes. The instrument symbols used in these drawings are generally based on International Society of Automation (ISA) Standard S5. 1.
5. PLC – An industrial solid-state device that monitors and controls inputs & outputs and makes logic-based decisions for automated processes or machines.
6. PMCS – A term that references the overall plant control network including SCADA, DCS, PLCs, RTUs, remote & local controls, instrumentation, and communications.
7. PSI – Similar to the CSI with the exception that this person or company provides integration services specific to a single process such as the instrumentation/control system for screening, degritting, or filtration. Each PSI works for their respective process equipment supplier/manufacturer.
8. SCADA – A networked computer system for remote monitoring and control that operates with coded signals over communication channels.

1.3 SUBMITTALS

- A. Comply with the requirements specified in Section 01340.
- B. Provide manufacturer data for products list in Part 2.
- C. PMCS (Existing)
 1. System Description
 - a. Detailed block diagram showing the existing and the added system hardware configuration and identifying model numbers of the new system components.
 - b. Format, protocol and procedures for data highway communications and local communications with input/ output modules and peripheral devices.
 - c. Documentation of all PLC programs including the databases to establish communication between the PLC and PMCS.
- D. Operation and Maintenance Manuals.
 1. Comply with the requirements of Section 01650.
 2. Include the following:
 - a. Updated manufacturer data sheets.
 - b. Loop diagrams.
 - c. PMCS HMI screens (Screenshots).
 - d. Training manuals.

1.4 QUALITY ASSURANCE

- A. Comply with the requirements specified in Section 01650.
- B. Reference Standards
 - 1. The following organizations have generated standards that are to be used as guides in assuring quality and reliability of components and systems; govern nomenclature; define parameters of configuration and construction, in addition to specific details in the Contract Documents:
 - a. The Instrumentation, Systems and Automation Society, (ISA)
 - b. Underwriters' Laboratories, Inc., (UL)
- C. Subject to compliance with requirements, available integrators offering services and products that may be incorporated into the Work include.
 - 1. Carolina Technical Services
Attn: Danny Kruchkow
Danny@carolinatechnical.com

1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with the requirements specified in Section 01640.
- B. Delivery, Storage, And Handling
 - 1. Comply with any additional requirements of the CSI.

PART 2 - PRODUCTS

2.1 WIRELESS ETHERNET (GHOST BRIDGE)

- A. Description:
 - 1. The ethernet ghost bridge shall be used to establish a non-wired communication path between PLC systems to share real-time data points without hardwired I/O. The virtual bridge shall be configured over the plant's Ethernet network to enable bidirectional communication of process signals between the SCADA system and LCP-LS-1.
- B. Functional Requirements:
 - 1. Ghost bridge shall use wireless Ethernet or a manually agreed-upon industrial protocol.
 - 2. Logical signals shall be mapped through the ghost bridge and treats as internal SCADA tags.
 - 3. Tag naming, data types, and communication addressing shall be coordinated between the system integrator and control panel manufacturer.

4. The ghost bridge shall not require any physical I/O modules for signal routing between SCADA and the Lime Slurry Control Panel LCP-LS-1.
5. The bridge shall support at a minimum:
 - a. Reading of flow rate from SCADA to LCP-LS-1.
 - b. Transmission of pump control signals from LCP-LS-1 to SCADA.
 - c. Alarm and status data for monitoring and HMI display.

C. Configuration and Commissioning:

1. The SCADA integrator shall be responsible for configuring and validating the ghost bridge communication path during commissioning.
2. A full list of ghost bridge tags shall be submitted for approval prior to system integration.
3. The control system shall ensure fail-safe conditions are met in the event of loss of communication between systems.

D. Products

1. Accepted manufacturers include: AdaLov CPE369 Slave Wireless Bridge and compatible PoE adapter, or Engineer Approved Equal.
2. CAT 5E network cable as needed.
3. AdaLov CPE369 Master Wireless Bridge, PoE adapter and compatible Ethernet Switch to connect to SCADA and receive signal from the slave Wireless Bridge.
4. System integrator shall provide complete documentation including IP configuration, antenna orientation, and mounting details.

2.2 ETHERNET SWITCH

- A. 1 Port
- B. Power Over Ethernet
- C. RJ-45

PART 3 - EXECUTION

3.1 CONTRACT CLOSEOUT

- A. Comply with the requirements specified in Section 01700 "Contract Closeout".

3.2 SYSTEM HARDWARE OPERATIONAL TESTING

- A. All input/output devices and components shall be tested to verify operability and basic calibration.

3.3 START-UP SERVICES

- A. The CSI shall include 40 man-hours for Start-up in their bids. These hours will be on site. Any hours not used for Start-up shall be used for Owner-directed field programming changes. The Contractor shall provide one instrumentation technician to work with the integrator during the Start-up time.

END OF SECTION

SECTION 16400

ELECTRICAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide a complete electrical system as indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 05990 – Miscellaneous Metals.

1.2 ABBREVIATIONS

A	Ampere (Amps)	MCA	Minimum Circuit Amps
AFF	Above Finished Floor	MCC	Motor Control Center
AFG	Above Finished Grade	MCM	1000 Circular Mils (KCMIL)
AHJ	Local Authority Having Jurisdiction	MOCP	Maximum Over-current Protection
AIC	Amps Interrupting Current	N	Neutral
AFCI	Arc-Fault Circuit Interrupter	NEC	2011 National Electrical Code
ANSI	The American National Standards Institute	NEMA	National Electrical Manufacturers Association
BF	Ballast Factor	NFPA	National Fire Protection Association
Bkr.	Breaker	NIC	Not in Contract
C	Conduit	OSHA	Occupational Safety and Health Act
Ckt.	Circuit	PF	Power Factor
CRI	Color Rendering Index	PLC	Programmable Logic Controller
CU	Copper Conductor	PVC	Polyvinyl Chloride Conduit
DETD	Dual Element Time Delay Fuse	RGSC	Rigid Galvanized Steel Conduit
Disc.	Disconnect	RMS	Root Mean Square
Dn	Down	RTU	Remote Terminal Unit
EMT	Electrical Metallic Tubing	SCADA	Supervisory Control and Data Acquisition
FLA	Full Load Amps	SCCR	Short-Circuit Current Rating
FPM	Fuse per Manufacturer Requirements	SPD	Surge Suppression Device
FS	Federal Specifications	Sym	Symmetrical
G or Gnd.	Ground	THD	Total Harmonic Distortion

GFCI	Ground-Fault Circuit Interrupter	TSP	Twisted Shielded Pair
GFP	Ground-Fault Protection	TST	Twisted Shielded Triplet
HD	Heavy Duty	TVSS	Transient Voltage Surge Suppressor
HP	Horsepower	UL	Underwriters Laboratories Inc.
IBC	International Building Code	UON	Unless Otherwise Noted
IEEE	The Institute of Electrical and Electronics Engineers	V	Volts
IMC	Intermediate Metallic Conduit	W	Watts
KVA	Kilovolt-Amps	WFC	Watertight Flexible Conduit
KW	Kilo Watt	WG	Wire Guard
KA	Kilo Amps	XFMR	Transformer
LCCF	Lamp Current Crest Factor		

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. These shall include, but not be limited to, an electrical supervisor who is a licensed master electrician, a field foreman with a minimum journeyman electrician's license and adequate electricians and helpers.
- B. Without additional cost to the Owner, provide such other labor and materials required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.
- C. Electrical subcontractor shall furnish a 100 percent performance bond and a 100 percent payment bond to the Contractor as security for the faithful performance of this Section, as security for the payment of all persons performing labor on the project under this Section and furnishing materials in connection with this Section. The performance bond and payment bond shall be in separate instruments.

1.4 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Manufacturer's data sheets for each product listed in Part 2.
 - 2. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.

C. Layouts:

1. In addition to manufacturer's equipment shop drawings, submit electrical installation working drawings containing the following:
 - a. Concealed and buried conduit layouts, shown on floor plans drawn at not less than $1/4" = 1\text{-ft-0-in}$ scale. The layouts shall include locations of process equipment, motor control centers, transformers, panelboards, control panels and equipment, motors, switches, motor starters, large junction or pull boxes, instruments and other electrical devices connected to concealed or buried conduits.
 - b. Plans shall be drawn on high quality reproducible, media, size 22" by 34" and shall be presented in a neat, professional manner.
 - c. Concrete floors and/or walls containing concealed conduits shall not be poured until conduit layouts are approved.

D. Operational and Maintenance Manual: Upon completion of this portion of the Work and as a condition of its acceptance, provide operation and maintenance manuals in accordance with the provisions of Section 01650 of these Specifications. Include within each manual:

1. Copy of the approved Record Documents for this portion of the Work.
2. Copies of all circuit directories.
3. Copies of all warranties and guaranties.

1.5 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

1.6 WARRANTY

- A. Provide standard one (1) year warranty on all labor and materials.
- B. Provide minimum ten (10) year warranty on Surge Protection Devices, incorporating unlimited replacements of suppressor parts if destroyed by transients during the warranty period.
- C. Provide standard five (5) year parts and labor warranty on manual transfer switches.
- D. Comply with Section 01650.

1.7 RULES AND PERMITS

- A. The entire installation shall be in accordance with the latest edition of the NEC, OSHA, and all local codes.
- B. Apply and pay for all permits and inspections required by local or state laws.
- C. Furnish the Owner with certificate of inspection and final approval from all authorities having jurisdiction.
- D. Installers of PVC Coated Conduit shall be certified and be able to present a valid, unexpired installer certification card prior to installation taking place.

1.8 DRAWINGS

- A. The drawings and specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. The drawings are diagrammatic and are to be followed as closely as the construction will permit.
- B. The drawings show the general location of outlets, conduits and circuit arrangement. Because of the small scale of the drawings, it is not possible to indicate all of the detail involved. The Contractor shall carefully investigate the structural and finish conditions affecting all his Work and shall arrange such work accordingly, furnishing such fittings, junction boxes and accessories as may be required to meet such conditions.

1.9 ELECTRICAL OUTAGE

- A. Coordinate all outages with the Owner, 72 hours prior. Schedule all outages such that they will not interfere with normal plant operation and that there will be no delays in equipment startup and placing the facilities in operation.

1.10 SPARE PARTS

- A. Provide the following spare parts to Owner in neatly packaged box marked with contents:
 - 1. Keys: One (1) set of spare panelboard/switchboard keys with lists to Owner.
 - 2. Fuses: One (1) box fuses for each type and size installed on the project.
 - 3. Fuse Puller: One (1) fuse puller to Owner capable of removing all types of fuses installed on job.
 - 4. SPD: One (1) SPD protection module per unit as an on-site spare.
 - 5. Control and Lighting Fixture Lamps: Ten (10) percent of quantity furnished, minimum of one of each type.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide only materials that are new, of the type and quality specified. Where Underwriters' Laboratories, Inc. have established standards for such materials, provide only materials bearing the UL label. Materials called for are to be considered as standard that, however, implies no right on the part of the Contractor to substitute other materials and methods without written authority from the Engineer.
- B. Temporary power:
 - 1. In addition to providing temporary power as described in Section 01500 of these Specifications, provide and pay the costs for installing permanent electrical meter or meters.
 - 2. When all equipment is in place and connected, and the Engineer determines the project is ready for final checkout, arrange to have the permanent metering installed in the Owner's name. At this point, the Owner will be responsible for all charges.
- C. Where any material or operation is specified by reference to published specifications or standards or the specifications or standards of any other organization; the referenced specification or standard shall be as much a part of this Section as if quoted in full herein.

2.2 RACEWAYS

- A. Applicable Standards:
 - 1. ANSI C80.1: Rigid Steel Conduits, Zinc-Coated.
 - 2. ANSI C80.3: Electrical Metallic Tubing, Zinc Coated.
 - 3. ANSI C80.5: Rigid Aluminum Conduits.
 - 4. ANSI C80.6: Intermediate Metallic Conduits.
 - 5. ANSI/NEMA FB1: Fittings and Supports for Conduit and Cable Assemblies.
 - 6. UL 6: Rigid Steel Conduit – Zinc Coated.
 - 7. UL 651-2002: Schedule 40 PVC and schedule 80 Rigid PVC Conduit.
 - 8. UL 514B: Flexible conduit fittings.
 - 9. NEMA RN 1: Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 10. NEMA FB 1: Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.
 - 11. ASTM F512: Polyvinyl Chloride (PVC) Conduit.

12. ASTM D870: Standard Practice for Testing Water Resistance of Coatings Using Water Immersion.
 13. ASTM D1151: Standard Practice for Effect of Moisture and Temperature on Adhesive Bonds.
 14. FS WW-C 581E: Federal Specification for Rigid Galvanized Steel Conduit.
 15. FS-WW-C-563A: Federal Specification for Electrical Metallic Tubing.
 16. FS-WW-C-540C: Federal Specification for Rigid Aluminum Conduit.
 17. FS WW-C 566: Federal Specification for Flexible Metal Conduit.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Wheatland.
 2. Allied Tube.
 3. Carlon.
 4. Perma-Cote; Division of Robroy.
 5. Ocal.
 6. Plasti-Bond
 7. KorKap
 8. Or Engineer Approved Equal.
- C. Metal Conduits, Tubing, and Fittings
1. Galvanized rigid steel conduit (GRC): Comply with ANSI C80.1 and UL 6.
 2. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit IMC.
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040 inch (1 mm), minimum.
 3. Liquid-tight flexible metallic conduit (LFMC): Flexible steel conduit with PVC jacket and complying with UL 360.
 4. 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.
 5. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
 6. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.
- D. Nonmetallic Conduits, Tubing, and Fittings
1. Rigid nonmetallic conduit (RNC): Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

2. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material. Provide threaded type fittings and form 8 conduit bodies with material to match conduit.
 3. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Conduit/Cable supports – properties:
1. Provide 316 stainless steel supports for all exposed metallic conduit as manufactured by Unistrut or approved equal.
 2. Provide fiberglass supports for all exposed non-metallic conduit/cable as manufactured by Aickinstrut or approved equal.
 3. Provide one-hole, PVC coated, malleable iron conduit straps with back spacer for all PVC coated rigid galvanized steel conduit.
 4. Provide PVC coated beam clamps with uncoated 316 stainless steel nuts and bolts for all PVC coated rigid galvanized steel conduit.
 5. Provide stainless steel strain relief and cable grips/supports for power cables. Tie each support off to the hanger support. Provide Type 316 stainless steel clevis hangers, McMaster Carr 3037T666 or equal, with stainless steel rods and Type 316 stainless steel hardware.
 6. Provide fiberglass loop hangers, McMaster Carr 451 or equal, with stainless steel rods for all exposed non-metallic conduit/cable.
- F. All conduits to conform to the following specifications:
1. Installation under concrete slab: Schedule 80 PVC.
 2. Exposed outdoor location: PVC-Coated Steel Conduit.
 3. Exposed Interior location: Schedule 80 PVC.
 4. Installation in concrete encased duct banks: Schedule 40 PVC.
 5. Installation underground exposed to earth: Schedule 80 PVC.

2.3 CONDUCTORS

- A. Applicable standards:
1. NEMA WC 3: Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 2. NEMA WC 5: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 3. UL 44 – 2002: Rubber-Insulated Wires and Cables.
 4. UL 83 – 1999: Thermoplastic-Insulated Wires and Cables.
 5. UL 854 – 2002: Service Entrance Cables.
 6. ATSM B496: Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors.

7. ICEA S-94-649: Concentric Neutral Cables Rated 5-46 kV.
 8. AEIC CS8: Specification for Extruded Dielectric Shielded Power Cables Rated 5 through 46 kV.
 9. RUS Bulletin 50-70: REA Specifications for 15 kV and 25 kV Primary Underground Power Cable.
- B. Conductors: Subject to compliance with requirements, provide products by one of the following:
1. Alpha Wire Company.
 2. Belden Inc.
 3. Cooper Industries, Inc.
 4. Encore Wire Corporation.
 5. General Cable; General Cable Corporation.
 6. Senator Wire & Cable Company.
 7. Southwire Company.
 8. Or Engineer Approved Equal.
- C. Connectors: Subject to compliance with requirements, provide products by one of the following:
1. 3M.
 2. AFC Cable Systems; a part of Atkore International.
 3. Gardner Bender.
 4. Hubbell Power Systems, Inc.
 5. Ideal Industries, Inc.
 6. NSi Industries LLC.
 7. O-Z/Gedney; a brand of Emerson Industrial Automation.
 8. Or Engineer Approved Equal.
- D. Conductors types:
1. Low Voltage Conductors (0-600V)
 - a. For secondary service entrance, feeders, underground, under floor, in damp or wet locations, and to any process associated equipment provide copper, 600V, 90°C, Type XHHW.
 - b. For all other low voltage conductors, provide copper, 600V, 75°C, Type THWN.
 - c. Provide stranded conductors for sizes #12 and larger.
 - d. Provide same type of equipment grounding conductors as specified above.
 - e. Analog Control/Communications (TSP or TST) – Provide tinned copper, polyethylene insulated, twisted pair or triplet, aluminum-polyester, overall shield with 20-gauge drain.

- f. Provide analog signal conductors sized as shown on drawings with minimum size of 18-gauge.
 - g. For all discrete signal conductors, provide copper stranded, 600V, Type THWN with a minimum size of #14, unless otherwise noted.
 - h. For all control conductors installed in underground conduits provide cable listed as suitable for direct burial.
2. Splices, Connections and Terminations (0 to 600V):
- a. For #8 AWG, use solderless pressure connectors with insulating covers for copper wire splices and taps. Use insulated spring wire connectors with plastic caps for #10 AWG and smaller.
 - b. Use insulated, mechanical connectors for copper wire splices and taps, #6AWG and larger. Tape connectors with electrical tape to prevent moisture infiltration.
 - c. Where connections are located in manholes or handholes use insulated submersible type.

2.4 GROUNDING AND BONDING

A. Applicable standards:

- 1. UL 467-1998: Grounding and Bonding Equipment.
- 2. NFPA 70: National Electrical Code.
- 3. ANSI/IEEE 32: Requirements, Terms and Test Procedures for Neutral Grounding Devices.
- 4. IEEE 80: Guide for Safety in Substation Grounding.
- 5. IEEE 81: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
- 6. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Associates).

B. 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. Galvan Industries, Inc.; Electrical Products Division, LLC.
- 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
- 5. Or Engineer Approved Equal.

C. Conductors

1. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
2. Bare Copper Conductors: Stranded Conductors: ASTM B 8.
3. 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.

D. Connectors

1. 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.
2. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
3. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
4. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

E. Grounding Electrodes

1. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

F. Ground Enhancing Material

1. Maintains constant resistance for the life of the system
2. Does not require the continuous presence of water to maintain its conductivity.
3. Non-corrosive
4. Complies with or exceeds IEC 62561-7
5. Complies to the U.S. Environmental Protection Agency (EPA)
6. Resistivity: <2 Ω -cm for powder <20 Ω -cm for mixed and cured material
7. Flexural Strength: 300-450 psi
8. Compressive Strength: 100-200 psi after 672 hours curing time

G. Ground Access Wells:

1. Provide 12"x12"x12" polymer concrete ground access well where indicated on plans.
2. Provide engraved cover with "ground" indicator.
3. Rated for a minimum of 20,000 lbs.
4. Provide Harger GAW series or approved equal.

2.5 SURGE SUPPRESSION

A. Applicable standards:

1. UL 1449 4th Edition - Standard for Safety of Surge Protection Devices.
2. ANSI/IEEE C62.41.1-2002 - IEEE Guide on the Surge Environment in Low-Voltage AC Power Circuits
3. ANSI/IEEE C62.41.2 – IEEE Recommended Practice on Characterization of Surges in Low Voltage AC Power Circuits.
4. IEEE C62.45-2002 - IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.
5. UL 67 - Panelboards (when mounted in panelboards).
6. UL 891 - Dead-Front Switchboards (when mounted in switchboards).
7. NEMA LS1 - National Electrical Manufacturer's Association – 1992, R2000.
8. MIL STD. 220C - Test Methods of Insertion Loss Measurement.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASCO Power Technologies, Inc.
2. APC by Schneider Electric
3. Cutler Hammer by Eaton.
4. Current Technology by Thomas and Betts.
5. Or Engineer Approved Equal.

C. Surge Suppression Device (SPD):

1. Manufacturer's published UL 1449 Third Edition test results shall reflect SPD connected lead length of 6" or greater.
2. Provide SPD devices with a minimum EMI/RFI filtering of -50dB at 100 kHz using MIL-STD-220A methodology.
3. Provide a SPD unit with a short circuit current rating (SCCR) clearly marked and install at a point on the system where the available fault current is not in excess of that rating.
4. Provide dedicated circuit breaker/disconnect for the SPD.
5. Provide SPD with one set of NO/NC dry contacts.
6. Provide SPD with protection-indicating LED's that are visible without opening enclosure.
7. Provide NEMA 4X 316 stainless steel enclosures for all interior process area and exterior installations. Provide NEMA 12 (stainless steel) in all other installations.
8. Provide a Type 2 SPD with 20kA I-nominal (In) rating.
9. Provide SPD that meets or exceeds the following criteria:
 - a. Maximum UL 1449 Voltage Protection Ratings (VPR) and Maximum Continuous Operating Voltage (MCOV):

System Voltage	L-N	L-G	N-G	L-L	MCOV
120/240V 1Ø Split Phase	700	700	700	1200	150
240/120V 3Ø High Leg	700/1200	700/1200	700	700/1200	150/320
208/120V 3Ø	700	700	700	1200	150
480/277V 3Ø	1200	1200	1200	2000	320

b. Minimum Surge Capacity and modes of protection:

SPD Location	Modular Parallel Protection	Modes of Protection	RFI Filtering	Surge Capacity Per Phase
Service Entrance \geq 800A	Yes	L-N, N-G, L-G	Yes	300kA
Service Entrance >200A, < 800A	Yes	L-N, N-G, L-G	Yes	200kA
Service Entrance \leq 200A	No	L-N, N-G, L-G	No	100kA
Distribution Panel \geq 800A	Yes	L-N, N-G, L-G	Yes	200kA
Distribution Panel > 400A, < 800A	Yes	L-N, N-G, L-G	Yes	150kA
Distribution Panel \leq 400A	No	L-N, N-G, L-G	No	100kA
Motor Control Center \geq 2000A	Yes	L-N, N-G, L-G	Yes	300kA
Motor Control Center > 600A, < 2000A	Yes	L-N, N-G, L-G	Yes	200kA
Motor Control Center \leq 600A	Yes	L-N, N-G, L-G	Yes	150kA
Branch Circuit Panels > 200A	No	L-N, N-G, L-G	No	150kA
Branch Circuit Panels \leq 200A	No	L-N, N-G, L-G	No	100kA

2.6 OUTLET BOXES

A. Applicable standards:

1. ANSI/NEMA OS 1: Sheet-steel Outlet Boxes, Device Boxes, Covers and Box Supports.

2. ANSI/NEMA OS 2: Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
 3. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
 4. NEMA FB 1: Type FD, Cast Ferroalloy Boxes.
 5. UL 508: UL Standard for Safety Industrial Control Equipment.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. O.Z./Gedney Company.
 2. Crouse-Hinds Electrical Construction Materials.
 3. Appleton Electric Company.
 4. Or Engineer Approved Equal.
- C. Boxes
1. Provide boxes containing fixture studs for hanging fixtures. Use concrete-tight boxes for installation in concrete. Do not use shallow boxes unless building construction is such that it is impossible to use standard-depth boxes.
 2. Provide outlet boxes and fittings for hazardous locations conforming to UL 886 for class, group, and division indicated.
 3. Provide boxes and covers for polyvinylchloride-coated steel conduit made of fiberglass reinforced resin. Boxes shall have hubs with extruded sleeves extending beyond the hub in the same manner as specified for conduit couplings. Provide cover screws of stainless steel.
 4. Provide polyvinylchloride boxes for use as junction boxes and provide high impact strength fiberglass-reinforced polyester boxes for use as device boxes, pull boxes, and terminal boxes for use with polyvinylchloride conduit. Size each box as required by the NEC.
- D. Fittings
1. Provide cast-iron fittings of malleable iron or a mixture of gray iron and cast steel.
 2. Provide suitable expansion fittings where conduits cross expansion joints. Equip these fittings with grounding straps, clamps, and copper bonding jumpers.

2.7 UNDERGROUND DUCTS

- A. Applicable standards:
1. ANSI/SCTE 77: Specification for Underground Enclosure Integrity.

2. ASTM C1028: Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
 3. ASTM C478-03a" Standard Specification for Pre-cast Reinforced Concrete Manhole Sections.
 4. ASTM A615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 5. ASTM C857-07: Practice of Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
 6. ASTM 858-07: Specifications for Underground Precast Concrete Utility Structures.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Quazite by Hubbell
 2. Oldcastle Precast
 3. Associated Concrete Products
 4. Or Engineer Approved Equal.
- C. Handholes:
1. Provide handholes a minimum size of 24" x 36" x 24" and larger sizes as required by per NEC.
 2. Provide traffic rated enclosures with knockouts as indicated on plans and cover tested to a minimum of 32,000 psi. Provide cover engraved with "Electric" or "Communications" as directed on plans.
 3. Provide traffic rated enclosures equal to Fibercrete FHR series or Engineer approved equal.
 4. Provide enclosures with divider, pulling eyes, cable racks and extension sleeves as applicable.
 5. Provide enclosures equal to Quazite PG series with HA type cover.
- D. Conduit Spacers: Furnish conduit spacers made of plastic to maintain spacing between conduits.
- E. Concrete: Minimum compressive strength, 3,000 psi.
- F. Handhole Frames and Covers:
1. Heavy duty gray cast iron.
 2. Conform to details indicated on the drawings and as specified.
 3. Provide machine-finished seat.
 4. Mark "ELECTRICAL" on cover of manhole

2.8 WIRING DEVICES

A. Applicable standards:

1. FS W-C-596: Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
2. FS W-S-896: Switch, Toggle.
3. NEMA WD 1: General Purpose Wiring Devices.
4. NEMA WD 2: Semiconductor Dimmers for Incandescent Lamps.
5. NEMA WD 5: Specific Purpose Wiring Devices.
6. UL 943: Standard for Ground Fault Circuit Interrupters.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell.
2. Pass and Seymour.
3. ABB – General Electric.
4. TayMac.
5. Lutron.
6. Leviton.
7. Or Engineer Approved Equal.

C. Switches:

1. Switches for lighting circuits and motor loads under 1/2 HP conforming to NEMA WD; FS W-S-896; AC-general use snap switch with toggle handle, rated 20 amperes and 120-277VAC.
2. Gray handle.
3. For exterior applications, provide cast box and weatherproof actuating lever toggle switch cover.

D. Straight-blade Receptacles:

1. Convenience and straight-blade receptacles conforming to NEMA WD 1, locking blade receptacles conforming to NEMA WD 5, and convenience receptacle configuration conforming to NEMA WD 1; Type 5-20, gray plastic face.

E. GFCI Receptacles:

1. GFCI Convenience Receptacles, 125 V, 20 A.
2. Straight blade, feed-through type.
3. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.

4. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

F. Wall Plates:

1. Provide continuous-use rated exterior device cover. Provide cover constructed entirely of UV stabilized high impact polycarbonate material with gasket, stainless steel mounting screws and UL listed for wet location continuous-use. Provide cover equal to TayMac Specification Grade series.
2. Design plates to fit the device or devices on which they are used.

2.9 LIGHTING

A. Applicable standards:

1. FS W-F-414: Fixture, Lighting.
2. ANSI C82.5: Specification for HID Ballasts.
3. ANSI C82.1: Specification for Fluorescent Lamp Ballasts.
4. 924: Standard for Emergency Lighting and Power Equipment.
5. 1598: UL Standard for Safety Luminaires
6. 8750: Light Emitting Diode (LED) Equipment for Use in Lighting Products.
7. LM-79: IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
8. LM-80: IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources

B. Luminaires and accessories requirements:

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Bulb shape complying with ANSI C79.1.
3. Lamp base complying with ANSI C81.61.
4. CRI of 80, CCT of 4000k.
5. Rated lamp life of 50,000 hours.
6. Lamps dimmable from 100 percent to 0 percent of maximum light output.
7. Internal driver.
8. Nominal Operating Voltage: 120 V ac.
9. Wiring: Factory-wired to be compatible with the project electrical and controls system.
10. Solid state Module: To be provided and warrantied by luminaire manufacturer.

11. Driver: To be provided and warranted by luminaire manufacturer and compatible with solid state modules and control devices. Power Factor: Greater than 0.90. Comply with ANSI C62.41 Category A for Transient protection.
12. Luminaire properly heat-sinked to ensure LED junction temperature ratings are not exceeded. Provide ambient operating temperature range for which product is warranted.

2.10 ENCLOSURES

- A. Description: Flush or surface-mounted cabinets. Wet or Damp Indoor and Outdoor Locations: NEMA 250, Type 4X, stainless steel.

2.11 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- A. Applicable standards:
1. ANSI/UL 198C: High intensity capacity fuses; current limiting types.
 2. ANSI/UL 198E: Class R fuses.
 3. FS W-F-870: Fuse holders (for plug and enclosed cartridge fuses).
 4. FS W-S-865: Switch, box (enclosed), surface-mounted.
 5. NEMA KS 1: Enclosed switches.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Square D by Schneider Electric
 2. Eaton Cutler-Hammer
 3. Siemens Industry, Inc.
 4. Or Engineer Approved Equal.
- C. Non-fusible switches:
1. Type HD, Heavy Duty, 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.
 2. Accessories:
 - a. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - b. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - c. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

- d. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
- e. Hookstick Handle: Allows use of a hookstick to operate the handle.
- f. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.12 PANELBOARDS

A. Applicable standards:

- 1. FS W-C-375: Circuit Breakers, Molded Case, Branch Circuit and Service.
- 2. FS W-F-870: Fuse Holders (for Plug and Enclosed Fuses).
- 3. FS W-F-115: Power Distribution Panel.
- 4. FS W-S-865: Enclosed Knife Switch.
- 5. NEMA AB 1: Molded Case Circuit Breakers.
- 6. NEMA PB 1: Panelboards.
- 7. NEMA PB 1.1: Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- 8. NEMA PB 1.2: Application Guide for Ground-fault Protective Devices for Equipment.
- 9. UL 67: Panelboards.

B. Acceptable manufacturers:

- 1. ABB – General Electric.
- 2. Square D.
- 3. Cutler-Hammer.
- 4. Siemens Energy & Automation.
- 5. Or Engineer Approved Equal.

C. Power Distribution panelboards:

- 1. Panelboards: NEMA PB 1; circuit breaker type.
- 2. Enclosure: NEMA PB 1, Type 12, unless shown otherwise on the Drawings.
- 3. Panelboard mounting as shown on the Drawings.
- 4. Provide cabinet front with concealed trim clamps, and hinged door with flush lock. Finish in manufacturer's standard gray enamel.
- 5. Provide panelboards with tin plated, copper bus, ratings as scheduled.
- 6. Provide copper ground bus in all panelboards. Minimum integrated short circuit rating: As shown in panel schedules.

7. Molded case circuit breakers: NEMA AB 1; provide bolt-in-type circuit breakers with integral thermal and instantaneous magnetic trip in each pole.
8. Molded case circuit breakers with current limiters: AB 1; provide circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
9. Provide panelboards with typed directory as shown on panel schedules.
10. Provide panelboards keyed alike.

2.13 MISCELLANEOUS MATERIALS

- A. Provide support framing, channel and associated accessories of 316 stainless steel conforming to the Drawings and to Sections 05990 of these specifications, except in areas containing chemicals, whereby fiberglass reinforced plastic only shall be utilized.
- B. Provide and install equipment racks for panels as shown on the drawings and as described in the specifications, with the following as a minimum:
 1. Provide cross members consisting of two (2) horizontal pieces of pre-drilled 1-1/2" x 1-1/2" mounting channel, manufactured by Kindorff or Engineer approved equal.
 2. Attach all struts with spring-loaded nuts and associated hardware provided by manufacturer of strut and specifically designed for this purpose.
 3. Use 316 stainless steel stud nuts, manufactured by Kindorff or Engineer approved equal.
 4. Support the mounting channel "cross bars" vertically by C-channels, 3" x 2" x 8'.
 5. Mount channels a maximum of 24" apart, center-to-center, quantity as required to accommodate equipment.
 6. Provide a foundation buried 36" underground and secured with 3000 PSI concrete pad, sized as shown on plans with a minimum of 36" clear walking space in front of control panels and 12" on sides and rear of panel.
 7. Provide 3/4" chamfer on all concrete edges.
- C. Provide 316 stainless steel (bolts, nuts, washers, U-bolts, anchors, threaded rods, etc.) attachment hardware.

2.14 ELECTRICAL SYSTEM STUDIES

- A. Provide a short circuit, protective device coordination and arc-flash study for the electrical distribution system constructed under this contract. The study shall consider the electrical utility system upstream protective devices down to the 480Y/277V transformer secondary. The study shall include calculations used to verify the short circuit ratings of the electrical distribution equipment to be provided under this contract and to identify the required settings of associated protective devices.
- B. Provide a report summarizing the coordination study including: one-line of system, relay and breaker setting tabulation, relay, circuit breaker, and fuse protective device coordination and short circuit calculation, all prepared by an independent specialty firm. Device calibration and settings are to be based on the results of this coordination study.
- C. Short Circuit Study
 - 1. Perform a short circuit study in accordance with ANSI Standard C37.010 to verify the adequacy and correct application of circuit protective devices and other electrical system components.
 - 2. The study shall address the case when the system is being powered from the utility source as well as from the on-site generating facilities. Minimum and maximum possible fault conditions shall be covered in the study.
 - 3. Include the fault contribution of all motors. Horsepower shown in the Contract Documents may be used to calculate fault contribution of motors. In the short circuit study VFDs shall be replaced by conductors of the same size as the branch circuit conductors.
 - 4. Calculate short-circuit momentary duties and interrupting duties on the basis of an assumed bolted 3-phase short circuit at each bus. The short circuit tabulations shall include X/R ratios, asymmetry factors, kVA and symmetrical fault-current. Where ground fault protection is specified, provide a ground fault current study for the same system areas, including the associated zero sequence impedance diagram. Include in tabulation form, fault impedance, X/R ratios, asymmetry factors, motor contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.
 - 5. The studies shall include representation of the site power system, the base quantities selected, impedance source data, calculation methods and tabulations, one-line diagrams, conclusions and recommendations.
- D. Protective Device Coordination Study

1. Provide a protective device time current coordination study with coordination plots of current limiting devices, plus tabulated data, including ratings and settings selected. In the study, balance shall be achieved between the competing objectives of protection and continuity of service (with emphasis on continuity of service) for the system specified, taking into account the basic factors of sensitivity, selectivity and speed.
2. Provide separate plots for utility and generator operation as applicable. Show maximum and minimum fault values in each case. Multiple power sources shown in one plot is not acceptable.
3. Each primary protective device required for a delta-to-wye-connected transformer shall be selected so the characteristic or operating band is within the transformer parameters, which, where feasible, shall include a parameter equivalent to 58 percent of the ANSI withstand point to afford protection for secondary line-to-ground faults. Separate low voltage circuit breakers from each other and the associated primary protective device, by a 16 percent current margin for coordination and protection in the event of line-to-line faults. Separate protective relays by a 0.4 second time margin when the maximum 3 phase fault flows to assure proper selectivity. The protective device characteristics or operating bands shall be terminated to reflect the actual symmetrical and asymmetrical fault-currents sensed by the device. Provide the coordination plots for 3 phase and phase-to-ground faults on a system basis. Include all devices down to largest branch circuit feeder circuit breaker. Include all adjustable setting ground fault protective devices.
4. Identify discrepancies in the conclusions and recommendations of the report. Upon resolution of discrepancies and recommendation, update all associated analyses and revise the affected studies.
5. The coordination plots shall graphically indicate the coordination proposed for the several systems centered on full scale log forms. The coordination plots shall include complete titles, representative one-line diagrams and legends, associated upstream power system relays, fuse or system characteristics, significant motor starting characteristics, significant generator characteristics, complete parameters for power, and substation transformers, complete operating bands for low voltage circuit breaker trip devices, fuses, and the associated system load protective devices. The coordination plots shall define the types of protective devices selected, together with the proposed coil taps, time-dial settings and pick-up settings required. The short-time region shall indicate the relay instantaneous elements, the magnetizing inrush, and ANSI transformer damage curves, the low voltage circuit breaker and instantaneous trip devices, fuse manufacturing tolerance bands, and significant symmetrical and asymmetrical fault-currents.

6. The thermal limit of all feeder cables to each bus and large motors, where applicable in the study, shall be shown.
7. No more than six devices shall be shown on one coordination plot. Of these six curves, two (the largest upstream device and the smallest downstream device) shall repeat curves shown on other coordination plots in order to provide cross reference. Give each unique protective device curve in the study a study-unique number or letter identifier to permit cross reference between plots. Do not use identifier letters or numbers more than once.
8. Each primary protective device required for delta-wye connected transformer shall be selected so that the characteristic or operating band is within the transformer parameters, which, where feasible, shall include a parameter equivalent to 58 percent of the ANSI withstand point to assure protection for secondary line-to-ground faults.
9. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings. Include C.T. ratio, burden and all other calculations required for the determination of settings.

E. Arc Flash Hazard Analysis

1. Perform arc flash hazard analysis for the following items:
 - a. Panelboards
 - b. Control panels with voltage over 50 Volts
 - c. Motor control centers
 - d. Transformers that have auxiliary electrical devices operating at over 50 Volts
 - e. Manual transfer switches
2. Methods of performing analysis:
 - a. Use NFPA 70E article 130 tables if the short circuit study shows that the condition for those tables are met.
 - b. Otherwise use IEEE 1584 calculations.
 - 1) If the conditions fall within the IEEE 1584 parameters use the IEEE 1584 calculations based on actual OCPD curves and settings.
 - 2) If the conditions do not fall within the 1584 parameters, use the Lee method.
3. Label each item for which the calculations were performed with the following information:
 - a. Limited approach boundary

- b. Information required by NFPA 70E, 130.2(D)(2).
- c. Restricted approach boundary
- d. Personal protective equipment required within restricted approach boundary
- e. Flash protection boundary
- f. Personal protective equipment required within flash protection boundary
- g. Prohibited approach boundary

2.15 IDENTIFICATION

- A. Mark all 480-volt equipment with red laminated plastic nameplates having one-half inch (1/2") engraved lettering, reading "DANGER 480-VOLTS". Attach plate to equipment with stainless steel screws.
- B. Mark conductors within panelboards with self-sticking label bearing the number corresponding to the circuit number on the drawings. Connect these conductors to corresponding breaker in panel. Mark circuit numbers in outlet boxes only where color-coding is repeated by having two or more conductors of the same color.
- C. Mark equipment, switchboards, panelboards, cabinets, transformers, control devices, starters, switches, etc.
- D. Labels shall be created by means of black phenolic material having engraved Micarta letters with white core having 1/4" engraved lettering.
- E. Provide designations as indicated on the drawings to include:
 - 1. Name of the equipment or equipment that is being served,
 - 2. Power source and circuit of origin along with room location
 - 3. Voltage and number of phases.
- F. Attach plates to equipment with stainless steel screws.
- G. Mark all junction boxes with the voltages contained internal to it. If multiple power sources are internal to the junction boxes, it shall be labelled "Contains Multiple Power Sources"
- H. Panelboards shall contain typed and laminated panel schedules indicating circuit numbers and loads
- I. Arc Flash Warning Labels
 - 1. Labels: 3.5-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.

2. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 - a. Location designation.
 - b. Nominal voltage.
 - c. Flash protection boundary.
 - d. Hazard risk category.
 - e. Incident energy.
 - f. Working distance.
 - g. Engineering report number, revision number, and issue date.
3. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- 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.

3.2 PREPARATION

- A. Coordination:
 1. Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
 2. Coordinate the installation of electrical items with the schedule for work of other trades to prevent unnecessary delays in the total Work.
 3. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear the encroachment.
- B. Data indicated on the Drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the Drawings and Specifications should be used only for guidance in such regard.
- C. Where outlets are not specifically located on the Drawings, locate as determined in the field by the Engineer. Where outlets are installed without such specific direction, relocate as directed by the Engineer and at no additional cost to the Owner.

- D. Verify all measurements at the building. No extra compensation will be allowed because of differences between work shown on the Drawings and actual measurements at the site of construction.
- E. Branch circuit wiring and arrangement of home runs have been designed for maximum economy consistent with adequate sizing for voltage drops and other considerations. Install the wiring with circuits arranged exactly as shown on the Drawings, except as otherwise approved in advance by the Engineer.

3.3 TRENCHING AND BACKFILLING

- A. Perform trenching and backfilling associated with the work of this Section in strict accordance with the provisions of Section 02221.

3.4 RACEWAYS AND FITTINGS

- A. When PVC coated conduit systems are utilized, the raceway manufacturer prior to installation shall certify the Contractor. Submit certification to the Engineer in writing.
- B. When PVC coated conduit systems are utilized, provide inspection and certification of the complete raceway installation in writing by an authorized representative of the PVC coated materials supplier.
 - 1. During the construction process, at regular intervals, and prior to any raceway being covered, the representative shall inspect the system until it is confirmed that it meets the manufacturer's intended requirements.
 - 2. Remove and reinstall any portion of the conduit installation that does not meet the intended installation methods at no additional cost to the Owner.
- C. Provide certification to insure that all PVC overlapping connections, conduit threading, thread coating, sealing, etc., has been performed in accordance with manufacturer's recommended procedures.
- D. Apply cold galvanizing compound to all field-cut threads prior to installation.
- E. In general, follow the raceway installation layout shown on the plans, however, this layout is diagrammatic only, and where changes are necessary due to structural conditions, other apparatus or other causes, make such changes without any additional cost to the Owner.
- F. Cut all conduits square using a saw or pipe cutter and de-burr cut ends.
- G. Install the conduit to the shoulder of fittings and couplings and fastened securely.

- H. Use conduit hubs, or sealing locknuts, for fastening conduit to cast boxes and for fastening conduit to sheet metal boxes in damp or wet locations.
- I. No more than the equivalent of three 90-degree bends may be installed between boxes.
- J. Use conduit bodies to make sharp changes in direction, as around beams.
- K. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2" size.
- L. Avoid Moisture traps where possible; where moisture traps are unavoidable, there must be a junction box with drain fitting provided at the conduit low point. Use suitable conduit caps to protect installed conduit against entrance of dirt, concrete, plaster, mortar, and moisture.
- M. Size all conduits for conductor type installed with $\frac{3}{4}$ " being the minimum size conduit allowed.
- N. Arrange conduit to maintain headroom and present a neat appearance.
- O. Route any exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- P. Provide at all times a minimum of 6" clearance between conduit and piping and a 12" clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
- Q. Arrange all conduit supports to prevent distortion of alignment by conductor pulling operations.
- R. Fasten conduits above finished ceilings using straps, lay-in adjustable hangers, clevis hangers or bolted split stamped hangers.
 - 1. Do not fasten conduit with wire or perforated pipe straps. All wire that was used for temporary conduit support during construction must be removed before conductors are pulled.
 - 2. All conduits must be supported at a maximum distance of 5' on centers.
- S. Group conduits in parallel runs where practical using a conduit rack.
- T. Make all underground conduit joints watertight by applying manufacturer's recommended thread compound. Thread compound must be conductive and be compatible with conduit and conductor-jacket material.

- U. Provide suitable pull string or #12 AWG insulated conductor in empty conduit, except sleeves and nipples.
- V. Maintain minimum 12" clearance between all conduits containing signal circuits and conduits containing power circuits.
- W. Install expansion-deflection joints where conduit crosses building expansion or seismic joints.
- X. Where conduit penetrates fire-rated walls and floors, the opening around the conduit must be sealed with UL listed foamed silicone elastomer compound.
- Y. Install exposed raceways either parallel or perpendicular to building walls.
- Z. Install raceways exposed on walls or free standing perpendicular to the floor.
- AA. Install exposed raceways on channel so as to provide a minimum spacing of 1/2" between raceway and the surface to which it is mounted.
- BB. Bends:
 - 1. Where emerging from walls, ceilings, floor or concrete slabs, all conduit bends shall be made entirely within the structure (i.e.: the conduit shall emerge perpendicular to the surface and the bend shall be covered).
 - 2. Make all 90-degree conduit turns with factory-bent, rigid galvanized steel, long radius elbows.
 - 3. Utilize rigid galvanized steel, long radius elbows on all 90 degree conduit bends of 2" and larger.
- CC. Install no metal conduit in contact with the earth or concrete slab unless protected with two coats of bitumastic coating.
- DD. Provide necessary sleeves and chases where conduits pass through floors and walls, and provide other necessary openings and spaces, arranging for in proper time to prevent unnecessary cutting in connection with the Work.
- EE. Perform cutting and patching in accordance with the provisions for the original Work.
- FF. Refer to Section 02221 for minimum cover of underground conduits.
- GG. Sealing Conduit:
 - 1. Install watertight conduit hubs on all conduits terminating in the top or sides of NEMA 3R, 4 or 4X enclosures.

2. Use a sealing locknut having an integral gasket on conduits terminating in the bottom of NEMA 3R, 4 or 4X enclosures.
 3. Seal all conduits terminating in NEMA 3R, 4 or 4X enclosures with duct seal.
 4. Seal watertight all conduits terminating in NEMA 6 or watertight rated enclosures.
 5. Install sealing compound and fiber, per manufacturer's recommendation, in hazardous location conduit sealing fittings. Tighten plugs per manufacturer's recommended torque.
- HH. Make motor lead connections and connections to other electrical equipment subject to vibration, or where indicated with flexible weatherproof type steel core conduit with wrapping and cover, factory assembled.
- II. Conduit installations in hazardous locations as defined by Article 500 of the NEC must conform to the special requirements of Articles 501, 502, and 503 of the NEC.
- JJ. Chapter 9 of the NEC shall apply unless larger raceways are specified.
- KK. Ensure all threads are fully installed into fittings, boxes, enclosures and equipment per NEC and UL listing requirements to provide mechanical integrity, grounding and sealing. Provide fittings and adapters to ensure full length of conduit or conduit fitting threads are installed per code and listing requirements.
- LL. Liquidtight flexible metal conduit shall be supported and securely fastened within 12 inches of each box, cabinet, conduit body or other conduit body termination and shall be supported and secured at intervals not to exceed 4-1/2 feet. Flexible metal conduit shall not exceed 6 feet in length except for luminaire connections as allowed per the NEC.
- MM. Provide plastic threaded type bushings for all conduits terminated in enclosures.

3.5 CONDUCTORS

- A. 600 V Applications
1. Service Entrance: Type XHHW-2, single conductors in raceway.
 2. Exposed Feeders: Type XHHW-2, single conductors in raceway.
 3. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
 4. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
 5. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

B. Installation

1. Install no conductor smaller than #12 AWG unless otherwise indicated.
2. Provide copper conductors.
3. Provide conductors as shown on the plans or as specified herein.
4. Provide continuous wiring from outlet to outlet, identified by color and marked with size, grade and manufacturer.
5. Provide continuous wiring without joints, through pull boxes.
6. Provide minimum of #10 AWG conductors on branch circuits, which exceed 100' at 120 volts and 200' at 277 volts from panel to load center.
7. Terminate #14 AWG stranded conductors where indicated for control, using insulated compression-type spade lugs.
8. Terminate #12 AWG stranded conductors using insulated compression-type spade lugs.
9. Install an equal number of conductors for each phase of a circuit in the same raceway or cable.
10. The conductor lengths for parallel circuits must be made equal.
11. Neatly train and lace all wiring inside boxes, equipment, and panel boards.
12. Connect circuits sharing a common neutral to different phases regardless of the numbering.
13. Provide phase, neutral, and ground conductors as required to accommodate metering installed. Any additional conductors required for meter to function properly shall be installed at the Contractor's expense.

3.6 GROUNDING AND BONDING

A. Applications

1. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
2. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum. Bury at least 24 inches below grade. Bury 12 inches above duct bank when indicated as part of duct-bank installation.
3. 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.
4. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - a. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 - b. 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.

5. Conductor Terminations and Connections
 - a. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - b. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - c. Connections to Ground Rods at Test Wells: Bolted connectors.
 - d. Connections to Structural Steel: Welded connectors.
6. Ground Enhancement Material
 - a. Provide for all grounding installed below grade.
 - b. Provide a minimum of 3" diameter coverage.
 - c. Follow manufacturer's instructions for handling, storage, and installation.

B. Installation

1. Ground and bond the electrical system and motors in accordance with Article 250 of the NEC.
2. Install electric bond around panels, cabinets, pull boxes, enclosures, etc., to incoming and outgoing sub-feed raceways by use of grounding type bushings.
3. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
4. Provide grounding electrode conductor(s) and connect as shown on drawings.
5. Bond together metal siding not attached to grounded structure, bond to ground.
6. Provide separate, insulated, green equipment grounding conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
7. Provide grounding type bushings for conduits 1" or larger and bond to ground bar or lug of enclosure.
8. Bond neutral and ground at service entrance only.
9. Provide exothermic-type weld grounding connections that are buried or otherwise normally inaccessible and excepting specifically those connections for which access is required for periodic testing.
10. Make each grounding connection strictly in accordance with the manufacturer's written instructions. Failure to follow manufacturer's written instructions shall result in immediate rejection.
11. Welds which have "puffed up" or which show convex surfaces, indicating improper cleaning, are not acceptable. Provide grounding connection devices compatible with the conductor(s) and/or rods being joined.

12. Maximum acceptable resistance to earth ground is 25 Ohms. Provide testing of the service entrance system ground and verify the resistance to earth ground is within the specified requirements. If the existing service entrance ground does not meet the specified requirements, install additional rod electrodes as required to achieve specified resistance to ground.
13. Interface with lightning protection system where applicable.

C. Grounding Handholes

1. Install a driven ground rod through 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.

3.7 SURGE SUPPRESSION

A. Factory Installed:

1. Install SPD on the load side of the main circuit breaker.
2. Provide circuit breaker disconnect for SPD as shown on plans.
3. Install SPD in accordance with manufacturer instructions.
4. Minimum lead length 6".

B. Field Installed:

1. Connect SPD ground to service entrance grounding electrode conductor or to equipment grounding conductor if SPD located downstream of service entrance equipment. Confirm SPD installed per manufacturer's recommendation.
2. Install SPD on the load side of the main circuit breaker.
3. Install SPD in accordance with manufacturer instructions.
4. Maximum lead length 12".

3.8 OUTLET BOXES

- A. Do not install boxes back-to-back in walls. Install the boxes at a minimum of 6" apart except in acoustic-rated walls with a minimum separation of 12".

- B. Locate boxes in masonry walls such that only the cutting of the masonry unit corner is required. Coordinate masonry cutting such that neat openings for the boxes can be achieved.
- C. Provide knockout closures for unused openings.
- D. Support boxes independently of the conduits.
- E. Use multiple gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- F. Install boxes in the walls without damaging wall insulation.
- G. Install outlets to locate luminaires as shown on plans. In inaccessible ceiling areas, position outlets and junction boxes within 6" of recessed luminaires, to be accessible through luminaire ceiling opening.
- H. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness.
- I. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- J. Align wall mounted outlet boxes for switches, thermostats, and similar devices.
- K. Provide cast outlet boxes in locations (exposed to the weather) and indoor wet locations.
- L. Size all boxes in strict accordance with Article No. 370 of the NEC, except that no box will be less than the minimum specified.
- M. Check the location of all outlets to see that the outlets will clear any new or existing wall fixture, shelving, work tables, sinks, bulletin boards, etc. and the outlet will fit the area intended.
- N. Set floor boxes level and flush with finish flooring material. Use cast iron floor boxes for installations in slab on grade.
- O. Locate pull and junction boxes above accessible ceilings or in unfinished areas. Support pull and junction boxes independently of conduit.
- P. Install underground boxes as shown on drawings with top of box approximately 2" above finished grade. Install bottom of box over 12" of gravel to allow for adequate drainage.

3.9 WIRING DEVICES

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Install wall switches at 48" above the floor level and 6" from edge of door jam on strike side, unless otherwise noted on Drawings.
- C. Install wall switches with the OFF position down.
- D. Install convenience receptacles at 18" above the floor level or 6" above counter or backsplash.
- E. Install convenience receptacles with the grounding pole on top.
- F. Install all specific-use receptacles at heights shown on Contract Drawings.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas using jumbo size plates for outlets installed in masonry walls.
- H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- I. Install devices and wall plates flush and level.

3.10 IDENTIFICATION

- A. Provide color-coding for #12 and #10 conductors as follows:

	277/480-Volt	120/208(240)-Volt
Phase "A"	Brown	Black
Phase "B"	Orange	Red
Phase "C"	Yellow	Blue
Neutral	White with Tracer	White
Ground	Green	Green

- B. Mark all conductors #8 and larger and all feeders with plastic tape to match the above color-coding.
- C. Provide primary cables with phase code as directed by the Engineer.

3.11 CONNECTIONS AND TERMINATIONS IN 600V CONDUCTORS

- A. Provide final connections and/or terminations for all wiring indicated on the electrical drawings and in this division of the specifications. Equipment supplied under other divisions of the specifications that require electrical connections under this division shall be provided with Engineer approved wiring and termination diagrams.
- B. General
 - 1. For #8 AWG, use solderless pressure connectors with insulating covers for copper wire splices and taps. Use insulated spring wire connectors with plastic caps for #10 AWG and smaller.
 - 2. Use insulated, mechanical connectors for copper wire splices and taps, #6AWG and larger. Tape connectors with electrical tape to prevent moisture infiltration.
 - 3. Where connections are located in handholes use insulated submersible type.
 - 4. Thoroughly clean wires before installing lugs and connectors.
 - 5. Terminate spare conductors with electrical tape.
 - 6. Splices are prohibited.

3.12 CONDUIT SUPPORTS

- A. Seal all ends of non-metallic conduit support with manufacturer's recommended sealer.
- B. Provide UL listed vinyl end caps for all ends of strut-type metallic conduit supports.
- C. Provide all miscellaneous materials and supports as required by the NEC and these specifications to provide support for conduits, raceways, boxes, fittings and equipment.

3.13 POWER EQUIPMENT

- A. Provide power and control wiring for motor starters and safety switches as shown on the Drawings.
- B. Connections to miscellaneous building equipment:
 - 1. Wire to, and connect to, all items of building equipment not specifically described but to which electrical power is required.
 - 2. Coordinate as necessary with other trades and suppliers to verify types, numbers, and locations of equipment.

3.14 MOUNTING OF SWITCHGEAR, CONTROL PANELS AND ELECTRICAL EQUIPMENT

- A. Install all equipment per the manufacturer's recommendations and the contract drawings.
- B. Install surface-mounted panelboards plumb, in conformance with NEMA PB 1.1.
- C. Install disconnect switches with centerline at 48" above finished floor, grade, etc. unless otherwise noted.
- D. Secure switchboard assemblies to foundation or floor channels.
- E. Secure disconnect switches to channel frames with spring-type fasteners and hardware intended for this specific use where wall mounted, unless otherwise indicated.
- F. Mount floor and wall mounted equipment utilizing Type 316 stainless steel anchors and fasteners of the size and number recommended by the manufacturer.
- G. Provide necessary hardware to secure the assembly in place.
- H. Provide 316 stainless steel fasteners for all other installation types.
- I. Inspect switchboards and panel boards for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.
- J. Install and check all equipment in accordance with the manufacturer's recommendations.
- K. Ensure that equipment mounting pad locations are level to within 0.125 inches per three foot of distance in any direction. Notify Engineer immediately if any discrepancies are found in the field.
- L. Ensure that all equipment bus bars are torqued to the manufacturer's recommendations.
- M. Assemble all equipment shipping sections, remove all shipping braces and connect all shipping split mechanical and electrical connections.
- N. Provide filler plates for unused spaces in panelboards and switchboards.
- O. Provide typed circuit directory with protective plastic sleeve secured to inside of panel door for each branch circuit panelboard.
- P. Provide Micarta type labels located adjacent to each breaker operator, delineating equipment served for each circuit breaker in all switchboards.

- Q. Measure steady state load currents at each switchboard and panelboard feeder. Should the voltage difference measured at the equipment between any two phases exceed 20 percent, rearrange circuits to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- R. Measure and recording Megger readings phase-to-phase, phase-to-ground, and neutral-to-ground (four wire systems only).

3.15 UNIT RESPONSIBILITY

- A. Switchgear, panelboards, motor control centers, relays, switches, starters, etc. furnished under this Section of the specifications shall be supplied by the same manufacturer so as to give unit responsibility and ease of maintenance.

3.16 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.
- B. Conductors
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.
 - 2. Individually test 600-volt conductors for insulation resistance between phases and from each phase to ground.
 - 3. Test after cables have been installed and before they are placed into service with a low-resistance ohmmeter.
 - 4. Applied potential shall be 1000 Vdc for one minute in accordance with NETA recommendations.
 - 5. The ENGINEER shall be given written notice a minimum of two (2) days before the anticipated test date. The CONTRACTOR shall record the circuit designation and ohmmeter readings for each phase-phase and phase-ground measurement. This written record shall be submitted to the ENGINEER. The cost of any retest due to insufficient ohmmeter readings shall be the responsibility of the CONTRACTOR.
 - 6. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 7. Cables will be considered defective if they do not pass tests and inspections.
 - 8. Prepare test and inspection reports.
- C. Grounding and Bonding

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 is specified, at service disconnect enclosure grounding terminal, at ground test wells, 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.
5. Grounding system will be considered defective if it does not pass tests and inspections.
6. Prepare test and inspection reports.
7. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - b. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - c. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - d. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
 - e. Substations and Pad-Mounted Equipment: 5 ohms.
 - f. Handhole Grounds: 10 ohms.
8. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.
9. Prepare test and inspection reports.

- D. Provide personnel and equipment, make required tests, and secure required approvals from the Engineer and governmental agencies having jurisdiction.
- E. Provide written notice to the Engineer adequately in advance of each of the following stages of construction:
 - 1. In the underground condition prior to placing concrete floor slab, when all associated electrical work is in place.
 - 2. When all rough-in is complete, but not covered.
 - 3. At completion of the work of this Section.
- F. When material and/or workmanship are found to not comply with the specified requirements, replace items within three days after receipt of notice at no additional cost to the Owner.
- G. Provide a qualified field serviceman, representing the manufacturer of each piece of major electrical equipment, to make proper and complete adjustments of all adjustable devices, load switches, etc. after final installation and completion of all field wiring. Verify and approve all connections prior to any initial or test operation of equipment. Submit confirmation in writing by the manufacturer's authorized representative of said services to the Engineer.

3.17 CLEANING AND PAINTING

- A. Collect and remove from the premises all debris, scraps and other waste material after completion of work.
- B. Tamp and level all trench work.
- C. Remove excess dirt and debris, when and as directed by the Engineer.
- D. Thoroughly clean all electrical equipment, lighting fixtures, exposed conduit, enclosures and boxes of all foreign materials and paint in accordance with Section 09900 of these Specifications unless noted or directed otherwise.
- E. Clean any exposed threaded area of raceway of cutting oil and paint with a cold galvanizing compound prior to final finish painting.

3.18 ELECTRIC EQUIPMENT BY OTHERS

- A. The equipment manufacturer shall furnish all motors for equipment.
- B. Verify voltage, dimensions, extent, type, etc. of this and all other such electrical equipment.

- C. Furnish and install all electrical supply and control equipment and material required to put all the items in proper operative condition.
- D. Refer to other sections of these specifications for verification of other equipment and devices requiring electrical connections, wiring and devices not included in this section.
- E. Refer to other drawings for details not indicated on the electrical drawings.
- F. Prior to connecting any piece of such equipment, check the nameplate data against the information shown on the drawings and call to the immediate attention of the Engineer any discrepancies discovered.

3.19 PROJECT COMPLETION

- A. Test all 600-Volt service entrance and feeder wiring using an instrument, which applies a voltage of approximately 500 volts DC to provide a direct reading of resistance.
- B. Perform test on ground system utilizing Fall-Of-Potential method. Meg grounding systems to measure ground resistance, and provide not more than 25 ohms resistance, adding ground rods as necessary to achieve that level.
- C. Conduct all tests in presence of Engineer or his representative. Identify and properly record all readings. Submit readings to Engineer for acceptance.
- D. Measure voltages as directed by the Engineer and report to him these values.
- E. Provide entire system free from all shorts and grounds.
- F. Fully comply with local and national codes for equipment bonding and grounding.
- G. Test system in the presence of the Engineer and operate to his complete satisfaction in accordance with true intent of plans and specifications. Defray cost of all adjustments necessary to bring system up to standards set forth by Contract Documents at no additional cost.
- H. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual.
- I. On the first day the facility is in operation, for at least eight (8) hours at a time directed by the Engineer, provide a qualified foreman and crew to perform such electrical work as may be required by the Engineer.

3.20 FIELD SETTINGS

- A. Perform field adjustments of the protective devices, as required, to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device evaluation study, and protective device coordination study.
- B. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.

3.21 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for this work and all costs for same shall be included in the price bid for the work to which it pertains.

END OF SECTION