FLORIDA KEYS AQUEDUCT AUTHORITY

C-905-PHASE IIB
KEY LARGO TO OCEAN REFF
TRANSMISSION WATERMAIN REPLACEMENT

FKAA PROJECT # 1152-17-PHASE IIB

CONFORMED
CONTRACT DOCUMENTS

APRIL 2018

MONROE COUNTY
FLORIDA
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INVITATION TO BID

FKAA PROJECT # 1152-17-PHASE IIB

C-905 PHASE IIB
KEY LARGO TO OCEAN REEF
TRANSMISSION WATERMAIN REPLACEMENT

Sealed proposals for C-905 PHASE IIB TRANSMISSION WATER MAIN REPLACEMENT will be received at the Engineering Department of the Florida Keys Aqueduct Authority (FKAA), 1100 Kennedy Drive, Key West, Florida 33040, until 2:00 p.m., local time on the 12th day of April, 2018 and then will be publicly opened and read. Any bids received after the time and date specified will not be considered.

The proposed Phase IIB of the project consists of 19,790 linear feet of 16-inch diameter C-900 DR14 (Unrestrained Pipe) and 2,730 linear feet of 16-inch diameter C-900 DR14 (Restrained Pipe). The work also includes 4 Master Meter Taps. The location of the work is along C905, from Ocean Reef toward Key Largo. The project will tie into Phase IIA at a proposed valve on the south end and an existing 17” valve on the north end.

Drawings and Specification may be obtained on Demand Star by Oniva at www.demandstar.com/supplier or call toll free 1-800-711-1712, they will also be available at www.fkaa.com under “Bid Opportunities”.

A mandatory Pre-bid Meeting is scheduled on Wednesday, April 4th, 2018 at 10:00am at the Florida Keys Aqueduct Authority, Cudjoe Office, 755 Blimp Road, Cudjoe Key, Florida.

Each proposal must be submitted on the prescribed form and accompanied by a certified check or bid bond executed on the prescribed form, payable to the Florida Keys Aqueduct Authority, in an amount not less than 5 percent of the amount bid.

The Contract, if awarded, will be awarded to the responsive, qualified and responsible bidder submitting the lowest combined unit cost-lump sum price proposal, accepted by the FKAA.

All bid bonds, contract bonds, insurance contracts, and certificates of insurance shall be either executed by or countersigned by a licensed resident agent of the surety or insurance company having his place of business in the State of Florida, and in all ways complying with the insurance laws of the State of Florida. Further, the said surety or insurance company shall be duly licensed and qualified to do business in the State of Florida.

In order to perform public work, the successful Bidder shall hold or obtain such Contractors’ and Business Licenses as required by State Statutes.

Before a contract will be awarded for the work contemplated herein, the FKAA will conduct such investigation as is necessary to determine the performance record and ability of the apparent low bidder to perform the size and type of work specified under this contract. Upon request, the
Bidder shall submit such information as deemed necessary by the FKAA to evaluate the Bidder’s qualifications.

The FKAA reserves the right to reject all proposals where the FKAA deems rejection to be in its best interest, or to reject any Proposal not in compliance with the contract documents. The FKAA reserves the right to waive any informalities and irregularities in said Proposals.

Firms are hereby placed on formal notice that neither the FKAA Board of Directors, nor any employees of the FKAA are to be lobbied either individually or collectively concerning this project.

The Governing Board of Directors of the Florida Keys Aqueduct Authority reserves the right to reject any and all bids, in whole or in part, to waive any irregularities or informalities in any bid, and to award to any party considered to be in the best interest of the Authority.

Dated this 22nd day of March, 2018.

FLORIDA KEYS AQUEDUCT AUTHORITY

By

Jolynn Reynolds
Manager of Engineering

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INSTRUCTIONS TO BIDDERS

1. FORMAT

The Contract Documents are divided into parts, divisions, and sections to separate categories of subject matter for convenient reference. Generally, there has been no attempt to divide the Specification sections into work performed by the various building trades, work by separate subcontractors, or work required for separate facilities in the project.

2. SPECIFICATION LANGUAGE

Command type sentences are used in the Contract Documents. These refer to and are directed to the Contractor.

3. GENERAL DESCRIPTION OF THE PROJECT

A general description of the work to be done is contained in the Invitation To Bid. The scope of work is further indicated on the accompanying Drawings and specified in applicable parts of these Contract Documents.

4. QUALIFICATION OF CONTRACTORS

The prospective bidders must meet the statutorily prescribed requirements before Award of Contract by the FKAA.

The FKAA reserves the right before awarding the Contract to require a Bidder to submit such evidence of his qualifications as it may deem necessary, and may consider any evidence available to the FKAA of the financial, technical, and other qualifications and abilities of a Bidder. The Bidder must submit in letter form, with his Proposal, a statement of his qualifications to perform in a satisfactory manner, and within the time specified, and in fulfillment of all applicable provisions of the Contract Documents, all of the work to which his bid pertain. He must submit information as to the following Qualification Requirements:

A. The Bidder has the authorization to conduct business and holds at a minimum, an Underground Utility Contractors license for the installation of water distribution systems, water main extensions or similar type work or a General Contractors License for construction of building structures, and valid certifications of competency of qualifications, (issued by the public agencies having jurisdiction of the area where the project is located) required to perform the work proposed by these Contract Documents.

B. The Bidder has the financial resources deemed necessary to permit the project to proceed without interruption and complete as specified herein.

C. The Bidder has a well trained and competent organization which has done work of similar character and magnitude. An organizational structure as
intended, including total manpower, to complete the project will be submitted with the Bidder’s proposal.

D. The Bidder will have adequate equipment available to do the work at the proper time. A complete list of all equipment intended for use on this project will be submitted with the Bidder’s proposal.

E. The Bidder has ample repair parts and supplies to maintain all FKAA facilities properly, and with a minimum of delay.

The Contract will be awarded only to a Bidder who, in the opinion of the FKAA, is fully qualified to perform the work proposed by these Contract Documents. Each Bidder shall complete and submit with his bid the attached document entitled Information Required of Bidder.

The above Qualification Requirements will be deemed met, and the Information Required of Bidder need not be submitted, provided the Bidding Contractor has timely and successfully completed similar work with the FKAA within the past two years.

At the request of a Bidding Contractor, the FKAA may accept evidence of qualification with other agencies of the State of Florida in lieu of all or a portion of the above Qualification Requirements.

5. DOCUMENT INTERPRETATION

The Contract Documents governing the work proposed herein consist of the Drawings and all material herewith. These Contract Documents are intended to be mutually complementary and to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any person contemplating the submission of a Proposal shall have thoroughly examined all of the various parts of these documents, and should there be any doubt as to the meaning or intent of said Contract Documents, the Bidder should request of the FKAA, in writing (at least 6 working days prior to bid opening) an interpretation thereof. Any interpretation or change in said Contract Documents will be made only in writing, in the form of Addenda to the Contract Documents which will be furnished to all Bidders receiving a set of the Contract Documents. Bidders shall submit with their Proposals, or indicate receipt of, all Addenda. The FKAA will not be responsible for any other explanation or interpretations of said Contract Documents not issued in writing by Addendum.

6. BIDDER’S UNDERSTANDING

Each Bidder must inform himself of the conditions relating to the execution of the work, and it is assumed that he will inspect the site and make himself thoroughly familiar with all the Contract Documents. Failure to do so will not relieve the successful Bidder of his obligation to enter into a Contract and complete the contemplated work in strict accordance with the Contract Documents. It shall be the Bidder’s obligation to verify for himself and to his complete satisfaction all information concerning site and subsurface conditions. Each
Bidder shall inform himself of, and the Bidder awarded a Contract shall comply with all Federal, State, and local laws, statues, and ordinances relative to the execution of the work. This requirement includes, but is not limited to, applicable regulations concerning minimum wage rates, nondiscrimination in the employment of labor, protection of public and employee safety and health, environmental protection, the protection of natural resources, fire protection, burning and nonburning requirements, permits, fees, maintenance of traffic and similar subjects.

7. DRAWINGS

Design Drawings or Shop Drawings submitted to the FKAA by the Bidder must be standard size prints (Refer to Florida Keys Aqueduct Minimum Design and Construction Standards and Specifications).

8. TYPE OF PROPOSAL

A. LUMP SUM

When the Proposal for the work is to be submitted on a lump sum basis, a single lump sum price shall be submitted in the appropriate place. The total amount to be paid the Contractor shall be the amount of the lump sum proposal as adjusted for additions or deletions resulting from changes in construction. The Bidder shall furnish, in the spaces provided in the Proposal, a breakdown of his lump sum bid.

B. COMBINED UNIT PRICE - LUMP SUM

When the Proposal for the work is to be submitted on a combined unit price - lump sum basis, unit prices or lump sum price amounts shall be submitted for all items of work set forth in the Proposal. All items required to complete the work specified or shown on the Drawings but not included in the Proposal shall be considered incidental to those set forth in the Proposal. The estimate of quantities of work to be done is tabulated in the Proposal and, although stated with as much accuracy as possible, is approximate only and is assumed solely for the basis of calculation upon which the award of Contract shall be made. Payment to the Contractor for unit price work will be made on the measurement of the work actually performed by the Contractor as specified in the Contract Documents. The total amount to be paid the Contractor for the lump sum work shall be the amount of the lump sum Proposal as adjusted for additions or deletions resulting from FKAA-authorized changes in the project.

9. PREPARATION OF PROPOSALS

All blank spaces in the proposal form must be filled in, preferably in BLACK ink, in both words and figures where required. No changes shall be made in the phraseology of the forms. Written amounts shall govern in cases of discrepancy between the amounts stated in
figures. In case of discrepancy between unit prices and totals, unit prices will prevail.

Any Proposal may be deemed nonresponsive which contains material omissions, or irregularities, or in which any of the prices are obviously unbalanced, or which in any manner shall fail to conform to the conditions of the published Invitation To Bid.

Only one bid from any individual, firm, partnership, or corporation under the same or difference names will be considered. Should it appear to the FKAA that any Bidder is interested in more than one bid for work contemplated, all bids in which such Bidder is interested will be rejected.

The Bidder shall sign his Proposal in the blank space provided therefore. If Bidder is a corporation, the legal name of the corporation shall be set forth above, together with the signature of the officer or officers authorized to sign Contracts on behalf of the corporation. If Bidder is a partnership, the true name of the firm shall be set forth above, together with the signature of the partner or partners authorized to sign Contracts in behalf of the partnership. If signature is by an agent, other than an officer of a corporation or a member of a partnership, a notarized power-of-attorney must be on file with the FKAA prior to opening of Proposals or submitted with the Proposal.

A. CHANGES IN QUANTITIES

The FKAA reserves the right to increase or decrease the amount of class of work item shown in the Proposal that may be deemed necessary. In the event of increase or decrease, the unit prices for such work items may be subject to adjustment as provided in Section 8.2, of the General Conditions.

10. STATE AND LOCAL SALES AND USE TAXES

Unless any Supplementary Conditions contain a statement that the FKAA is exempt from State sales tax on materials incorporated into the work due to the qualification of the work under this Contract, all State and local sales and use taxes, as required by the laws and statutes of the State and its political subdivisions, shall be paid by the Contractor. Prices quoted in the Proposal shall include all nonexempt sales and use taxes, unless provision is made in the Proposal form to separately itemize the tax.

If any Supplementary Conditions state that the FKAA is exempt from State sales tax on any materials, the Contractor must follow such procedures as may be necessary to preserve the sales tax exemption. If the Contractor fails to do so, he must pay all resulting sales taxes, including applicable interest, penalties or other costs.

11. SUBMISSION OF PROPOSALS

All Proposals must be submitted not later than the time prescribed, at the place, and in the manner set forth in the Invitation To Bid. Proposals must be made on the Proposal forms provided herein. Each Proposal must be submitted in a sealed envelope, so marked as to indicate its contents without being opened, and addressed in conformance with the
instructions in the Invitation To Bid.

12. **TELEGRAPHIC OR WRITTEN MODIFICATION OF PROPOSAL**

Any Bidder may modify his bid by telegraphic or written communication at any time prior to the scheduled closing time for receipt of bids, provided such communication is received by the FKAA prior to the closing time. The telegraphic or written communication should not reveal the bid price; it should, however, state the addition or subtraction or other modification so that the final prices or terms will not be known by the FKAA until the sealed bid is opened.

13. **WITHDRAWAL OF PROPOSAL**

Any Proposal may be withdrawn prior to the scheduled time for the opening of Proposals either by telegraphic or written request, or in person. If, within twenty-four hours after Bids are opened, any Bidder files a duly signed written notice with the FKAA and promptly thereafter demonstrates to the reasonable satisfaction of the FKAA that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid and the Bid Security will be returned. Thereafter, that Bidder will be disqualified from further bidding on the work to be provided under the Contract Documents.

14. **BID SECURITY**

Proposals must be accompanied by, a certified check, or cashier’s check drawn on any State or National Bank, or a bid bond issued by a Surety authorized to issue such bonds in the State where the work is located, in the amount of 5 percent of the total amount of the proposal submitted. This bid security shall be given as a guarantee that the Bidder will execute the attached Contract and furnish properly executed Performance and Payment Bonds, each in the full amount of the Contract price within the time specified.

The Attorney-in-Fact who executes this bond in behalf of the Surety must attach a notarized copy of his power-of-attorney as evidence of his authority to bind the Surety on the date of execution of the bond. Where State Statute requires, certification by a resident agent shall also be provided.

If the Bidder elects to furnish a Bid Bond, he shall use the Bid Bond form bound herewith, or one conforming substantially thereto in form and content.

15. **RETURN OF BID SECURITY**

Within 30 days after the award of the Contract, the FKAA will return the bid securities to all Bidders whose Proposals are not to be further considered in awarding the Contract. Retained bid securities will be held until the Contract has been finally executed, after which all bid securities, other than Bidder’s bonds and any guarantees which have been forfeited, will be returned to the respective Bidders whose Proposals they accompanied.
16. **AWARD & BASIS OF CONTRACT**

The FKAA reserves the right to accept any Bid or combination of Bid alternates which, in the FKAA’s judgment will best serve the FKAA’s interest, reject any and all Bids, to waive any and all informalities and/or irregularities, and to negotiate contract terms with the Successful Bidder, and the right to disregard all nonconforming, nonresponsive, unbalanced or conditional Bids. The FKAA reserves the right to reject any one or all Bids, or any part of any Bid, to waive any informality in any Bid, and to award the purchase in the best interest of the FKAA. Discrepancies in the multiplication of units of work and unit prices will be resolved in favor of the unit price. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

Within 30 calendar days after the opening of Proposals, unless otherwise stated in the Invitation To Bid or Supplementary Conditions of these Documents, the FKAA will issue notice that it intends to accept one of the proposals or will act in accordance with BASIS OF AWARD, below. Acceptance of the Proposal by the FKAA will be by written Notice of Award, mailed or delivered to the office designated in the Proposal. In the event of failure of the lowest responsible and responsive qualified Bidder to sign and return the Contract, as prescribed herein, the FKAA may award the Contract to the next lowest responsible and responsive qualified Bidder. Such award, if made by the FKAA will be made within 30 days after the opening of Proposals.

17. **BASIS OF AWARD**

The Contract will be awarded to the responsible Bidder submitting the lowest acceptable Proposal.

The award will be made by the FKAA on the basis of that Proposal from the lowest responsive*, responsible**, qualified Bidder. When projects are paid for in part with Federal funds, the award will be made on the basis of that Proposal submitted by the responsive, responsible, qualified Bidder submitting the lowest Proposal acceptable to the financing agency.

*RESPONSIVE BIDDER: Any person, firm or corporation submitting a bid for the work contemplated whose Bid Form is complete and regular, free of exclusions or special conditions and has no alternative bids for any item unless requested in the technical specifications.

**RESPONSIBLE BIDDER: Any person, firm or corporation submitting a bid for the work contemplated who maintains a permanent place of business, has adequate plant equipment to do the work properly and within the time limit that is established, and has complied with FKAA’s procedures to establish to FKAA’s reasonable satisfaction that he is qualified to perform the Contract, and has adequate financial status to meet his obligations contingent to the work.
18. **EXECUTION OF CONTRACT**

The successful Bidder shall, within 15 calendar days, not including Sundays and legal holidays, after receiving Notice of Award, sign and deliver to the FKAA the Contract hereto attached together with the acceptable bonds as required in these Documents. Within 5 days, not including Sundays and legal holidays, after receiving the signed Contract with acceptable bonds from the successful Bidder, and if the FKAA is satisfied that all conditions of these Contract Documents have been satisfied, the Executive Director of the FKAA or his authorized agent will sign the Contract. Signature by both parties constitutes formation of the Contract.

19. **PLANS FOR CONSTRUCTION**

The successful Bidder will be furnished 3 sets of documents without charge. Any additional copies required will be furnished to the Contractor at reproduction cost.

20. **PERFORMANCE AND PAYMENT BONDS**

The successful Bidder shall file with the FKAA separate Performance Bond and Payment Bonds on the forms bound herewith, each in the full amount of the Contract price in accordance with the requirements of Florida Statutes Section 255.05, as security for the faithful performance of the Contract and the payment of all persons supplying labor and materials for the construction of the work, and to cover all guarantees against defective workmanship or materials, or both, for a period of one (1) year after the date of final acceptance of the work by the FKAA, except that materials supplied by the FKAA shall not be covered by the Payment Bond.

The Surety furnishing these bonds shall be authorized to do business in the State of Florida, shall be in compliance with the provisions of the Florida Insurance Code, shall have twice the minimum surplus and capital required by the Florida Insurance Code, and shall hold a currently valid certificate of authority issued by the United States Department of Treasury pursuant to Section 31, Paragraphs 9304-9308, of the United States Code.

For contracts in which the amount is greater than $500,000.00 the Surety must, in addition to the above requirements, have a rating of not less than (A-) by the latest edition of the KEY RATING GUIDE as published by A.M. Best Company, A.M. Best Road, Oldwick, NJ 08858.

For contracts $200,000 or less, the alternate bonding procedure described in Paragraph 22 may be utilized.

The Attorney-in-Fact (Resident Agent) who executes the Performance and Payment Bonds in behalf of the Surety must attach a notarized copy of his power-of-attorney as evidence of his authority to bind the Surety on the date of execution of the bonds.

All Contracts, Performance and Payment Bonds, and respective powers-of-attorney will have the same date.
21. **FAILURE TO EXECUTE CONTRACT AND FURNISH BOND**

The Bidder who receives Notice of Intended Award to him and who fails to promptly and properly execute the Contract and furnish the Performance and Payment Bonds shall forfeit the bid security that accompanied his bid, and the bid security shall be retained as liquidated damages by the FKAA, and it is agreed that this sum is a fair estimate of the amount of damages the FKAA will sustain in case the Bidder fails to enter into a Contract and furnish the bonds as hereinbefore provided. Bid security deposited in the form of a certified check, or cashier’s check shall be subject to the same requirements as a Bid Bond.

22. **ALTERNATIVE TO PERFORMANCE AND PAYMENT BONDS**

If the total contract amount is $200,000. or less, the Bidder who has a contract awarded to him is not required to furnish the Performance and Payment Bonds described above. If the Contractor elects not to furnish said bonds, Contractor shall be required to conform to the following procedures relative to payment of contractors, subcontractors, laborers and materialmen.

I.

At any time prior to final completion of the contract, the FKAA shall not authorize or make payment to the Contractor in excess of ninety percent (90%) of the amount due on the contract on the basis of the work suitably completed and material suitably stored on the site. In case of default by the Contractor, the Laborers, Materialmen, and Subcontractors, making claims for unpaid bills, will be paid from the ten percent (10%), retainage (as defined in Florida Statutes section 713.01), on a pro rata basis as follows. The sum all valid claims made shall be divided into each individual claim thereby deriving a percentage value for each individual claim. The total retainage will then be multiplied by the percentage value for each individual claim and the result shall be the pro rata share of the retainage to be paid to each claimant. However, no payment shall exceed the valid claim made.

II.

The Contractor shall provide a certified list of all subcontractors, laborers and material suppliers to the FKAA’s Construction Manager within ten days of his receiving his Notice to Proceed with the work. This list shall be immediately updated thereafter with notice of subcontractors provided prior to such subcontractors entering the job site(s). Each month a certified statement shall be sent to the FKAA stating that the list and its updates include the names and addresses of all of those subcontractors, laborers, and material suppliers furnishing labor and/or material for the project.

III.

The FKAA shall place a notice in the following form, on three successive weeks, in a local
newspaper and the Contractor shall post such notice in a conspicuous place on the project site:

“Notice is hereby made to all those concerned and affected that (CONTRACTOR’S NAME) is performing (PROJECT NAME), (PROJECT NUMBER) at (LOCATION) for the Florida Keys Aqueduct Authority. All parties furnishing labor and/or materials to said project are requested to provide notice of such in writing by certified mail to the Construction Manager, Florida Keys Aqueduct Authority, 1100 Kennedy Drive, Key West, Florida  33040, within twenty days of first providing such labor and/or materials.”

IV.

When a Contractor receives any payment from the FKAA, the Contractor shall pay such moneys received to each Subcontractor and Supplier in proportion to the percentage of work completed by each Subcontractor and Supplier at the time of receipt of the payment. If the Contractor receives less than full payment, then the Contractor shall be required to disburse only the funds received on a pro rata basis with the Contractor, Subcontractors, and Suppliers, each receiving a prorated portion based on the amount due on the payment. The Contractor shall make such payments within seven (7) working days after receipt by the Contractor of such full or partial payment, and if the Contractor without reasonable cause fails to do so, the Contractor shall in addition pay the penalties imposed by Florida Statutes section 287.0585.

V.

The Contractor shall provide a written statement with each pay request to the FKAA’s Construction Manager which indicates which Subcontractors and Suppliers will be paid and how much to each. This pay request breakdown shall define the disbursement intended for all of the funds requested.

VI.

With all but the first payment request, the Contractor shall provide a written statement from each of the Subcontractors and Suppliers indicated in V. above that payments is indicated in the preceding statements have been made as indicated. In the event any payment is not made as indicated on a prior statement noted V. above, the Contractor shall immediately furnish an explanation as to the reasons for such deviation and shall request approval from the FKAA’s Construction Manager.

VII.

The final payment of retainage (i.e., the last 10% of the amount due on the contract) shall not be made until the project has been inspected by the person designated by the FKAA for that purpose and until he has verified that the project has been constructed in accordance with the approved plans, specifications and approved change orders and until the project has been accepted.
be made until the Contractor has supplied the FKAA with signed and dated statements, from all Laborers, Materialmen, and Subcontractors identified under II, above, stating that they have not claims against the Contractor for the work under the contract. Said statements shall identify the project by name and project number.

23. PERFORMANCE OF WORK BY CONTRACTOR

The Contractor shall perform on the site and with his own organization, labor equivalent to at least sixty percent of the total amount of the work to be performed under this Contract. If, during the progress of the work hereunder, the Contractor requests a reduction of such percentage, and the FKAA determines that it would be to the FKAA’s advantage, the percentage of the labor required to be performed by the Contractor’s own organization may be reduced; PROVIDED prior written approval of such reduction is obtained by the Contractor from the FKAA.

Each Bidder must furnish with his bid a list of the items that he will perform with his own forces and the estimated total cost of these items in addition to his list of subcontractors with the estimated total cost for each.

24. TIME OF COMPLETION

The time of completion of the work to be performed under this Contract is the essence of the Contract. Delays and extensions of time may be allowed in accordance with the provisions stated in Article 7.7, of the General Conditions. The time allowed for the completion of the work is stated in the Proposal.

25. SHOP DRAWINGS

The Contractor shall submit a minimum of four (4) copies, each, of shop drawings. Three (3) of these will be retained by the FKAA with one (1) being returned to the Contractor. If the Contractor requires more than one (1) shop drawing to be returned, he may submit the number as required to a maximum of eight (8) total. Shop drawings shall consist of illustrative data, specifications, setting plans, installation instructions where required, and other data as may be requested, to the FKAA, for approval prior to ordering fabrication of specially fabricated materials to be furnished. Any purchase, fabrication or shipment of materials and equipment prior to such approval, shall be at the Contractor’s risk and of such materials and equipment may be rejected if they do not meet all the requirements of the Contract Documents.

The Contractor shall submit all Drawings at least one (1) month prior to the time the equipment will be installed or in accordance with a schedule submitted at the time of the preconstruction conference and agreed upon by the FKAA.

Prior to his submission of shop drawings, the Contractor shall have verified any necessary field dimensions, and shall have determined conformance with the requirements of the Contract Documents, or, upon submission, advise the FKAA of any deviations. The submitted shop drawings shall bear the Contractor’s stamp of approval indicating that the
Contractor has made such verification and determination. Shop drawings shall be clearly detailed and dimensioned. If, in the opinion of the Engineer, the shop drawings submitted are incomplete, or inaccurate, he may reject them without checking and require re-submission.

The FKAA or its designee shall review shop drawings with reasonable promptness, but the review and approval shall be only for conformance with the design concept of the project, and compliance with the requirements of the Contract Documents and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto. The FKAA’s approval of shop drawings shall not relieve the Contractor of any deviation from the requirements of the Contract Documents, without the Engineer’s written specific approval of such deviation, nor shall it relieve the Contractor from responsibility for errors and omissions in shop drawings nor from his basic responsibility of satisfactory completion of the project in accordance with the requirements of the Contract Documents.

26. **SUB-CONTRACTING/MBE PARTICIPATION**

The FKAA reserves the right to accept or reject any or all bids wherein a subcontractor is named and to make the award to the Bidder, who, in the opinion of the FKAA will be in the best interest of and/or most advantageous to the FKAA. The FKAA also reserves the right to reject a bid of any Bidder if the bid names a subcontractor who has previously failed in the proper performance of an award or failed to deliver on time contracts of a similar nature, or who is not in a position to perform properly under this award. The FKAA reserves the right to make said determination.

Bidders are hereby informed that the FKAA encourages the utilization and participation of Minority and Women Business Enterprises in contracts financed with FKAA funds. Bidders are encouraged to seek Minority and Women Business Enterprises for participation in subcontracting opportunities.

27. **PUBLIC ENTITY CRIMES**

A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases of real property to a public entity, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity, and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017, for CATEGORY TWO for a period of 36 months from the date of being placed on the convicted vendor list.

* * * * * * * * * *
NOTE TO BIDDER: Use Ink, preferably BLACK, for completing this PROPOSAL FORM.

To: Hand Delivered, U.S. Postal Service or Overnight Services
   Florida Keys Aqueduct Authority
   Engineering Department
   FKAA Project #1152-17-Phase IIB
   1100 Kennedy Drive
   Key West, Florida  33040

Project Title: C-905 PHASE IIB TRANSMISSION WATER MAIN REPLACEMENT

FKAA Project: # 1152-17-Phase IIB

Bidder’s person to contact for additional information on this Proposal:

Name: Marnie Walterson, Utility Design Supervisor

Telephone: (305) 295-2154

BIDDER’S DECLARATION AND UNDERSTANDING

The undersigned, hereinafter called the Bidder, declares that the only persons or parties interested in this Proposal are those named herein, that this Proposal is, in all respects, fair and without fraud, that it is made without collusion with any official of the FKAA, and that the Proposal is made without any connection or collusion with any person submitting another Proposal on this Contract.

The Bidder further declares that the Bidder has carefully examined the Contract Documents for the construction of the project, that the Bidder has personally inspected the site, that the Bidder has satisfied himself as to the quantities involved, including materials and equipment, and conditions of work involved, including the fact that the description of the quantities of work and materials, as included herein, is brief and is intended only to indicate the general nature of the work and to identify the said quantities with the detailed requirements of the Contract Documents, and that this Proposal is made according to the provisions and under the terms of the Contract Documents, which Documents are hereby made a part of this Proposal.

The Bidder further agrees that the Bidder has exercised his own judgment regarding the interpretation of subsurface information and has utilized all data which the Bidder believes pertinent from the Engineer, FKAA, and other sources in arriving at his conclusions.
CONTRACT EXECUTION AND BONDS

The Bidder agrees that upon receiving notice of FKAA’s intent to accept this Proposal the Bidder will, within 15 working days after Notice of Award, sign the Contract, submit the executed Performance and Payment Bonds, and will, to the extent of his Proposal, furnish all machinery, tools, apparatus, and other means of construction and do the work and furnish all the materials necessary to complete all work as specified or indicated in the Contract Documents.

CERTIFICATES OF INSURANCE

The Bidder further agrees to furnish the FKAA, before signing of the Contract, the certificates of insurance as specified in these Documents. The FKAA shall be listed as additionally insured on all Insurance Certificates.

START OF CONSTRUCTION AND CONTRACT COMPLETION TIME

The Bidder further agrees to begin work within ten (10) calendar days after the date of the Notice to Proceed and that construction shall be substantially complete, in all respects, within 270 calendar days after the date of the Notice to Proceed, and Final Completion of construction will be within 30 calendar days of the date of Substantial Completion. It will be the bidder’s responsibility to obtain clearance for all its employees and subcontractors prior to commencement of work.

LIQUIDATED DAMAGES

In the event the Bidder is awarded the Contract and shall fail to complete the work within the time limit or extended time limit agreed upon for Substantial Completion, as more particularly set forth in the Contract Documents, liquidated damages shall be paid to the FKAA at the rate of $1,000.00 per day for all work awarded under the contract until the work has been substantially completed as provided by the Contract Documents. After Substantial Completion, if the Bidder fails to complete the work within the time limit or extended time limit agreed upon for Final Completion, liquidated damages shall be paid to the FKAA at the rate of $500.00 per day until Final Completion of the project.

ADDENDA

The Bidder hereby acknowledges that he has received Addenda No’s __________, __________, __________, __________, __________, __________, (Bidder shall insert No. of each Addendum received) and agrees that all Addenda issued are hereby made part of the Contract Documents, and the Bidder further agrees that the Proposal includes all impacts resulting from said Addenda.

SALES AND USE TAXES

The Bidder agrees that all sales and use taxes are included in the stated bid prices for the work, unless provision is made herein for the Bidder to separately itemize the estimated amount of sales
UNIT PRICE WORK

The Bidder further proposes to accept as full payment for the work proposed herein the amounts computed under the provisions of the Contract Documents and based on the following unit price amounts, it being expressly understood that the unit prices are independent of the exact quantities involved. The Bidder agrees that the unit prices represent a true measure of the labor and materials required to perform the work, including all allowances for overhead and profit for each type and unit of work called for in these Contract Documents. The amounts shall be shown in both words and figures. In case of a discrepancy, the amount shown in words shall govern.

PUBLIC ENTITY CRIMES

A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases of real property to a public entity, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity, and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017, for CATEGORY TWO for a period of 36 months from the date of being placed on the convicted vendor list.

FLORIDA TRENCH SAFETY ACT

The Bidder further acknowledges that included in the various items of the Proposal and in the total bid price are costs for complying with the Florida Trench Safety Act (90-96, Laws of Florida) effective October 1, 1990. These costs shall not be paid for in a separate bid item.
## UNIT PRICE BID

**FLORIDA KEYS AQUEDUCT AUTHORITY**

**FKAA PROJECT # 1152-17-PHASE IIB**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUAN.</th>
<th>UNIT</th>
<th>FIGURES</th>
<th>UNIT PRICE</th>
<th>TOTAL EXT. AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. General Conditions</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>(a) Mobilization &amp; Demobilization (Maximum of 2%-See Section 01025)</td>
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<tr>
<td>Lump Sum</td>
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<tr>
<td>(b) Bonds and Insurance</td>
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<tr>
<td>Lump Sum</td>
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<tr>
<td>(c) MOT</td>
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<tr>
<td>Lump Sum</td>
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<tr>
<td>(d) As-Builts Drawings</td>
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<td>Lump Sum</td>
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<tr>
<td>2. Water Mains in Place</td>
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<tr>
<td>(a) 16-Inch C-900 PVC Pipe-DR14 (Unrestrained)</td>
<td></td>
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<tr>
<td>19,790 L.F.</td>
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<td>$_____________</td>
<td>$_____________</td>
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</tr>
<tr>
<td>(b) 16-Inch C-900 PVC Pipe-DR14 (Restrained)</td>
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<tr>
<td>2,730 L.F.</td>
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<td>$_____________</td>
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<tr>
<td>3. Valve &amp; Valve Box</td>
<td></td>
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<tr>
<td>(a) 16-Inch Butterfly Valve and Valve Box</td>
<td></td>
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<tr>
<td>5 Each</td>
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<td>$_____________</td>
<td>$_____________</td>
<td>$_____________</td>
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<td></td>
<td></td>
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<tr>
<td>(b) Air Release Valve (Pedestal Housing/Enclosure)</td>
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<tr>
<td>9 Each</td>
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<td>$_____________</td>
<td>$_____________</td>
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</tbody>
</table>

**PROJECT # 1152-17-PHASE IIB 3-4**

**PROPOSAL**
### 4. Ductile Iron Fittings

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 16”- 45° Bend</td>
<td>2 Each</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>(b) 16”-11-1/4° Bend</td>
<td>5 Each</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>(c) 6” Cap</td>
<td>1 Each</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>(d) 12” Cap</td>
<td>1 Each</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>(e) 6” x 6” Tee with Plug</td>
<td>1 Each</td>
<td>$_________</td>
<td>$_________</td>
</tr>
</tbody>
</table>

### 5. Connect to Existing Water Mains

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Connect to Existing 16” Water Main</td>
<td>1 Each</td>
<td>$_________</td>
<td>$_________</td>
</tr>
</tbody>
</table>

### 6. Master Meter Assembly

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 4” Master Meter Assembly</td>
<td>1 Each</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>(b) 2” Master Meter Assembly</td>
<td>3 Each</td>
<td>$_________</td>
<td>$_________</td>
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</tbody>
</table>

### 7. Pavement Restoration

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Pavement Restoration (Per Detail # 1a)</td>
<td>21,510 L.F.</td>
<td>$_________</td>
<td>$_________</td>
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<tr>
<td>(b) Full Lane Restoration (Per Detail # 3a)</td>
<td>22,520 L.F.</td>
<td>$_________</td>
<td>$_________</td>
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</tbody>
</table>
(c) Roadway Restoration (Per Detail # 1d)
1,010 L.F.
$__________________ $__________________ $__________________

8. Filter Fabric Surrounding Pipeline Bedding Material (In Low Lying Areas <= 4.0’ NGVD)
(a) 5,690 S.Y.
$__________________ $__________________ $__________________

9. 5% Contingency Allowance

$__________________ $__________________ $__________________

SUM OF EXTENDED TOTALS
BASIS OF AWARD $__________________ $__________________

Name of Firm Submitting Bid

___________________________________________

Signature of Bidder

___________________________________________

Title

___________________________, ________________________, $ ________________
Name Type Work Value

___________________________, ________________________, ________________________, ________________________, ________________
Street City State Zip Code

___________________________, ________________________, $ ________________
Name Type Work Value

___________________________, ________________________, ________________________, ________________________, ________________
Street City State Zip Code

SUBCONTRACTORS
The Bidder further proposes that the following subcontracting firms or businesses will be awarded subcontracts for the following portions of the work in the event that the Bidder is awarded the Contract:

PROJECT # 1152-17-PHASE IIB 3-6 PROPOSAL
SURETY

The Bidder is awarded a construction Contract on this Proposal, the Performance and Payment Bonding will be handled in the following manner (Bidder to check one):

[   ] In accordance with Paragraph 22 of “Instructions to Bidders”, Performance and Payment Bonds will not be furnished. Bidder agrees to abide by the conditions of Paragraph 22 (FOR CONTRACTS LESS THAN $200,000 ONLY).

[   ] Payment and Performance Bonds will be furnished by a Surety. The Surety who will provide the Payment and Performance Bonding will be __________________________ whose address is __________________________________________________________

   Street

   ______________________', ______________________', ______________________

   City      State     Zip Code

BIDDER

The name of the Bidder submitting this Proposal is __________________________________________________________

Sea-scape, __________________________, __________________________

The name of the Bidder submitting this Proposal is __________________________________________________________,

doing business at

Street        City        State        Zip Code

which is the address to which all communications concerned with this Proposal and with the Contract shall be sent.

The names of the principal officers of the corporation submitting this Proposal, or of the partnership, or of all persons interested in this Proposal as principals are as follows:

____________________________________________

____________________________________________

____________________________________________

____________________________________________
If Sole Proprietor or Partnership

IN WITNESS hereto the undersigned has set his (its) hand this day of ___________, ______.

____________________________________
Signature of Bidder

____________________________________
Title

If Corporation

IN WITNESS WHEREOF the undersigned corporation has caused this instrument to be executed and its seal affixed by its duly authorized officers this ____________ day of ____________, 20__.

(SEAL)

Name of Corporation

By________________________

Title________________________

Attest________________________

Secretary

Information Required of Bidder

GENERAL INFORMATION

PROJECT # 1152-17-PHASE IIB 3-8 PROPOSAL
The Bidder shall furnish the following information. Failure to comply with this requirement may render the Proposal nonresponsive and may cause its rejection. Additional sheets shall be attached as required.

1. Contractor’s Telephone Number:________________________________________

2. Contractor’s License:__________________________________________________
   Primary Classification:____________________________________________________
   Florida State License No.:__________________________________________________
   Supplementary classifications held, if any:____________________________________

3. Number of years as a contractor in construction work of this type:__________

4. Names of persons who inspected site of proposed work for your firm:
   Name:____________________________________________________
   Dates of Inspection:__________________________________________
   Name:_______________________________________________________
   Dates of Inspection:__________________________________________

5. ATTACH TO THIS BID the experience resume of the person who will be designated chief construction superintendent.

6. ATTACH TO THIS BID references and other information sufficiently comprehensive to permit an appraisal of contractor’s current financial condition.

7. ATTACH TO THIS BID Contractor’s organizational structure, including manpower, to complete the project within the specified limits.

8. ATTACH TO THIS BID Contractor’s list of equipment intended for use to complete the project within the specified limits.

9. ATTACH TO THIS BID a list of all construction contracts completed by the Contractor during the last five (5) years involving work of similar type and comparable value. This list shall include the following information as a minimum:
   Name, address, and telephone number of Owner
   Name of project
Location of project

Brief description of the work involved

Contract amount

Date of completion of contract

Name, address, and telephone number of architect or engineer

Name of the Owner’s Construction Manager
BID BOND

STATE OF FLORIDA )
COUNTY OF )

KNOW TO ALL MEN BY THESE PRESENTS, that we,

hereinafter called the PRINCIPAL, and

hereinafter called SURETY, are held and firmly bound unto Florida Keys Aqueduct Authority,
represented by its Board of Directors, hereinafter called OWNER, in the sum of

_________________________ DOLLARS ($_________________________)

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

THE CONDITION OF THIS BOND IS SUCH THAT:

WHEREAS, the PRINCIPAL contemplates submitting or has submitted a bid to the OWNER for
the furnishing of all labor, materials (except those to be specifically furnished by the OWNER),
equipment, machinery, tools, apparatus, means of transportation for, and the performance of the
work covered in the Proposal and the detailed Drawings and Specifications, entitled:

WHEREAS, it was a condition precedent to the submission of said bid that a cashier’s check,
certified check, or bid bond in the amount of 5 percent of the base bid to be submitted with said bid
as a guarantee that the PRINCIPAL, would, if notified of OWNER’S intent to award the Contract to
the PRINCIPAL, enter into a written Contract with the OWNER for the performance of said
Contract, within 15 consecutive calendar days after written notice having been given of the award of
the Contract.

NOW, THEREFORE, the conditions of this obligation are such that if the PRINCIPAL accepts
within 15 consecutive calendar days after written notice of such intended award executes and
delivers to the OWNER the written Contract with the OWNER and furnishes the Performance and
Payment Bonds, each in an amount equal to 100 percent of the base bid, satisfactory to the OWNER,
then this obligation shall be void; otherwise the sum herein stated shall be due and payable to the
OWNER and the SURETY herein agrees to pay said sum immediately upon demand of the OWNER
in good and lawful money of the United States of America, as liquidated damages for failure thereof
said PRINCIPAL.

IN WITNESS WHEREOF, the said _______________________________ as

PROJECT # 1152-17-PHASE IIB 4-1 BID BOND
PRINCIPAL herein, has caused these presents to be signed in its name by its _________________ and attested by its _________________ under its corporate seal, and the said _________________ as SURETY herein, has caused these presents to be signed in its name by its _________________ corporate seal, this __________ day of _______________ A.D., 20__. 

Signed, sealed and delivered in presence of: __________________________ the Principal-Contractor

__________________________

By __________________________ As to Principal

Title ________________

__________________________

Surety

By __________________________

Attorney-in-Fact (Power-of-Attorney to be attached)

__________________________

As to Surety

__________________________

By Resident Agent

* * * * * * * * *
CONTRACT

THIS AGREEMENT, made and entered into on the ______day of ___________________, by
And between “___________________”, the “CONTRACTOR” and the “FLORIDA KEYS
AQUEDUCT AUTHORITY,” ALSO REFERRED TO AS THE “FKAA.”

WITNESSETH:

That the Contractor, for the consideration hereinafter fully set out, hereby agrees with the FKAA
as follows:

1. That the Contractor shall furnish materials as required, and perform all of the work in
manner and form as provided by the following enumerated Contract Documents, which
are attached hereto and made a part hereof, as if fully contained here:

   Invitation to Bid: Instructions to Bidders: General Conditions: Supplementary
   Conditions; Specifications; Proposal; Addenda; and the Drawings.

   As contained in:

2. The work must be substantially completed, as defined by Article 1.16 of the General
Conditions, within __270 calendar days__ from the date of the Notice to Proceed. The work
as provided in Article 1.15, of the General Conditions, and completed and ready for final
payment in accordance with Article 1.17, of the General Conditions within __30 calendar
days__ from the date of Substantial Completion.

3. Liquidated Damages: The Contractor recognizes that time is of the essence of the FKAA
Contract and that the FKAA will suffer financial loss if the work is not completed within
the times specified in paragraph 2 above, plus any extensions thereof allowed in
accordance with Article 7.9 of the General Conditions.

   All parties recognize the delays, expense and difficulties involved in proving in a legal
proceeding the actual loss suffered by the FKAA if the work is not completed on time.
Accordingly, instead of requiring any such proof, the FKAA and Contractor agree that as
liquidated damages for delay (but not as a penalty) Contractor shall pay the FKAA
[$1,000.00] for each day that expires after the time specified for substantial completion
until the work is substantially complete. After Substantial Completion if Contractor shall
neglect, refuse or fail to complete the remaining the work within the contract time or any
proper extension thereof granted by the FKAA, Contractor shall pay the FKAA[$500.00]
for each day that expires after the time specified for completion and readiness for final
payment. Sundays and legal holidays shall be included in determining days in default.
4. That the FKAA hereby agrees to pay to the Contractor for the faithful performance of this Contract, subject to additions and deductions as provided in the Contract Documents, in lawful money of the United States, the amount of: ____________________________ based on the estimated quantities and Unit or Lump Sum Prices contained herein.

5. That on or before the 30th day of each calendar month, the FKAA shall make partial payments to the Contractor on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the FKAA, LESS the retainage provided in the Contract Documents, which is to be withheld by the FKAA until all work within a particular part has been performed strictly in accordance with this Contract and until such work has been accepted by the FKAA.

6. That upon submission by the Contractor, of evidence satisfactory to the FKAA that all payrolls, material bills, and other costs incurred by the Contractor, in connection with the construction of the work have paid in full, final payment on account of this Contract shall be made with 60 days after the completion by the Contractor, of all work covered by this Contract and the acceptance of such work by the FKAA.

7. It is further mutually agreed between the parties hereto that if, at any time after the execution of the Contract and the Surety Bonds, hereto attached for its faithful performance and payment, the FKAA shall deem the Surety or Sureties upon any such bond to be unsatisfactory or if, for any reason any such bond ceases to be adequate to cover the performance of the work, the Contractor shall, at its expense, within 5 days after the receipt of notice from the FKAA so to do, furnish an additional bond or bonds in such form and amount and with such Surety or Sureties as shall be satisfactory to the FKAA. In such event, no further payment to the Contractor shall be deemed to be due under this Contract until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the FKAA.

8. No additional work or extras shall be done unless the same shall be duly authorized by appropriate action by the FKAA and written notice shall be delivered to Contractor directing Contractor to proceed with such additional work or extras.

9. That the Contractor shall:

Check One Only

[ ] (a) Furnish Payment and Performance Bonds which comply with Chapter 255, Florida Statutes, and other applicable law.

[ ] (b) Agree to follow the Alternative to Performance and Payment Bonds Procedures found in Instructions to Bidders Paragraph No. 22 (FOR CONTRACTS LESS THAN $200,000 ONLY).
IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day and date first above written, in ______ five _______ counterparts, each of which shall, without proof or accounting for the other counterpart be deemed an original Contract.

WITNESSESS:

Signature    Date

Signature    Date

CONTRACTOR

By        Date

Title

FKAA

ATTEST

Kirk C. Zuelch    Date

Clerk        Date

Reviewed for legal sufficiency:

Robert Feldman    Date
General Counsel

BOARD APPROVAL DATE: ______________________________
PERFORMANCE BOND

BOND NO._____________________

AMOUNT: $_____________________

KNOW ALL MEN BY THESE PRESENTS, that in accordance with Florida Statutes Section 255.05, ___________________________________________________________________________

with offices at________________________________________________ __________________

hereinafter called the CONTRACTOR (Principal), and __________________________________

with offices at________________________________________________ __________________

a corporate duly organized and existing under and by virtue of the laws of the State of hereinafter called the SURETY, and authorized to transact business within the State of Florida, as SURETY, are held and firmly bound unto FLORIDA KEYS AQUEDUCT AUTHORITY, represented by its Board of Directors, as FKAA (Obligee), in the sum of:

$_____________________

DOLLARS ($_____________________)

lawful money of the United States of America, for the payment of which, well and truly be made to the FKAA, the CONTRACTOR and the SURETY bind themselves and each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents as follows:

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS, the CONTRACTOR has executed and entered into a certain Contract hereto attached, with the FKAA, dated ______________, 20___, to furnish at his own cost, charges, and expense all the necessary materials, equipment, and/or labor in strict and express accordance with said Contract and the Contract Documents as defined therein, all of which is made a part of said Contract by certain terms and conditions in said Contract more particularly mentioned, which Contract, consisting of the various Contract Documents is made a part of this Bond as fully and completely as if said Contract Documents were set forth herein;

NOW THEREFORE, the conditions of this obligation are such that if the above bounden CONTRACTOR shall in all respects comply with the terms and conditions of said Contract and his obligation thereunder, including the Contract Documents and shall indemnify, defend and save harmless the above FKAA against and from all costs, expenses, damages, attorney’s fees, including appellate proceedings, injury or loss of whatever kind and however arising including without limitation delay damages to which said FKAA may be subject by reason of any wrongdoing, misconduct, want of care or skill, negligence, failure of performance, breach, failure to petition within the prescribed time, or default, including patent infringements, on the part of said CONTRACTOR, his agents or employees, in the execution or performance of said Contract; then
this obligation shall be void; otherwise, to remain in full force and effect for the term of said Contract, including any and all guarantee periods as specifically mentioned in said Contract Documents;

**AND**, the said Surety for value received, hereby stipulates and agrees that no change involving any extension of time, or addition to the terms of the Contract Documents, or to the work to be performed, or materials to be furnished thereunder shall affect said obligation of said Surety on this Bond, and the said Surety does hereby waive notice of any such changes, extension of time, alterations, or additions of the terms of the Contract Documents, or to the work. Claimant shall give written notice to the Contractor and to the Surety as required by Florida Statutes, Section 255.05. Any actions against the Contractor or the Surety shall be brought within the time specified by Section 255.05.

**IN WITNESS WHEREOF**, the above parties bounded together have executed this instrument this ___ day of ______________________, 20___, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.

**CONTRACTOR**

____________________________________
By ___________________________ (SEAL)

______________

ATTEST

**SURETY**

____________________________________
By ___________________________ (SEAL)

______________

ATTEST
PAYMENT BOND

BOND NO.____________________

AMOUNT: $____________________

KNOW ALL MEN BY THESE PRESENTS, that in accordance with Florida Statutes Section 255.05, ________________________________________________

with offices at ________________________________________________

hereinafter called the CONTRACTOR, (Principal), and ___________________________________

with offices at ________________________________________________

a corporation duly organized and existing under and by virtue of the laws of the State of ________,

hereinafter called the SURETY, and authorized to transact business within the State of Florida, as

SURETY, are held and firmly bound unto FLORIDA KEYS AQUEDUCT AUTHORITY,

represented by its Board of Directors, as FKAA (Obligee), in the sum of:

________________________________________________________________________

DOLLARS ($____________________),

lawful money of the United States of America, for the payment of which, well and truly be made to

the FKAA, and the CONTRACTOR and the SURETY bind themselves and each of their heirs,

executors, administrators, successors, and assigns, jointly and severally, firmly by these presents as

follows:

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS, the CONTRACTOR has executed and entered into a certain Contract hereto attached,

with the FKAA, dated ____________________________, 20__, to furnish at his own cost,

charges, and expense the necessary materials, equipment, and/or labor in strict and express

accordance with said Contract and the Contract Documents as defined therein, all of which is made a

part of said Contract by certain terms and conditions in said Contract more particularly mentioned,

which Contract, consisting of the various Contract Documents is made a part of this Bond as fully

and completely as if said Contract Documents were set forth herein;

NOW THEREFORE, the conditions of this obligation are such that if the above bounden

CONTRACTOR shall in all respects comply with the terms and conditions of said Contract and his

obligation thereunder, including the Contract Documents and further that if said CONTRACTOR

shall promptly make payments to all persons supplying materials, equipment, and/or labor used

directly or indirectly by said Contractor or Subcontractors in the prosecution of the work provided

for in said Contract in accordance with Florida Statutes, Section 255.05; then this obligation shall be

void; otherwise, to remain in full force and effect for the term of said Contract, including any and all

guarantee periods as specifically mentioned in said Contract Documents;

AND, the said SURETY for value received, hereby stipulates and agrees that no change involving

any extension of time, or addition to the terms of the Contract or to the work to be performed, or
materials to be furnished thereunder, or in the Contract Documents shall affect said obligation of said SURETY on this Bond, and the said SURETY does hereby waive notice of any such changes, extension of time, alternations, or additions of the terms of the Contract, or to the work, or to the Contract Documents. Claimant shall give written notice to the Contractor and to the SURETY as required by Florida Statutes, Section 255.05. Any actions against the Contractor or the SURETY shall be brought within the time specified by Section 255.05.

IN WITNESS WHEREOF, the above parties bounded together have executed this instrument this ______ day of ____________________, 20__, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.

CONTRACTOR

_____________________________________
By______________________________ (SEAL)

______________________________
ATTEST

SURETY

_______________________________________
By______________________________ (SEAL)

______________________________
ATTEST
STANDARD
GENERAL CONDITIONS
OF THE
CONSTRUCTION CONTRACT
FOR THE
FLORIDA KEYS AQUEDUCT AUTHORITY
# GENERAL CONDITIONS

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**********

PROJECT # 1152-17-PHASE IIB 8-4 GENERAL CONDITIONS
GENERAL CONDITIONS

This part of the Contract Documents is preprinted. Any modifications to the following Articles required for this project are made in the Supplementary Conditions.

ARTICLE I - DEFINITIONS

Wherever in the Contract Documents the following terms are used, the intent and meaning shall be interpreted as follows:

1.1 AS APPROVED

The words “as approved”, unless otherwise qualified, shall be understood to be followed by the words “by the FKAA for conformance with the Contract Document”.

1.2 AS SHOWN, AND AS INDICATED

The words “as shown” and “as indicated” shall be understood to be followed by the words “on the Drawings”.

1.3 BIDDER

The person or persons, partnership, firm, or corporation submitting a Proposal for the work contemplated.

1.4 CONTRACT DOCUMENTS

The “Contract Documents” consist of the Bidding Requirements, Contract forms, Conditions of the Contract, the Specifications, and the Drawings, including all Addenda or other modifications thereof incorporated into the documents before their execution and all Change Orders, Supplemental Agreements, Amendments, Settlement Agreements or other modifications thereof incorporated into the documents after their execution and including all other requirements incorporated by specific reference thereto. These form the Contract.

1.5 CONTRACTOR

The person or persons, partnership, firm, or corporation who enters into the Contract awarded him by the Owner.

1.6 CONTRACT COMPLETION

The “Contract Completion” is the date the Owner accepts the entire work as being in compliance with the Contract Documents, or formally waives nonconforming work to the extent of nonconformity, and issues the final payment in accordance with the requirements set forth in Article, “Final Payment” of these General Conditions.

1.7 DAYS

Unless otherwise specifically stated, the term “days” will be understood to mean calendar days, Sundays and legal holidays included.
1.8 **DRAWINGS**

The term “Drawings” refers to the official Drawings, profiles, cross sections, elevations, details, and other working drawings and supplementary drawings, or reproductions thereof, signed by the FKAA, which show the location, character, dimensions, and details of the work to be performed. Drawings may either be bound in the same book as the balance of the Contract Documents or bound in separate sets, and are a part of the Contract Documents, regardless of the method of binding.

1.9 **ENGINEER**

Wherever in these Documents the word “Engineer” appears, it shall be understood to mean the Director of Engineering of the Florida Keys Aqueduct Authority (FKAA) or his authorized representative.

1.10 **NOTICE**

The term “Notice” or the requirements to notify, as used in the Contract Documents or applicable State or Federal statutes, shall signify a written communication delivered in person or by certified or registered mail to the individual, or to a member of the firm, or to an officer of the corporation for whom it is intended. Certified or registered mail shall be addressed to the last business address known to him who gives the notice.

1.11 **OR EQUAL**

The term “or equal” shall be understood to indicate that the “equal” product is the same or better than the product named in function, performance, reliability, quality, and general configuration. Determination of equality in reference to the project design requirements will be made by the FKAA. Such “equal” products shall not be purchased or installed by the Contractor without the FKAA’s written approval.

1.12 **FKAA**

Wherever in these Documents the word “FKAA” appears, it shall be understood to mean the Florida Keys Aqueduct Authority whose address is 1100 Kennedy Drive, P.O. Box 1239, Key West, Florida 33041-1239.

1.13 **PLANS (See DRAWINGS)**

1.14 **SPECIFICATIONS**

The term “Specifications” refers to those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards, and workmanship as applied to the work and certain administrative details applicable thereto. Where standard specifications, such as those of ASTM, AASHTO, etc., have been referred to the applicable portions of such standard specifications shall become a part of these Contact Documents. If referenced specifications conflict with specifications contained herein, the requirements contained herein shall prevail.
1.15 **NOTICE TO PROCEED**

A written notice given by the FKAA to the Contractor fixing the date on which the Contract time will commence to run and on which the Contractor shall start to perform his obligation under the Contract Documents.

The Notice to Proceed shall be given within 30 days following execution of the Contract by the FKAA.

1.16 **SUBSTANTIAL COMPLETION**

“Substantial Completion” shall be that degree of completion of the project or a defined portion of the project, as evidenced by the FKAA’s written notice of Substantial Completion, sufficient to provide the FKAA the full-time use of the project or defined portion of the project for the purposes for which it was intended. “Substantial Completion” of an operating facility shall be that degree of completion that has provided a minimum of 7 continuous days of successful, trouble-free, operation, which period shall begin after all performance and acceptance testing has been successfully demonstrated to the FKAA. All equipment contained in the work, plus all other components necessary to enable the FKAA to operate the facility in the manner that was intended, shall be complete on the substantial completion date.

1.17 **FINAL COMPLETION**

“Final Completion” shall mean completion of all work under the Contract Documents, including all conditions to final payment as set forth in Article 9.9, FINAL PAYMENT of these General Conditions.

1.18 **WORK**

The word “Work” within these Contract Documents shall include all material, labor, tools, and all appliances, machinery, transportation, and appurtenances necessary to perform and complete the Contract, and such additional items not specifically indicated or described which can be reasonably inferred as belonging to the item described or indicated and as required by good practice to provide a complete and satisfactory system or structure. As used herein, “Provide” shall be understood to mean “Furnish and install, complete, in-place”.

**ARTICLE II - PRELIMINARY MATTERS**

2.1 **DELIVERY OF DOCUMENTS**

When the Contractor delivers the signed Agreements to the FKAA, the Contractor shall also deliver to the FKAA such Bonds and Insurance Policies, Certificates or other documents as the Contractor may be required to furnish in accordance with the Contract Documents.

2.2 **COPIES OF DOCUMENTS**

The FKAA shall furnish to Contractor three copies (unless otherwise specified in the Supplementary Conditions) of the Contract Documents or as are reasonably necessary for the execution of the work. Additional copies will be furnished, upon request, at the cost of reproduction.
2.3 **COMMENCEMENT OF CONTRACT TIME; NOTICE TO PROCEED**

The Contract Time will commence to run on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within thirty days after the Effective Date of the Agreement.

2.4 **STARTING THE PROJECT**

Contractor shall start to perform the work on the date when the Contract Time commences to run, but no work shall be done at the site prior to the date on which the Contract Time commences to run.

2.5 **BEFORE STARTING CONSTRUCTION**

Before undertaking each part of the work, the Contractor shall carefully study and compare the Contract Documents, check and verify pertinent figures shown thereon and all applicable field measurements. The Contractor shall promptly report in writing to FKAA any conflict, error, ambiguity or discrepancy which the Contractor may discover and shall obtain a written interpretation or clarification from FKAA before proceeding with any work affected thereby; however, the Contractor shall not be liable to the FKAA for failure to report any conflict, error, ambiguity or discrepancy in the Contract Documents, unless Contractor knew or reasonably should have known thereof.

Prior to and at the Preconstruction Conference, the CONTRACTOR shall submit to FKAA for review:

2.5.1 At least 7 days prior to the preconstruction conference a proposed progress schedule indicating the starting and completion dates of the various stages of the work; and,

2.5.2 At the preconstruction conference a preliminary schedule of Shop Drawing submissions and those shop drawings necessary to begin the work; and, a preliminary schedule of values for all of the work which will include quantities and prices of items aggregating the Contract Price and will subdivide the work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of work which will be confirmed in writing by Contractor at the time of submission.

2.5.3 Preconstruction video tapes if required by the technical specifications.

2.5.4 The Contractor shall not commence construction operations until the construction progress schedule, schedule of values and the shop drawing submission schedule described above have been reviewed by the FKAA for general conformance with the Contract Documents. After review of the schedules, no deviation shall be made without prior written acceptance by the FKAA for general conformance with the Contract Documents.

2.6 **PRECONSTRUCTION CONFERENCE**

After the Effective Date of the Agreement, but before the Contractor starts work at the site, a conference attended by the Contractor and others as deemed appropriate by the FKAA, will be...
held to discuss the schedules referred to in paragraph 2.5, to discuss procedures for handling Shop Drawings and other submittals and for procedure for submitting Applications for Payment, and to establish a working understanding among the parties as to the work. Nothing herein shall relieve the Contractor from the responsibility of contacting local utilities and any other necessary agencies.

2.7 FINALIZING SCHEDULES

At least ten days before submission of the first Application for Payment a conference attended by the Contractor, FKAA, and others as appropriate will be held to finalize the schedules submitted in accordance with paragraph 2.5. The finalized progress schedule will be acceptable to the FKAA as providing an orderly progression of the work to completion within the Contract Time, but such acceptance will neither impose on the FKAA responsibility for the progress or scheduling of the work nor relieve the Contractor from full responsibility therefor. The finalized schedule of Shop Drawings submissions will be acceptable to the FKAA as providing a workable arrangement for processing the submissions. The finalized schedule of values will be acceptable to the FKAA as to form and substance.

ARTICLE III - CONTRACT DOCUMENTS

3.1 INTENT OF CONTRACT DOCUMENTS

The Contract Documents are complementary, and what is called for by one shall be as binding as if called for by all. The intent of the Documents is to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any work, materials, or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result shall be supplied whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe work, materials, or equipment, such words shall be interpreted in accordance with that meaning.

Reference to standard specifications, manuals, or codes of any technical society, organization or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code or laws or regulations in effect on the first published date of the Invitation to Bid, except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of the FKAA, the Contractor, or any of their consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to FKAA, or any of FKAA’s consultants, agents, or employees, any duty or authority to supervise or direct the furnishing or performance of the work or any duty or authority to undertake responsibility contrary to the provisions of Article 4.3 LIMITATIONS OF FKAA’S RESPONSIBILITIES.

3.2 DISCREPANCIES AND OMISSIONS

Any discrepancies or omissions found in the Contract Documents shall be reported to the FKAA immediately. The FKAA will clarify discrepancies or omissions, in writing, within a reasonable time. In resolving inconsistencies among two or more sections of the Contract Documents, precedence shall be given in the following order:
A. CONTRACT
B. PROPOSAL
C. SUPPLEMENTARY CONDITIONS
D. INVITATION TO BID
E. INSTRUCTIONS TO BIDDERS
F. GENERAL CONDITIONS
G. SPECIFICATIONS AND DRAWINGS

Addenda shall take precedence over all sections referenced therein. Figure dimensions on Drawings shall take precedence over scale dimensions. Detailed Drawings shall take precedence over General Drawings.

3.3 CHANGES IN WORK

The FKAA, without notice to the Sureties and without invalidating the Contract, may order changes in the work within the general scope of the Contract by altering, adding to, or deducting from the work, the Contract being adjusted accordingly. All such work shall be executed under the conditions of the original Contract, except as specifically adjusted at the time of ordering such change.

In giving instructions, the FKAA may order minor changes in the work not involving extra cost and not inconsistent with the purposes of the project, but otherwise, except in an emergency endangering life or property, additions or deductions from the work shall be performed only in pursuance of an approved Change Order signed by the FKAA.

If the work is reduced by alterations, such actions shall not constitute a claim for damages of any kind including any claim based on loss of anticipated profits, and the Contractor’s sole and exclusive remedy shall be to seek an adjustment of unit prices to the extent permitted by Article 8.2, UNIT PRICES of these General Conditions.

3.4 EXAMINATION AND VERIFICATION OF CONTRACT DOCUMENTS

The Contractor shall thoroughly examine and become familiar with all of the various parts of these Contract Documents and determine the nature and location of the work, the general and local conditions, and all other matters which can in any way affect the work under this Contract. Failure to make an examination necessary for this determination shall not release the Contractor from the obligations of this Contract. No verbal agreement or conversation with any officer, agent, or employee of the FKAA, or with the FKAA either before or after the execution of this Contract, shall affect or modify any of the terms or obligations herein contained.

3.5 DOCUMENTS TO BE KEPT ON THE JOBSITE

The Contractor shall keep one copy of the Contract Documents on the jobsite, in good order, available to the FKAA and to his representatives.

The Contractor shall maintain on a daily basis at the jobsite, and make available to the FKAA on request, one current record set of the Drawings which have been accurately marked up to indicate all modifications in the completed work that differ from the design information shown on the Drawings. Upon Substantial Completion of the work and prior to final payment, the Contractor shall give the FKAA one complete set of marked up record Drawings.
The Contractor shall maintain a current copy of the approved Maintenance of Traffic plan for the project at the site at all times.

3.6 ADDITIONAL CONTRACT DOCUMENTS

The FKAA will furnish to the Contractor on request and free of charge, three copies of the Contract Documents and three sets of full-size Drawings. Additional copies of Contract Documents or Drawings may be obtained on request by paying the actual cost of reproducing the Contract Documents or Drawings.

3.7 OWNERSHIP OF CONTRACT DOCUMENTS

All Drawings, Plans, Specifications, and copies thereof furnished by the FKAA and the FKAA are their property. They are not to be used on other work and, with the exception of the signed Contract set, are to be returned to them on request at the completion of the work. Any reuse of these materials without specific written verification or adaptation by the FKAA will be at the risk of the user and without liability or legal expense to the FKAA. Such user shall hold the FKAA harmless from any and all damages, including reasonable attorneys’ fees, up to the amount of the Contract price herein, from any and all claims arising from any such reuse. All models are the property of the FKAA.

3.8 MISCELLANEOUS PROVISIONS

3.8.1 This Contract shall be governed by and interpreted in accordance with the laws of the State of Florida. Venue shall be in the Circuit Court in and for Monroe County, Florida. In the event of any breach or default under the terms of this Contract or if any legal proceeding is instituted in connection with this Contract, the prevailing party shall be entitled to recover from the other all reasonable attorney’s fees and costs incurred whether for negotiation, settlement, trial or appellate services.

3.8.2 This Contract shall be binding upon the successors and assigns of each of the parties, but neither party shall assign this Contract without the prior written consent of the other party. Consent shall not be unreasonably withheld. Contractor shall not enter into any contractual agreement with a third party for performance of any conditions under this Contract without the express written approval of the FKAA. Contract and any permits required for performance of the Contract may not be assigned, conveyed or otherwise disposed of without permission of the FKAA Board of Directors.

3.8.3 All notices shall be in writing and transmitted to the party’s address stated within. All notices shall be deemed effectively given when delivered, if delivered personally or by courier overnight mail service; three days after such notice has been deposited in the United States mail postage prepaid; if mailed certified or registered US Mail, return receipt requested; or when received by the party of which notice is intended if given in any other manner.

3.8.4 This Contract may be modified only by written agreement signed by both parties. Wherever used, the terms “Contractor” and “FKAA” shall include the respective officers, agents, directors, elected or appointed officials and employees and, where appropriate, subcontractors.

3.8.5 If any term, provision, covenant or condition of this Contract is held by a court of
competent jurisdiction to be invalid, void or unenforceable, the remainder of the provisions shall remain in full force and effect and shall in no way be affected, impaired or invalidated.

3.8.6 It is understood that the relationship of Contractor to FKAA is that of independent contractor. The services provided under this Contract are of a professional nature and shall be performed in accordance with good and accepted industry practices for contract operators similarly situated. However, such services should not be confused with engineering services and nothing herein is intended to imply that Contractor is to supply professional engineering services to FKAA unless specifically stated in this Contract to the contrary.

**ARTICLE IV - THE FKAA ENGINEER**

4.1 **AUTHORITY OF THE ENGINEER**

The Engineer shall be the FKAA’s representative during the construction period. His authority and responsibility shall be limited to the provisions set forth in these Contract Documents. The Engineer shall have the authority to reject work and materials which does not conform to the Contract Documents. However, neither the Engineer’s authority to act under this provision, nor any decision made by him in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the Engineer to the Contractor, any Subcontractor, their respective sureties, any of their agents or employees, or any other person performing any of the work.

4.2 **DUTIES AND RESPONSIBILITIES OF THE ENGINEER**

The Engineer will make periodic visits to the site of the project to observe the progress and quality of the work and to determine, in general, if the work is proceeding in accordance with the intent of the Contract Documents. Visits and observations made by the Engineer shall not relieve the Contractor of his obligation to conduct comprehensive inspections of the work and furnish materials and perform acceptable work, and to provide adequate safety precautions, in conformance with the intent of the Contract.

One or more project representatives may be assigned to observe the work for compliance with the Contract Documents and to act in matters of construction under this Contract. It is understood that such representatives shall have the power to issue instructions and make decisions within the limitation of the authority given to them by the Engineer. The Contractor shall furnish all reasonable assistance required by the Engineer for proper inspection of the work. The FKAA Field Inspector shall not have the power or authority to delete, increase, modify or otherwise change the requirements of the Contract Documents. The above-mentioned Field Inspector shall not relieve the Contractor of his obligations to conduct comprehensive inspections of the work and to furnish materials and perform acceptable work, and to provide adequate safety precautions, in conformance with the intent of the Contract.

4.3 **LIMITATIONS ON ENGINEER’S RESPONSIBILITIES**

The Engineer will not be responsible for the Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, and the Engineer will not be responsible for Contractor’s failure to perform or furnish the work in accordance with the Contract Documents.
The Engineer will not be responsible for the acts or omissions of the Contractor or of any Subcontractor, any supplier, or of any other person or organization performing or furnishing any of the work.

Whenever in the Contract Documents the terms “as ordered”, “as directed”, “as required”, “as allowed”, “as approved”, or terms of like effect or import are used, or the adjectives “reasonable”, “suitable”, “acceptable”, “proper”, or “satisfactory”, adjectives of like effect or import are used to describe a requirement, direction, review or judgment of the Engineer as to the work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the work for compliance with the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to the FKAA any duty or authority to supervise or direct the furnishing or performance of the work of or any duty or authority to undertake responsibility contrary to the provisions of this Article.

4.4 REJECTED WORK

Any defective work or nonconforming materials or equipment that may be discovered at any time prior to expiration of the warranty period shall be removed and promptly replaced by work which shall conform to the provisions of the Contract Documents. Any material condemned or rejected shall be removed at once from the project site.

Failure on the part of the Engineer to condemn or reject bad or inferior work or to note nonconforming materials or equipment on Contractor submittals shall not be construed to imply acceptance of such work. The Engineer shall reserve and retain all of its rights and remedies at law against the Contractor and its Surety for correction of any and all latent defects discovered after the guarantee period.

4.5 SUBMITTALS

After checking and verifying all field measurements and after complying with applicable procedures specified the Contractor shall submit to the Engineer, in accordance with the schedule for submittals for review, shop drawings, electrical diagrams, and catalog cuts for fabricated items and manufactured items (including mechanical and electrical equipment), which shall bear a stamp or specific written indication that Contractor has satisfied Contractor’s responsibilities under the Contract Documents with respect to the review of the submittal. All submittals shall be identified as the Engineer may require. The data shown shall be complete with respect to quantities, dimensions specified performance and design criteria, materials, and similar data to enable the Engineer to review the information.

The Contractor shall also submit to the Engineer for review with such promptness as to cause no delay in work, all samples required by the Contract Documents. All samples shall have been checked by and accompanied by a specific written indication that Contractor has satisfied Contractor’s responsibilities under the Contract Documents with respect to the review of the submission and shall be identified clearly as to material, supplier, pertinent data such as catalog numbers and the use for which intended. Before submission of each submittal, Contractor shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar data with respect thereto and reviewed or coordinated each submittal with other submittals and with the requirements of the work and the Contract Documents.

At the time of each submission, the Contractor shall give the Engineer specific written notice of each variation that the submittal may have from the requirements of the Contract Documents,
and, in addition, shall cause a specific notation to be made on each shop drawing submitted to the Engineer for review and approval of each such variation.

The Engineer will review submittals with reasonable promptness, but the Engineer’s review will be only for conformance with the design concept of the project and for compliance with the information given in the Contract Documents and shall not extend to means, methods, techniques, sequences, or procedures of construction (except where a specific means, method, technique, sequence, or procedure of construction is indicated in or required by the Contract Documents) or to safety precautions or programs incident thereto. The review of a separate item as such will not indicate review of the assembly in which the item functions. Contractor shall make corrections required by the Engineer, and shall return the required number of corrected copies of shop drawings and submit as required new samples for review. Contractor shall direct specific attention in writing to revisions other than the corrections called for by the Engineer on previous submittals.

The Engineer’s review of submittals shall not relieve the Contractor from responsibility for any variation from the requirements of the Contract Documents unless the Contractor has in writing called to the Engineer’s attention to each such variation at the time of submission and the Engineer has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the shop drawing or sample approval; nor will any approval by the Engineer relieve the Contractor from responsibility for errors or omissions in the shop drawings or from responsibility for having complied with the provisions herein.

Where a shop drawing or sample is required by the specifications, any related work performed prior to the Engineer’s review and approval of the pertinent submission shall be the sole risk, expense and responsibility of the Contractor.

4.6 DETAIL DRAWINGS AND INSTRUCTIONS

The Engineer will furnish, with reasonable promptness, additional instructions by means of Drawings or otherwise, if, in the Engineer’s opinion, such are required for the proper execution of the work. All such Drawings and instructions will be consistent with the Contract Documents, true developments thereof, or reasonably inferable therefrom.

ARTICLE V - THE CONTRACTOR AND HIS EMPLOYEES

5.1 CONTRACTOR, AN INDEPENDENT AGENT

The Contractor shall perform all work under this Contract as an Independent Contractor and shall not be considered as an agent of the FKAA, nor shall the Contractor’s subcontractors or employees be subagents of the FKAA.

5.2 SUBCONTRACTING

Unless modified in the Supplementary Conditions the Contractor shall submit to the FKAA the names of all subcontractors proposed for the work, to be submitted with the proposal. The Contractor shall not employ any subcontractors that the FKAA may object to as lacking capability to properly perform work of the type and scope anticipated. No changes will be allowed from the approved subcontractor list without written approval of the FKAA.
The Contractor shall strictly comply with the requirements of, PERFORMANCE OF WORK BY CONTRACTOR, in the Instructions to Bidders.
The Contractor is as fully responsible to the FKAA for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them as he is for the acts and omissions of persons directly employed by him.

Nothing contained in the Contract Documents shall create any contractual relation between any subcontractor and the FKAA.

5.3 TAXES AND CHARGES

The Contractor shall withhold and pay any and all sales and use taxes, including any and all change of taxes thereof, and all withholding taxes, whether State or Federal, and pay all Social Security charges and also all State Unemployment Compensation charges, and pay or cause to be withheld, as the case may be, any and all taxes, charges, or fees or sums whatsoever, which are now or may hereafter be required to be paid or withheld under any laws.

5.4 REQUIREMENTS OF STATE LAW FOR PUBLIC WORKS PROJECTS

When the Contract Documents concern public works of the state or any county, municipality, or political subdivision created by its laws, the applicable statutes shall apply. The Contractor shall determine the contents of all applicable statutes and comply with their provisions throughout the performance of the Contract.

5.5 CODES, ORDINANCES, PERMITS, AND LICENSES

The Contractor shall keep himself fully informed of all local codes and ordinances, as well as State and Federal laws, which in any manner affect the work herein specified. The Contractor shall at all times comply with said codes and ordinances, laws, and regulations, and protect and indemnify the FKAA and their respective employees, officers, and agents against any claim or liability arising from or based on the violation of any such laws, codes and ordinances, or regulations. All permits, licenses, and inspection fees necessary for prosecution and completion of the work shall be secured and paid for by the Contractor, unless otherwise specified.

5.6 PERMITS FOR WORK WITHIN THE FEDERAL, STATE AND/OR COUNTY RIGHTS OF WAY

The FKAA has obtained a permit for the necessary water system improvements from the Florida Department of Environmental Protection and where applicable, the Florida Department of Transportation. A copy of the permit will be provided to the Contractor at the Preconstruction Conference.
The Contractor shall abide by all regulations and conditions stipulated in the permit(s), and such conditions and requirements are hereby made a part of these Contract Documents. The Contractor shall examine the permit(s) granted to the FKAA by the Federal, State and/or County agency. Failure to do so will not relieve the Contractor from compliance with the requirements stated therein.

5.7 MAINTENANCE OF TRAFFIC

The Contractor shall submit to the FKAA, a Maintenance of Traffic Plan that shows the scheme(s) that is intended for use on the project.
This Plan shall include appropriate signage, barricades and/or temporary striping in accordance with the Florida Department of Transportation, Roadway and Traffic Design Standards, (Topic #625-010-003-6) and/or the Manual on Uniform Traffic Control Devices (MUTCD), Part VI, Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations.

It shall be the Contractor’s responsibility, as Bidder, prior to submitting his Bid, to determine the traffic control requirements of the public agencies having jurisdiction of the project area, so that his Proposal reflects all costs to be incurred. No claims for additional payment will be considered for costs incurred in the proper maintenance, control, detour, and protection of traffic.

5.8 SUPERINTENDENCE

The Contractor shall have a supervisor present on the job at all times who shall be capable of reasonable job site communications (speaking, writing, and reading) in the English language. The Contractor shall designate, in writing, before starting work, an authorized representative who shall have complete authority to represent and to act for the Contractor. The FKAA shall be notified in writing prior to any change in superintendent assignment. The Contractor shall give efficient supervision to the work, using his best skill and attention. The Contractor shall be solely responsible for all construction means, methods, techniques, and procedures, and for providing adequate safety precautions and coordinating all portions of the work under the Contract. It is specifically understood and agreed that the FKAA, its employees and agents, shall not have control or charge of and shall not be responsible for the construction means, methods, techniques, procedures, or for providing adequate safety precautions in connection with the work under the Contract.

5.9 RECEPTION OF FKAA’S COMMUNICATIONS

The Superintendent shall receive for the Contractor all communications from the FKAA. Communications of major importance will be confirmed in writing upon request from the Contractor. The FKAA may schedule project meetings for the purposes of discussing and resolving matters concerning the various elements of the work. Time and place for these meetings and the names of persons required to be present shall be as determined by the FKAA. The Contractor shall comply with these attendance requirements and shall also require his Subcontractors to comply.

5.10 LINES AND GRADES

The Contractor shall retain a Registered Land Surveyor licensed in the State of Florida to establish the center lines or base lines of principal structures, roads, pipelines, and facilities, and set bench marks as necessary to establish the basic layout. It will be the Contractor’s responsibility to lay out the work from the lines and to transfer elevations from bench marks. Where new construction connects to existing facilities, the Contractor shall check and establish the exact location prior to construction of the facilities.

General dimensions for lines and elevations for grades of the structures, appurtenances, and utilities are indicated on the Drawings, together with other pertinent information required for laying out the work. If site conditions vary from those indicated, the Contractor shall notify the FKAA immediately, who will make any adjustments as required.
Where the location and elevation of the bench marks are shown, the Contractor shall furnish the necessary labor and materials to verify such locations and elevations and to accurately lay out the work and set the required elevations from the information indicated.

The Contractor shall provide a competent employee during normal working hours to assist the FKAA, when required, in checking lines and elevations in the Contractor’s lay out and for measuring quantities for payment purposes as the work proceeds. The Contractor shall cooperate with the FKAA so that the checking and measuring may be accomplished with the least interference to the Contractor’s operations.

5.11 SAFETY

The Contractor shall be solely and completely responsible for conditions of the jobsite, including safety of all persons (including employees) and property during performance of the work. This requirement shall apply continuously and not be limited to normal working hours. Safety provisions shall conform to U.S. Department of Labor (OSHA), the State Occupational Safety and Health Act, and all other applicable Federal, State, County, and local laws, ordinances, codes, the requirements set forth below, and any regulations that may be detailed in other parts of these documents. Where any of these are in conflict, the more stringent requirement shall be followed. The Contractor’s failure to thoroughly familiarize himself with the aforementioned safety provisions shall not relieve him from compliance with the obligations and penalties set forth herein.

The Contractor shall develop and maintain for the duration of this Contract, a safety program that will effectively incorporate and implement all required safety provisions. The Contractor shall appoint an employee who is qualified and authorized to supervise and enforce compliance with the safety program.

The duty of the FKAA to conduct construction review of the Contractor’s performance is not intended to include a review or approval of the adequacy of the Contractor’s safety supervisor, the safety program, or any safety measures taken in, on, or near the construction site.

The Contractor, as a part of his safety program, shall maintain at his office or other well-known place at the jobsite, safety equipment applicable to the work as prescribed by the aforementioned authorities, all articles necessary for giving first aid to the injured, and shall establish the procedure for the immediate removal to a hospital or a doctor’s care of persons (including employees) who may be injured on the jobsite.

If death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the FKAA. In addition, the Contractor must promptly report in writing to the FKAA all accidents whatsoever arising out of, or in connection with, the performance of the work whether on, or adjacent to, the site, giving full details and statements of witnesses.

If a claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the FKAA, giving full details of the claim.

The Contractor shall comply with all aspects of the Florida Trench Safety Act (90-96, Laws of Florida).
5.12 **PROTECTION OF WORK AND PROPERTY**

The Contractor shall at all times safely guard the FKAA’s property from injury or loss in connection with this Contract. The Contractor shall at all times safely guard and protect from damage his own work, and that of adjacent property (as provided by law and the Contract Documents). All passageways, guard fences, lights, and other facilities required for protection by Federal, State or municipal laws and regulations and local conditions, must be provided and maintained.

The Contractor shall protect his work and materials from damage due to the nature of the work, the elements, carelessness of other Contractors, or from any cause whatever until the completion and acceptance of the work. All loss or damages arising out of the nature of the work to be done under these Contract Documents, or from any unforeseen obstruction or defects which may be encountered in the prosecution of the work, or from the action of the elements, shall be sustained by the Contractor.

The Contractor shall comply with the Federal Archaeological Resources Act of 1979 (Public Law 95-96), Florida’s Historical Resources Act (Florida Statutes, Chapter 267) and the regulations of the local historic preservation board as applicable and protect against the potential loss or destruction of significant historical or archaeological data, sites, and properties in connection with the project.

5.13 **RESPONSIBILITY OF CONTRACTOR TO ACT IN EMERGENCY**

In case of an emergency which threatens loss or injury of property, and/or safety of life, the Contractor shall act, without previous instructions from the FKAA as the situation may warrant. The Contractor shall notify the FKAA thereof immediately thereafter. Any claim for compensation by the Contractor, together with substantiating documents in regard to expense, shall be submitted to the FKAA and the amount of compensation shall be determined by agreement.

5.14 **MATERIALS AND APPLIANCES**

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation, and other facilities necessary for the execution and completion of the work.

Unless otherwise specified, all materials shall be new, and both workmanship and materials shall be of good quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

In selecting and/or approving equipment for installation in the project, the FKAA assumes no responsibility for injury or claims resulting from failure of the equipment to comply with applicable national, State, and local safety codes or requirements, or the safety requirements of a recognized agency, or failure due to faulty design concepts, or defective workmanship and materials.

To ensure standardization and uniformity in all parts of the work under this Contract, like items of equipment shall be the products of one manufacturer. Unless the FKAA exempts a specific material upon the request of the Contractor, like items of materials shall be the products of one
manufacturer. Uniformity in like equipment items is required in order to provide the FKAA with interchangeability capabilities, simplified spare parts inventory, and standardized maintenance programs and manufacturers’ services.

Examples of material items the FKAA may consider exempting from standardization include structural steel, reinforcing steel, building insulation, roofing materials, sheet metal, materials specified only be reference to a recognized standards, and items hidden from view where interchangeability, color, and texture are not a significant factor for standardization.

The Contractor shall inform his suppliers and subcontractors of these requirements, and shall provide the necessary coordination to accomplish the standardization specified.

5.15 CONTRACTOR’S COMPLIANCE OSHA

The complete work shall include all necessary permanent safety devices required by the State and Federal (OSHA) industrial authorities and applicable local and national codes. Contractors and manufacturers of equipment shall be held responsible for compliance with the requirements included herein.

Contractors shall notify all equipment suppliers and subcontractors of the provision of this Article.

The Contractor shall observe and comply with all applicable local, State and Federal Occupational Safety and Health Regulations during the prosecution of work under this Contract. In addition, full compliance by the Contractor with the U.S. Department of Labor’s Occupational Safety and Health Standards as established in Public Law 91-96, will be required under the terms of this Contract.

5.16 SUBSTITUTION OF MATERIALS

Except for FKAA-selected equipment items, and items where substitution is clearly not permitted, whenever any materials, article, device, product, fixture, form, type of construction, or process is indicated or specified by patent or proprietary name, by name of manufacturer, or by catalog number, such specifications shall be deemed to be used for the purpose of establishing a standard of quality and facilitating the description of the material or process desired. This procedure is not to be construed as eliminating from competition other products of equal or better quality by other manufacturers where fully suitable in design, and shall be deemed to be followed by the words or “or equal”. The Contractor may, in such cases, submit complete data to the FKAA for consideration of another material, type, or process which shall be substantially equal in every respect to that so indicated or specified. Substitute materials shall not be used unless approved in writing. The FKAA will be the sole judge of the equality of any substituted article or material.

5.17 TESTS, SAMPLES, AND INSPECTIONS

The Contractor shall furnish, without extra charge, the necessary test pieces and samples, including facilities and labor for obtaining the same, as requested by the FKAA. When required, the Contractor shall furnish certificates of tests of materials and equipment made at the point of manufacture by a recognized testing laboratory.

The FKAA, and authorized government agents, and their representatives shall at all times be provided safe access to the work wherever it is in preparation or progress, and the Contractor
shall provide facilities for such access and for inspection, including maintenance of temporary and permanent access.

If the Specifications, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give timely notice of its readiness for examination. If any work should be covered up without approval or consent of the FKAA, it shall, if required by the FKAA, be uncovered for examination at the Contractor’s expense. Re-examination of questioned work may be ordered by the FKAA, and, if so ordered, the work shall be uncovered by the Contractor. If such work is found to be in accordance with the Contract Documents, the FKAA will pay the cost of re-examination and replacement. If such work is found to be not in accordance with the Contract Documents, the Contractor shall correct the defective work, and the cost of re-examination and correction of the defective work shall be paid by the Contractor.

5.18 ROYALTIES AND PATENTS

The Contractor shall pay all royalty and license fees, unless otherwise specified. The Contractor shall defend all suits or claims for infringement of any patent rights and shall save the FKAA harmless from any and all loss, including reasonable attorney’s fees, on account thereof.

5.19 CONTRACTOR’S RIGHT TO TERMINATE CONTRACT

If the work should be stopped under an order of any court or other public authority for a period of more than 3 months, through no act or fault of the Contractor, its Subcontractors, or respective employees or if the FKAA should fail to issue any estimate for payment within 30 days after it is due, or if the FKAA should fail to pay the Contractor within 30 days after time specified in Article IX, PARTIAL PAYMENTS, any sum recommended by the FKAA, then the Contractor may, upon 15 days’ written notice to the FKAA, stop work or terminate this Contract and recover from the FKAA payment for all acceptable work performed and any loss sustained plus reasonable termination expenses, unless said default has been remedied.

5.20 CORRECTION OF DEFECTIVE WORK

The Contractor hereby agrees to make, at his own expense, all repairs or replacements necessitated by defects in materials or workmanship, supplies under the terms of this Contract, and pay for any damage to other works resulting from such defects, which become evident within 1 year after the date of final acceptance of the work or within 1 year after the date of substantial completion established by the FKAA for specified items of equipment, or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents. Unremedied defects identified for correction during the warranty period but remaining after its expiration shall be considered as part of the obligations of the warranty. The Contractor further assumes responsibility for a similar guarantee for all work and materials provided by subcontractors or manufacturers of packaged equipment components.

The effective date for the start of the guarantee or warranty period for equipment qualifying as substantially complete is defined in Article 1.16, SUBSTANTIAL COMPLETION, and Article 7.12, SUBSTANTIAL COMPLETION DATE, in these General Conditions.

The Contractor also agrees to hold the FKAA harmless up to the amount of the Contract price from liability of any kind arising from damage due to said defects. The Contractor also agrees to hold the FKAA harmless from liability of any kind arising from damage due to said defects. The Contractor shall make all repairs and replacements promptly upon receipt of written order for same from the FKAA. If the Contractor fails to make the repairs and replacements promptly, the
FKAA may do the work, and the Contractor and his Surety shall be liable for the cost thereof.

ARTICLE VI - INSURANCE AND LIABILITY

6.1 GENERAL INSURANCE REQUIREMENTS

Prior to the commencement of work governed by this contract (including the pre-staging of personnel and material), the Contractor shall obtain, at his/her own expense, insurance as specified below, which are made part of this contract. The Contractor will ensure that the insurance obtained will extend protection to all Subcontractors engaged by the Contractor. As an alternative the Contractor may require all Subcontractors to obtain insurance consistent with the attached schedules.

The Contractor will not be permitted to commence work governed by this contract (including pre-staging of personnel and material) until satisfactory evidence of the required insurance has been furnished to FKAA as specified below. Delays in the commencement of work, resulting from the failure of the Contractor to provide satisfactory evidence of the required insurance, shall not extend deadlines specified in this contract and any penalties and failure to perform assessments shall be imposed as if the work commenced on the specified date and time, except for the Contractor’s failure to provide satisfactory evidence.

The Contractor shall maintain the required insurance throughout the entire term of this contract and any extensions specified in any attached schedules. Failure to comply with this provision may result in the immediate suspension of all work until the required insurance has been reinstated or replaced. Delays in the completion of work resulting from the failure of the Contractor to maintain the required insurance shall not extend deadlines specified in this contract and any penalties and failure to perform assessments shall be imposed as if the work had not been suspended, except for the Contractor’s failure to maintain the required insurance:

- Certificates of Insurance
- A Certified copy of the actual insurance policy.

FKAA, at its sole option, has the right to request a certified copy of any or all insurance policies required by this contract. All insurance policies must be provided by companies authorized to conduct business in the State of Florida and have A.M. Best Company rating of no less than (A-).

All insurance policies must specify that they are not subject to cancellation, non-renewal, material change, or reduction in coverage unless a minimum of thirty (30) days prior notification is given to FKAA by the insurer.

The acceptance and/or approval of the Contractor’s insurance shall not be construed as relieving the Contractor from any liability or obligation assumed under this contract or imposed by law.

The Florida Keys Aqueduct Authority, its employees and officials will be included as “Additional Insured” on all policies, except for Workers’ Compensation and Vehicle Liability.

In addition, FKAA will be named as an Additional Insured and Loss Payee on all policies covering Authority-owned property.

6.2 WORKERS COMPENSATION AND EMPLOYER’S LIABILITY
Prior to the commencement of work governed by this contract, the Contractor shall obtain Workers’ Compensation Insurance with limits sufficient to respond to Florida Statute 440.

In addition, the Contractor shall obtain Employers’ Liability Insurance with limits of not less than:

- $1,000,000 Bodily Injury by Accident
- $1,000,000 Bodily Injury by Disease, policy limits
- $1,000,000 Bodily Injury by Disease, each employee

Coverage shall be maintained throughout the entire term of the contract.

6.3 COMMERCIAL GENERAL LIABILITY REQUIREMENTS

Prior to the commencement of work governed by this contract, the Contractor shall obtain General Liability Insurance. Coverage shall be maintained throughout the life of the contract and include, as a minimum:

- Premises Operations
- Products and Completed Operations
- Blanket Contractual Liability
- Personal Injury Liability
- Expanded Definition of Property Damage

The minimum limits acceptable shall be $2,000,000 Combined Single Limit (CSL)

Any Occurrence Form policy is preferred.

If coverage is provided on a Claims Made policy, its provisions should include coverage for claims filed on or after the effective date of this contract. In addition, the period for which claims may be reported should extend for a minimum of twelve (12) months following the acceptance of work by FKAA.

The policy shall include coverage for the XCU (explosion, collapse, and underground) exposures with full policy limits available for this exposure.

If an Umbrella or Excess policy is used to satisfy the above required limits of liability, the terms and conditions of the Umbrella or Excess policy must be no less restrictive than the underlying primary liability policy.

6.4 VEHICLE LIABILITY REQUIREMENTS

Recognizing that the work governed by this contract requires the use of vehicles, the Contractor, prior to the commencement of work, shall obtain Vehicle Liability Insurance. Coverage shall be maintained throughout the life of the contract and include, as a minimum, liability coverage for:

- Owned, Non-Owned, and Hired Vehicles

The minimum limits acceptable shall be $1,000,000 Combined Single Limit (CSL)

If split limits are provided, the minimum limits acceptable shall be:
• $ 500,000 per Person
• $1,000,000 per Occurrence
• $ 100,000 Property Damage

6.5 UMBRELLA/EXCESS INSURANCE

See Section 6.3, Commercial General Liability Requirements.

6.6 BUILDER’S RISK INSURANCE SECTION

REMOVED-NOT APPLICABLE TO THIS PROJECT

6.7 INSTALLATION FLOATER INSURANCE

REMOVED-NOT APPLICABLE TO THIS APPLICABLE

6.8 CONTRACTORS AND SUBCONTRACTOR INSURANCE

The Contractor shall not commence work under this Contract until he has obtained all the insurance required hereunder and such insurance has been reviewed by the FKAA, nor shall the Contractor allow any Subcontractor to commence work on his subcontract until insurance specified below has been obtained. Review of the insurance by the FKAA shall not relieve or decrease the liability of the Contractor hereunder.

6.9 NO PERSONAL LIABILITY OF PUBLIC OFFICIALS

In carrying out any of the provisions hereof in exercising any authority granted by the Contract, there will be no personal liability upon any public official.

6.10 INDEMNIFICATION AND HOLD HARMLESS

The Contractor covenants and agrees to indemnify and hold harmless the Florida Keys Aqueduct Authority (FKAA) from any and all claims for bodily injury (including death), personal injury, and property damage (including property owned by FKAA) and any other losses, damages, and expenses (including attorney’s fees) which arise out of, in connection with, or by reason of services provided by the Contractor or any of its Subcontractor(s) in any tier, occasioned by the negligence, errors, or other wrongful act or omission of the Contractor or its Subcontractor(s) in any tier, their employees, or agents.

In the event the completion of the project (to include the work of others) is delayed or suspended as a result of the Contractor’s failure to purchase or maintain the required insurance, the Contractor shall indemnify the FKAA from any and all increased expenses resulting from such delay.

The first ten dollars ($10.00) of remuneration paid to the Contractor is for the indemnification provided for above.

The extent of liability is in no way limited to, reduced, or lessened by the insurance requirements
6.11 PROFESSIONAL LIABILITY

REMOVED-NOT APPLICABLE TO THIS APPLICABLE

ARTICLE VII - PROGRESS OF THE WORK

7.1 BEGINNING OF THE WORK

Before work shall be started and materials ordered, the Contractor shall meet and consult with the FKAA relative to materials, equipment, and all arrangements for prosecuting the work.

7.2 SCHEDULES AND PROGRESS REPORTS

At least seven (7) calendar days prior to the pre-construction meeting, the Contractor shall prepare and submit to the FKAA for review and approval, a project schedule showing approximately the dates on which each part or division of the work is expected to be started and finished. The schedule shall be brought up to date and submitted to the FKAA at the end of each month or at such other times the FKAA may request.

The Contractor shall also forward to the FKAA, at the end of each month, an itemized report of the delivery status of major and critical items of purchased equipment and material, including shop drawings and the status of shop and field fabricated work. These progress reports shall indicate the date of the purchase order, the current percentage of completion, estimated delivery, and cause of delay, if any.

If the completion of any part of the work or the delivery of materials is behind the approved schedule, the Contractor shall submit in writing a plan acceptable to the FKAA for bringing the work up to schedule.

The FKAA shall have the right to withhold progress payments for the work if the Contractor fails to update and submit the progress schedule and reports as specified.

7.3 PROSECUTION OF THE WORK

It is expressly understood and agreed that the time of beginning, rate or progress, and time of completion of the work are the essence of this Contract. The work shall be prosecuted at such time, and in or on such part or parts of the project as may be required, to complete the project as contemplated in the Contract Documents and the construction schedule.

The work shall be performed Monday through Friday between the hours of 8:00 a.m. and 5:00 p.m., excluding all FKAA legal holidays. The FKAA legal holidays currently are New Years Day, Martin Luther King Day, President’s Day, Memorial Day, Independence Day (4th of July), Labor Day, Veteran’s Day, Thanksgiving Day, Friday after Thanksgiving, and Christmas Day. The FKAA may change such legal holidays at any time without formal notice to the Contractor and it shall be the Contractor’s responsibility to determine and observe all FKAA legal holidays.

If the Contractor desires to carry on work at night or outside the regular hours, he shall give timely notice to the FKAA to allow satisfactory arrangements to be made for observing the work in progress. Unless the Contract Documents unambiguously require work to be performed at night or outside regular hours, the Contractor shall be responsible for all resulting FKAA
inspection or other increased costs to the FKAA.

- **Failure of the Contractor to Maintain Satisfactory Progress:** Time is an essential element of the Contract and, as delay in prosecution of the work will inconvenience the public, obstruct traffic and interfere with business, it is important that the work be pressed vigorously to completion. Moreover, the cost to the Florida Keys Aqueduct Authority for the administration of the Contract, including engineering, inspection and supervision, will be increased as the construction period is lengthened.

The Contractor is delinquent when unsatisfactory progress is being made under these conditions:

- The allowed Contract time for performing the work has expired and the Contract work is not complete; or
- The specified time or date for performing a special milestone stage of the work has expired and the work for that milestone stage is not complete; or
- The allowed Contract time has not expired and the percentage of dollar value of completed work is fifteen (15) percentage points or more below the dollar value of work which should have been completed according to the approved working schedule for the Project. After falling fifteen (15) percent behind, the delinquency continues until the percentage of dollar value of completed work is within five (5) percent points of the dollar value of work which should have been completed according to the approved working schedule for the Project.

If the Contractor fails to begin the work under the Contract within the time specified in the “Notice To Proceed”, or fails to perform the work with sufficient workmen and equipment or with sufficient materials to maintain satisfactory progress to assure the prompt completion of the Contract, or performs the work unsuitably or neglects or refuses to remove materials or to perform a new such work as may be rejected as unacceptable and unsuitable, or discontinues the prosecution of the work, or fails to resume work which has been discontinued within a reasonable time after notice to do so, or becomes insolvent or is declared bankrupt, or files for reorganization under the bankruptcy code, or commits any act of bankruptcy or insolvency, either voluntarily or involuntarily, or allows any final judgment to stand against him unsatisfied for a period of ten (10) calendar days, or makes an assignment for the benefits of creditors, or fails to comply with Contract requirements regarding minimum wage payments or EEO requirements, or for any other cause whatsoever, fails to carry on the work in an acceptable manner, or if the Surety executing the bond, for any reasonable cause becomes unsatisfactory in the opinion of the FKAA, the Engineer will give notice in writing to the Contractor and his Surety of such delay, neglect or default.

If the Contractor, within a period of ten (10) calendar days after the notice described above, shall not proceed to correct the conditions of which complaint is made, the FKAA, shall upon written certificate from the Engineer of the fact of such delay, neglect or default and the Contractor’s failure to correct such conditions, have full power and authority, without violating the Contract, to take prosecution of the work out of the hands of the Contractor and declare the Contract in default and terminated.

The FKAA shall have no liability for anticipated profits for unfinished work on a Contract which has been determined to be in default.

### 7.4 FKAA’S RIGHT TO RETAIN DEFECTIVE WORK

If any part or portion of the work completed under this Contract shall prove defective and not in...
accordance with the Drawings and Specifications, and if the imperfection in the same shall not be of sufficient magnitude or importance as to make the work dangerous or unsuitable, or if the removal of such work will create conditions which are dangerous or undesirable, the FKAA shall have the right and authority to retain such work but will make such deductions in the final payment therefor as may be just and reasonable.

7.5 **FKAA’S RIGHT TO DO WORK**

If the Contractor should, in the opinion of the FKAA, neglect to prosecute the work properly or should neglect or refuse at his own cost to take up and replace work as shall have been rejected by the FKAA, then the FKAA may notify the Surety of the condition, and after 10 days’ written notice to the Contractor and the Surety, or without notice if an emergency or danger to the work or public exists, and without prejudice to any other right which the FKAA may have under the Contract, take over that portion of the work which has been improperly executed, and make good the deficiencies and deduct the cost thereof from the payments then or thereafter due the Contractor.

7.6 **FKAA’S RIGHT TO TRANSFER EMPLOYMENT**

If the Contractor should abandon the work or if he should fail or refuse to make prompt payment to Subcontractors for material or labor, or should persistently disregard laws, ordinances, or fail or refuse to prosecute the work in conformance with the Contract Documents, or otherwise be guilty of a substantial violation of any provision of the Contract or any laws or ordinance, then the FKAA may, without prejudice to any other right or remedy, and after giving the Contractor and Surety 10 days’ written notice, transfer the employment for said work from the Contractor to the Surety. Upon receipt of such notice, such Surety shall enter upon the premises and take possession of all materials, tools, and appliances thereon for the purpose of completing the work included under this Contract and employ, by Contract or otherwise, any qualified person or persons to finish the work and provide the materials therefore, in accordance with the Contract Documents, without termination of the continuing full force and effect of this Contract. In case of such transfer of employment to such Surety, the Surety shall be paid in its own name on estimates according to the terms hereof without any right of the Contractor to make any claim for the same or any part thereof.

If after the furnishing of said written notice to the Surety, the Contractor and the Surety still fail to make reasonable progress on the performance of the work, the FKAA may terminate the employment of the Contractor and the Surety, and take possession of the premises and of all materials, tools, and appliances thereon and finish the work by whatever method he may deem expedient and charge the cost thereof to the Contractor and Surety. In such case, the Contractor shall not be entitled to receive any further payment until the work is finished. If the expense of completing the Contract, including compensation for additional managerial and administrative services, shall exceed such unpaid balance, the Contractor and the Surety shall pay the difference to the FKAA.

7.7 **DELAYS AND EXTENSION OF TIME**

7.7.1 If the Contractor is delayed in the progress of the work by any act or neglect of the FKAA or by any separate Contractor employed by the FKAA, or by strikes, lockouts, fire, adverse weather conditions not reasonably anticipated, or acts of nature, the Contractor shall, within 48 hours of the start of the occurrence, give written notice to the FKAA of the cause of the potential delay and estimate the possible time extension involved, and within 7 days after the cause of delay has been remedied, the Contractor
shall give written notice to the FKAA of any actual time extension requested as a result of the aforementioned occurrence, then the Contract time may be extended by change order for such reasonable time as the FKAA determines.

It is expressly agreed that the Contractor’s right to seek an extension of time as provided in this Article is the Contractor’s sole and exclusive remedy in the event of delay and that in no event shall the Contractor be entitled to recover damages for any delay, regardless of the cause or causes of such delay.

No extension of time will be granted to the Contractor for delays occurring to parts of the work that have no measurable impact on the completion of the total work under this Contract. No extension of time will be considered for weather conditions reasonably anticipated for the area in which the work is being performed.

Reasonably anticipated weather conditions should be based on official records of monthly precipitation and other historical data. Adverse weather conditions, if determined to be of a severity that would impact progress of the work, may be considered as cause for an extension of Contract completion time.

Delays in delivery of equipment or material purchased by the Contractor or his Subcontractors, including FKAA-Furnished Equipment, shall not be considered as a just cause for delay, unless the FKAA determines that for good cause the delay is beyond the control of the Contractor. The Contractor shall be fully responsible for the timely ordering, scheduling, expediting, delivery, and installation of all equipment and materials.

Within a reasonable period after the Contractor submits to the FKAA a written request for an extension of time, the FKAA will present his written opinion to the Contractor as to whether an extension of time is justified, and, if so, his recommendation as to the number of days for time extension. The FKAA will make the final decision on all requests for extension of time.

7.7.2. Work under this contract is scheduled through Hurricane Seasons. A non-compensable time extension will be granted by the Owner if, in their opinion, the Contractor is entitled to a time extension due to work stoppages during Hurricane and/or Tropical Storm Warnings. The procedures for work shutdown in the event of Hurricane and/or Tropical Storms are as follows:

- The Owner and the Contractor shall monitor weather reports during the Hurricane Season for Hurricanes and/or Tropical Storm Watches and identify storms that might hit the work area.
- Upon notification that a Storm Watch has been declared (48 to 72 hours in advance of projected landfall) the Contractor shall take all necessary precautions and make preparations to protect their work area.
- Upon notification that a Storm Warning has been declared (24 to 36 hours in advance of projected landfall) the Contractor shall complete all preparations, secure all material and equipment and close down all operations at the work area.
- Upon notification that an All Clear has been issued and re-entry into the area is permitted, the Contractor will remobilize in an expedient manner and return the work area to its pre-storm condition.

Since demobilization and remobilization is difficult to predict, the Contractor shall
assume a maximum of two (2) calendar days to demobilize, a maximum of three (3) calendar days for the storm event and re-entry and a maximum of two (2) calendar days to remobilize the work activities. Actual time of work stoppages will be granted.

The above does not include the normal rainy season or high seas delays. The Contractor shall factor normal wet weather season related work interruptions into its Base Contract Price. No authorization from the contingency Bid Items or Allowance Accounts will be made for normal wet weather related delays.

7.8 DIFFERING SITE CONDITIONS

The Contractor shall within 24-hours of discovery, and before the conditions are disturbed, give a written notice to the FKAA of:

- Subsurface or latent physical conditions at the site which differ materially from those indicated in this Contract, or

- Unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract.

The FKAA will investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor’s cost of, or the time required for, performing any part of the work under this Contract, whether or not the character or amount of work is changed as a result of the conditions, an equitable adjustment shall be made under this Article and the Contract modified in writing accordingly. The amount of any equitable adjustment allowed by this Article shall be determined in accordance with the procedures set forth in Article 8.1, PAYMENT FOR CHANGE ORDERS in these General Conditions.

No request by the Contractor for an equitable adjustment to the Contract under this Article will be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed above for giving written notice may be extended by the FKAA.

No request by the Contractor for an equitable adjustment to the Contract for differing site conditions will be allowed if made after final payment under this Contract.

7.9 LIQUIDATED DAMAGES

Should the Contractor fail to complete the work, or any part thereof, in the time agreed upon in the Contract or within such extra time as may have been allowed for delays by extensions granted as provided in the Contract, the Contractor shall reimburse the FKAA for the additional expense and damage for each calendar day, Sundays and legal holidays included, that the Contract remains uncompleted after the Substantial and Final Completion dates. It is agreed that the amount of such additional expense and damage incurred by reason of failure to complete the work is the per-diem rate, as stipulated in the Proposal. The said amount is hereby agreed upon as a reasonable estimate of the costs which may be accrued by the FKAA after the expiration of the time of completion. It is expressly understood and agreed that this amount is not to be considered in the nature of a penalty, but as liquidated damages which have accrued against the Contractor. The FKAA shall have the right to deduct such damages from any amount due, or that may become due the Contractor, or the amount of such damages shall be due and collectible from the Contractor or Surety.
7.10 OTHER CONTRACTS

The FKAA reserves the right to let other Contracts in connection with the work. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.

If any part of the work under this Contract depends on the proper execution or results of the work of any other Contractor, utility service company or FKAA, the Contractor shall inspect and promptly report to the FKAA in writing any latent or apparent defects or deficiencies in such work that render it unsuitable for such proper execution and results. The Contractor’s failure to report shall constitute an acceptance of the work by others as being fit and proper for integration with work under this Contract, except for latent or non-apparent defects and deficiencies in the work.

7.11 USE OF PREMISES

The Contractor shall confine his equipment, the storage of materials, and the operation of his workers to limits shown on the Drawings or indicated by law, ordinances, permits, or directions of the FKAA, and shall not unreasonably encumber the premises with his materials. The Contractor shall provide, at his own expense, the necessary rights-of-way and access to the work which may be required outside the limits of the FKAA’s property and shall furnish the FKAA copies of permits and agreements for use of property outside that provided by the FKAA. Contractor shall not load nor permit any part of the structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the work or adjacent property to stresses or pressures that will endanger it.

7.12 SUBSTANTIAL COMPLETION DATE

The FKAA may issue a written notice of substantial completion for the purpose of establishing the starting date for specific equipment guarantees, and to establish the date that the FKAA will assume the responsibility for the cost of operating such equipment. Said notice shall not be considered as final acceptance of any portion of the work or relieve the Contractor from completing the remaining work within the specified time and in full compliance with the Contract Documents. See Article 1.16, “SUBSTANTIAL COMPLETION” under the heading DEFINITIONS of these General Conditions.

7.13 PERFORMANCE TESTING

Operating equipment and systems shall be performance tested in the presence of the FKAA to demonstrate compliance with the specified requirements. Performance testing shall be conducted under the specified design operating conditions or under such simulated operating conditions as recommended or approved by the FKAA. The Contractor should schedule such testing with the FKAA at least 1 week in advance of the planned date for testing.

7.14 FKAA’S USE OF PORTIONS OF THE WORK

Following issuance of the written notice of Substantial Completion, the FKAA may initiate operation of the facility. Such use shall not be considered as final acceptance of any portion of the work, nor shall such use be considered as cause for an extension of the Contract completion time, unless authorized by a Change Order issued by the FKAA.
7.15 **CUTTING AND PATCHING**

The Contractor shall do all cutting, fitting, or patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by work of other Contractors shown upon or reasonably implied by the Drawings.

7.16 **CLEANING UP**

The Contractor shall, at all times, at his own expense, keep property on which work is in progress and the adjacent property free from accumulations of waste material or rubbish caused by employees or by the work. Upon completion of the construction, the Contractor shall, at his own expense, remove all temporary structures, rubbish, and waste materials resulting from his operations.

7.17 **FKAA MAY STOP THE WORK:**

If the work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the work in such a way that the completed work will conform to the Contract Documents, the FKAA may order Contractor to stop the work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the FKAA to stop the work shall not give rise to any duty on the part of the FKAA to exercise this right for the benefit of Contractor or any other party.

**ARTICLE VIII - PAYMENT**

8.1 **PAYMENT FOR CHANGE ORDERS**

The FKAA’s request for quotations on alterations to the work shall not be considered authorization to proceed with the work prior to the issuance of a formal Change Order, nor shall such request justify any delay in existing work. Quotations for alterations to the work shall include substantiating documentation with an itemized breakdown of Contractor and Subcontractor costs, including labor, material, rentals, approved services, overhead and profit.

FKAA may require detailed cost data in order to substantiate the reasonableness of the proposed costs.

Any compensation paid in conjunction with the terms of a Change Order shall comprise total compensation due the Contractor for the work or alteration defined in the Change Order. By signing the Change Order, the Contractor acknowledges that the stipulated compensation includes payment for the interruption of schedules, extended overhead, delay, disruption, inefficiency, or any other impact claim or ripple effect, and by such signing specifically waives any reservation or claim for additional compensation in respect to the subject Change Order.

At the FKAA’s option, payment or credit for any alterations covered by a Change Order shall be determined by one or a combination of the methods set forth in 8.2, 8.3, or 8.4 below, as applicable:

8.2 **UNIT PRICES - METHOD I**

The FKAA reserves the right to increase or decrease the amount of any services, materials or any
other work shown in the Proposal. In the event an increase or decrease in a quantity is in excess of 25 percent of the original bid quantity, and if there is no corresponding adjustment with respect to any other item of work, the FKAA or the Contractor may be entitled to an equitable adjustment of such unit price. Any request for an equitable adjustment of a unit price must be made in writing before the increased or decreased work is commenced. Compensation for such changed quantities will be determined by mutual agreement of the FKAA and the Contractor or by application of the cost reimbursement procedures set forth in Paragraph 8.4 of this Article.

Those Unit Prices stipulated in the Proposal shall be utilized where they are applicable. In the event the Change Order results in a change in the original quantity in excess of 15 percent of the original bid quantity, and the total dollar value of that bid item is significant, the FKAA will review the Unit Price to determine if a new unit price shall be negotiated. Unit Prices for new items included in the Change Order shall be negotiated and mutually agreed upon.

8.3 **LUMP SUM - METHOD II**

A total lump sum for the work negotiated and mutually acceptable to the Contractor and FKAA. Lump sum quotations for modifications to the work shall include substantiating documentation with an itemized breakdown of Contractor and Subcontractor costs, including labor, material, rentals, approved services, overhead, and profit, all calculated as specified under Method III below.

8.4 **COST REIMBURSEMENT WORK - METHOD III**

The term “cost reimbursement” shall be understood to mean that payment for the work will be made on a time and expense basis, that is, on an accounting of the Contractor’s forces, materials, equipment, and other items of cost as required and used to do the work.

If the method of payment cannot be agreed upon prior to the beginning of the work, and the FKAA directs by written Change Order that the work be done on a cost reimbursement basis, then the Contractor shall furnish labor, and furnish and install equipment and materials necessary to complete the work in a satisfactory manner and within a reasonable period of time. For the work performed, payment will be made for the documented actual cost of the following:

A. Labor, including foremen, for those hours they are assigned and participating in the cost reimbursement work (actual payroll, cost, including wages, fringe benefits as established by negotiated labor agreements, labor insurance, and labor taxes as established by law). No other fixed labor burdens will be considered, unless approved in writing by the FKAA.

B. Material delivered and used on the designated work, including sales tax, if paid for by the Contractor or his Subcontractor.

C. Rental, or equivalent rental cost of equipment, including necessary transportation for items having a value in excess of $100.

Rental or equivalent rental cost will be allowed for only those days or hours during which the equipment is in actual use. Rental and transportation allowances shall not exceed the current rental rates prevailing in the locality.

The rentals allowed for equipment will, in all cases, be understood to cover all fuel, supplies, repairs, and renewals, and no further allowances will be made for those items, unless specific agreement to the effect is made.
D. Additional bond, as required and approved by the FKAA.

E. Additional insurance (other than labor insurance) as required and approved the FKAA.

In addition to the actual costs in items A through E above, there shall be added the following fixed fees for the Contractor or Subcontractor actually performing the work:

- A fixed fee of 15 percent of the cost of Item A above,
- A fixed fee of 15 percent added to the cost of Items B and C, above and
- A fixed fee of 3 percent added to the cost of Items D and E above.

An additional fixed fee of 5 percent shall be allowed the Contractor for the administrative handling of portions of the work that are performed by an approved Subcontractor. No additional fixed fee will be allowed for the administrative handling of work performed by a Subcontractor, unless by written permission from the FKAA.

The added fixed fees shall be considered to be full compensation, covering the cost of general supervision, overhead, profit, and any other expense.

The Contractor’s records shall make clear distinction between the direct costs of work paid for on a cost reimbursement basis and the costs of other work. The Contractor shall furnish the FKAA report sheets in duplicate of each day’s cost reimbursement work no later than the working day following the performance of said work. The daily report sheets shall itemize the materials used, and shall cover the direct cost of labor and the changes for equipment rental, whether furnished by the Contractor, Subcontractor, or other forces. The daily report sheets shall provide names, social security numbers, and classifications of workers, the hourly rate of pay and hours worked, and also the size, type, and identification number of equipment and hours operated.

Material charges shall be substantiated by valid copies of vendors’ invoices. Such invoices shall be submitted with the daily report sheets, or, if not available, they shall be submitted with subsequent daily report sheets. Said daily report sheets shall be signed by the Contractor or his authorized agent.

The FKAA reserves the right to furnish such materials and equipment as the FKAA deems expedient, and the Contractor shall have no claim for profit or added fees on the cost of such materials and equipment.

To receive partial payments and final payment for cost reimbursement work, the Contractor shall submit to the FKAA, in a manner approved by the FKAA, detailed and complete documented verification of the Contractor’s and any of his Subcontractors’ actual costs involved in the cost reimbursement work. Such costs shall be submitted within 30 days after said work has been performed.

ARTICLE IX - PARTIAL PAYMENTS

9.1 GENERAL

Nothing contained in this Article shall be construed to affect the right, hereby reserved to reject the whole or any part of the aforesaid work, should such work be later found not to comply with the provisions of the Contract Documents. All estimated quantities of work for which partial payments have been made are subject to review and correction on the final estimate. Payment by the FKAA and acceptance by the Contractor of partial payments based on periodic estimates of
quantities of work performed shall not, in any way, constitute acceptance of the estimate quantities used as the basis for computing the amounts of the partial payments.

9.2 **ESTIMATE**

At least 30 days excluding Saturdays, Sundays or Legal Holidays, before each progress payment falls due, the Contractor shall submit to the FKAA a detailed estimate of the amount earned during the preceding month for the separate portions of the work, and request payment. As used in this Article, the words “amount earned” means the value, on the date of the estimate for partial payment, of the work completed in accordance with the Contract Documents, and the value of approved materials delivered to the project site suitably stored and protected prior to incorporation into the work.

The FKAA will, within 3 days excluding Saturdays, Sundays, or Legal Holidays, after receipt of each request for payment, either indicate in writing a recommendation of payment and present the request to the FKAA, or return the request to the Contractor indicating in writing the FKAA’s reasons for refusing to recommend payment. In the latter case, the Contractor may, within 7 days, make the necessary corrections and resubmit the request.

The FKAA may refuse to recommend the whole or any part of any payment if, in his opinion, it would be incorrect to make such representations to the FKAA. The FKAA may also refuse to recommend any such payment, or, nullify any such payment previously recommended to such extent as may be necessary in the FKAA’s opinion to protect the FKAA from loss because:

- The work is defective, or completed work has been damaged requiring correction or replacement;
- Written claims have been made against FKAA or Liens have been filed in connection with the work;
- The Contract Price has been reduced because of Change Orders;
- FKAA has been required to correct defective work or complete the work in accordance with Article 7.5, FKAA’S RIGHT TO DO WORK;
- Of Contractor’s unsatisfactory prosecution of the work in accordance with the Contract Documents; or
- Contractor’s failure to make payment to Subcontractors or for labor, materials, or equipment.

9.3 **DEDUCTION FROM ESTIMATE**

Unless modified in the Supplementary Conditions, deductions from the estimate will be as described below.

The FKAA will deduct from the estimate, and retain as part security, 10 percent of the amount earned to work satisfactorily completed. A deduction and retainage of 10 percent will be made on the estimate amount earned for approved items of material delivered to and properly stored at the jobsite but not incorporated into the work. When the work is 50 percent complete, and at the written request of the Contractor, the FKAA may reduce the retainage to 5 percent of the dollar value of all work satisfactorily completed to date provided that the Contractor is making satisfactory progress and there is no specific cause for a greater retainage. Such reduction shall not apply to the rate of retainage to be held with respect to work completed thereafter. The
FKAA may reinstate the retainage up to 10 percent if the FKAA determines, at his discretion, that the Contractor is not making satisfactory progress or where there is other specific cause for such withholding.

9.4 QUALIFICATION FOR PARTIAL PAYMENT FOR MATERIALS DELIVERED

Unless modified in the Supplementary Conditions, qualification for partial payment for materials delivered but not yet incorporated into the work shall be as described below.

Materials, as used herein, shall be considered to be those items which are fabricated and manufactured materials and equipment. No partial payment shall be considered for individual purchases of less than $200 for any one item.

To receive partial payment for materials delivered to the site, but not incorporated in the work, it shall be necessary for the Contractor to include a list of such material on the Partial Payment Request. At his sole discretion, the FKAA may approve items for which partial payment is to be made. Partial payment shall be based on the Contractor’s actual cost for the materials as evidenced by invoices from the supplier. Proper storage and protection shall be provided by the Contractor, and as approved by the FKAA.

Final payment shall be made only for materials actually incorporated in the work and, upon acceptance of the work, all materials remaining for which advance payments had been made shall revert to the Contractor, unless otherwise agreed, and partial payments made for these items shall be deducted from the final payment for the work.

Contractor warrants and guarantees that title to all work, materials, and equipment covered by any Application for Payment, whether incorporated in the project or not, will pass to FKAA at the time of payment free and clear of all liens, claims, security interests, and encumbrances.

If requested by the FKAA, the Contractor shall provide, with subsequent pay requests, invoices receipted by the supplier showing payment in full has been made.

9.5 PAYMENT

After deducting the retainage and the amount of all previous partial payments made to the Contractor from the amount earned, the amount due will be made payable to the Contractor. Recommendations for payment received by the FKAA less than 9 days prior to the scheduled day for payment will not be processed or paid until the following month.

9.6 CLAIMS FOR EXTRA WORK

In any case where the Contractor deems additional compensation will or may become due him, the Contractor shall notify the FKAA, in writing, of his intention to make claim for such compensation before he begins the work on which he bases the claim, in order that such matters may be settled, if possible, or other appropriate action promptly taken. If such notification is not given or the FKAA is not afforded proper facilities by the Contractor for keeping strict account of actual cost, then the Contractor hereby agrees to waive the claim for such additional compensation. Such notice by the Contractor, and the fact that the FKAA has kept account of the cost as aforesaid, shall not in any way be construed as proving the validity of the claim. Claims for additional compensation shall be made in itemized detail stating all reasons justifying each claim item and the full amount of compensation claimed for each item, and submitted, in writing,
to the FKAA within 10 days following completion of that portion of the work for which the Contractor bases his claim. In case the claim is found to be just, it shall be allowed and paid for as provided in Article 8.1, PAYMENT FOR CHANGE ORDERS.

9.7 DISQUALIFICATION FOR FUTURE WORK

The Contractor is notified that failure to perform satisfactorily on this project or any other project for the State of Florida shall be cause to declare the Contractor delinquent and to disqualify the Contractor from performing future projects for the FKAA.

9.8 RELEASE OF LIENS OR CLAIMS

The Contractor shall indemnify and hold harmless the FKAA from all claims for labor and materials furnished under this Contract. Prior to the final payment, the Contractor shall furnish to the FKAA, as part of his final payment request, an affidavit that all of the Contractor’s obligations on the project have been satisfied and that all monetary claims and indebtedness have been paid. The Contractor shall furnish complete and legal effective releases or waivers, satisfactory to the FKAA, of all liens arising out of or filed in connection with the work.

9.9 FINAL PAYMENT

Upon completion of all of the work under this Contract, the Contractor shall notify the FKAA, in writing, that he has completed his part of the Contract and shall request final inspection. Upon receipt of the Contractor’s written notice that the work is ready for final inspection, the FKAA shall make such inspection and shall submit his recommendations as to acceptance of the completed work and as to the final estimate of the amount due the Contractor under this Contract. Upon approval of this final estimate by the FKAA and compliance with provisions in Article 9.8, RELEASE OF LIENS OR CLAIMS, and other provisions as may be applicable, the FKAA shall pay to the Contractor all monies due him under the provisions of these Contract Documents. Approval of the final estimate by the FKAA shall mean approval by the FKAA’s Board of Directors. Final payment will generally be made approximately 30 to 45 days after submittal of the final pay request and other documentation as required by these Contract Documents.

9.10 NO WAIVER OF RIGHTS

Neither the inspection by the FKAA or any of their employees, nor any order by the FKAA for payment of money, nor any payment for, or acceptance of, the whole or any part of the work by the FKAA, nor any extension of time, nor any possession taken by the FKAA or its employees, shall operate as a waiver of any provision of this Contract, or any power herein reserved to the FKAA, or any right to damages herein provided, nor shall any waiver by the FKAA of any breach in this Contract be held to be a waiver of any other or subsequent breach. Acceptance of final payment by the Contractor shall not be final and conclusive or release the Contractor from any liability with regards to latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the FKAA’s rights under the warranty.

9.11 ACCEPTANCE OF FINAL PAYMENT CONSTITUTES RELEASE

The acceptance by the Contractor of the final payment shall release the FKAA from all claims and all liability to the Contractor for all things done or furnished in connection with the work, and every act of the FKAA and others relating to or arising out of the work. No payment, however, final or otherwise, shall operate to release the Contractor or his Sureties from obligations under this Contract and the Performance and Payment Bond, and other bonds and warranties, as herein
provided.

Approval of the final estimate by the FKAA shall mean approval by the FKAA’s Board of Directors. Final payment will generally be made approximately 30 to 45 days after submittal of the final pay request and other documentation as required by these Contract Documents.

ARTICLE X - TERMINATION OR SUSPENSION OF THE CONTRACT

10.1 TERMINATION BY THE CONTRACTOR

10.1.1 The Contractor may terminate the Contract if the Work is stopped by the Owner for a period of ninety (90) days through no act or fault of the Contractor or Subcontractor, Sub-subcontractor, material supplier, or their agents or employees or any other persons performing portions of the Work under contract with the Contractor, for any of the following reasons:

A. Issuance of an order of a court or other governmental authority having jurisdiction; or

B. An act of government, such as a declaration of national emergency making materials required to be incorporated in the Work and approved substitutions thereof unavailable.

10.1.2 If one of the above reasons exists, the Contractor may, after thirty (30) additional days’ written notice to the Owner and Project Engineer, terminate the Contract and recover from the Owner such payment for Work actually installed and incorporated into the Project.

10.2 TERMINATION BY THE OWNER FOR CAUSE

10.2.1 The Owner may terminate the Contract if the Contractor after seventy-two (72) hours of receiving notice from the Owner:

A. Refuses or fails to supply enough properly skilled workers or proper materials;

B. Fails to make prompt payment to Subcontractors or suppliers for materials or labor in accordance with respective agreements between the Contractor and the Subcontractors;

C. Disregards laws, ordinances, rules, regulations or orders of a public authority having jurisdiction;

D. Otherwise is guilty of material breach of a provisions of the Contract Documents;

E. Breaches in any warranty by the Contractor under or pursuant to the Contract Documents;

F. Fails to furnish the Owner with assurances satisfactory to the Owner evidencing Contractor’s ability to complete the Work in compliance with the Contract Documents;

G. Fails after commencement of the Work to proceed continuously with the construction and completion of the Work for more than ten (10) days, except as permitted under
the Contract Documents;

H. If the Contract institutes proceedings or consents to proceedings requesting relief or arrangement under the Federal Bankruptcy Act or any similar or applicable federal or state bankruptcy or insolvency law is filed against the Contractor and such petition is not dismissed within sixty (60) days from the date of said filing, or if the Contractor admits in writing his inability to pay his debts generally as they become due, or if he makes a general assignment for the benefit of his creditors, or if a receiver, liquidator, trustee or assignee is appointed on account of his bankruptcy or insolvency;

I. The Contractor abandons the Work; or

J. The Contractor submits an Application for Payment, sworn statement, waiver of lien, affidavit or document of any nature whatsoever which is falsified.

10.2.2 When any of the above reasons exists, the Owner, shall, without prejudice to any other rights or remedies of the Owner and, after giving the Contractor and the Contractor’s Surety, if any, an additional seven (7) days’ written notice, may terminate employment of the Contractor and may direct the Surety to:

A. Take possession of the site and all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor; and/or

B. Honor its bond obligations and cure the Contractor’s default.

If the Contractor’s Surety is directed to complete the Work, then all payments made after termination of the Contractor shall be pursuant to the terms of the Performance Bond.

If the Surety fails within seven (7) days to initiate and to continue to proceed with a diligent and full faith assuring the manning of the job, the payment of obligations, the resolution of disputes, and honoring its obligations, then the Owner may, at his option stop the Surety from proceeding, declare the Surety in default or in breach of the Contract and undertake the completion of the Work by other means. In such event, the Surety shall be liable for all costs, damages, expenses and losses as set forth in the Contract Documents, including but not limited to liquidated damages, delay damages, administrative costs, completion costs, additional services of the Project Engineer, the Owner, attorney fees, legal services, court cost and interest upon such additional costs from the time demanded until the time paid.

10.2.3 When the Owner terminates the Contract for one of the reasons stated in Subparagraph 10.2.1, the Contractor shall not receive further payment until the Work is finished and the Owner has determined all damages, costs and expenses.

10.2.4 If the unpaid balance of the Contract Sum exceeds all costs, damages, expenses and claims for finishing the Work, including compensation for the Project Engineer’s and the Owner’s services and expenses made necessary thereby, such excess shall be paid to the Contractor, pursuant to 10.2.3 herein. If such costs, damages, expenses and claims exceed the unpaid balance, the Contractor and Surety are jointly and severally liable and shall pay the difference to the Owner immediately upon the Owner’s demand.
10.3 **SUSPENSION BY THE OWNER FOR CONVENIENCE**

10.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

10.3.2 No adjustments shall be made in the Contract Sum to the extent:

   A. That performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

   B. That an equitable adjustment is made or denied under another provision of this Contract.

10.4 **OWNER’S TERMINATION FOR CONVENIENCE**

10.4.1 The Owner may, at any time, terminate the Contract in whole or in part for the Owner’s convenience and without cause. Termination by the Owner under this Paragraph 10.4 shall be by a Notice of Termination delivered to the Contractor specifying the extent of termination and the effective date.

10.4.2 Upon receipt of a Notice of Termination for Convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this Paragraph: (1) cease operation as specified in the Notice; (2) place no further orders and enter into no further subcontracts for materials, labor, services or facilities except as necessary to complete continued portions of the Contract; (3) terminate all subcontracts and orders to the extent they relate to the Work terminated; (4) proceed to complete the performance of the Work not terminated; and (5) take actions that may be necessary, or that Owner may direct, for the protection and preservation of the terminated Work.

10.4.3 Upon such termination, the Contractor shall recover as its sole remedy: payment for the Work properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for out-of-pocket costs items properly and timely furnished to the Project or fabricated off the Project Site, delivered and stored in accordance with the Owner’s instructions. Contractor hereby waives and forfeits all other claims for payment and damages, including without limitation, anticipated profits on the work and materials not performed for the Project.

10.4.3 The Owner shall be credited for payments previously made to the Contractor for the terminated portion of the Work, claims which the Owner has against the Contractor under the Contract and the value of the materials, supplies, equipment or other items that are to be disposed of by the Contractor that are part of the Contract Sum.

**ARTICLE XI – DISPUTE RESOLUTION**

11.1 **UNINTERRUPTED WORK**
CONTRACTOR recognizes that it is imperative that the Work on the Project proceed uninterrupted and without delay. CONTRACTOR shall carry on the Work during the resolution of all claims, disputes, and disagreements with FKAA. No Work shall be delayed or postponed pending resolution of any such claim, dispute, or disagreement except as FKAA and CONTRACTOR may otherwise agree in writing.

11.2 ISSUANCE OF A WRITTEN DETERMINATION ON ANY CLAIM, DISPUTE, OR DISAGREEMENT

FKAA shall issue a written determination of any claim, dispute, or disagreement that may arise during the course of this Contract, which shall be final and binding upon the parties unless CONTRACTOR requests, in writing, negotiate the claim, dispute, or disagreement pursuant to Section 11.3 within ten (10) calendars days of the written determination of FKAA.

11.3 WRITTEN REQUEST TO INITIATE MEDIATION

Within thirty (30) calendar days of receipt of a written request to negotiate a claim, dispute, or disagreement, executives of both FKAA and CONTRACTOR, at levels at least one step above the Project personnel who were involved in the claim, dispute, or disagreement, shall meet at a mutually acceptable time and place. The meeting of the executives is intended to afford the parties the opportunity to exchange relevant information and to attempt to negotiate a resolution of the claim, dispute, or disagreement. At the conclusion of the negotiation process, or the expiration of the thirty (30) calendar days from the date of CONTRACTOR’s written request to negotiate, whichever is sooner, the participating FKAA executive will issue a written summary of the negotiations, together with FKAA’s decision on the claim, dispute, or disagreement. That written decision shall be final and binding upon the parties unless CONTRACTOR requests mediation in accordance with Section 11.4 within ten (10) calendar days of the written decision. The implementation of the executive negotiation procedure under this Section shall be a condition precedent to CONTRACTOR’s commencement of litigation under this Contract.

11.4 APPOINT AN INDEPENDENT MEDIATOR

Upon receipt of a written request from CONTRACTOR to initiate mediation, FKAA shall appoint an independent mediator who shall be qualified by education and/or experience on the subject matter of the claim, dispute, or disagreement at issue. Within twenty (20) calendar days of the appointment of the independent mediator shall conduct mediation, or within such other times as the parties may mutually agree in writing, the independent mediator shall conduct a mediation session in an attempt to reach an amicable resolution of the claim, dispute, or disagreement. In the event that the parties are unable reach an amicable resolution within thirty (30) calendar days of the appointment of the independent mediator, the written decision of FKAA under Article 11.3 shall become final and binding upon parties. CONTRACTOR may, however, challenge that decision by filing and serving a complaint in the Circuit Court of the Sixteenth Judicial Circuit in and for Monroe County, sitting in Key West, Florida.

11.4.1 Each party shall be responsible for the prompt payment of one-half of the fees and expenses of the independent mediator incurred pursuant to the Section.

11.4.2 To the extent permitted by law, all negotiations, statements, and positions made or taken during mediation shall be confidential and shall be treated as compromise and settlement negotiations for purposes of the Florida Rules of Evidence.
11.5 **UNRESOLVED LITIGATION BEFORE SUBSTANTIAL COMPLETION**

The parties mutually agree that no litigation may be commenced before the Project has attained substantial completion or this Contract has been terminated pursuant to the Contract Documents. Any litigation that, in any manner whatsoever, relates to this Contract, or performance of any party hereunder, shall be commenced in the Circuit of the Sixteenth Judicial Circuit in and for Monroe County, Florida sitting in Key West, Florida. The prevailing party in any litigation shall be entitled to its attorneys’ fees, court costs, investigative, and out-of-pocket expenses, as an award against the non-prevailing party, and shall include attorney’s fees, court costs, investigative, and out-of-pocket expenses in appellate proceedings. Mediation proceedings initiated and conducted pursuant to this Agreement shall be in accordance with the Florida Rules of Civil Procedure and usual and customary procedures required by the Circuit Court of Monroe County.

11.6 **GOVERNING LAW; VENUE**

This Agreement shall be governed by and construed in accordance with the Laws of the State of Florida applicable to contracts made and to be performed entirely in the State. In the event that any cause of action or administrative proceeding is instituted for the enforcement or interpretation of this Agreement, the parties agree that venue will lie in the appropriate court or before the appropriate administrative body in Monroe County, Florida.

11.7 **REQUIREMENT TO PROMPTLY COMPLY**

The dispute resolution procedures provided under this Article shall not relieve CONTRACTOR of the requirement to promptly comply with the initial determination of FKAA and to perform any all associated work.
Section 01015

PROJECT REQUIREMENTS

1. GENERAL DESCRIPTION OF WORK. The Work to be performed under these Contract Documents is generally described as follows:

The proposed Phase IIB of the project consists of 19,790 linear feet of 16-inch diameter C-900 DR14 (Unrestrained Pipe) and 2,730 linear feet of 16-inch diameter C-900 DR14 (Restrained Pipe). The work also includes 4 Master Meter Taps. The location of the work is along C905, from Ocean Reef toward Key Largo. The project will tie into Phase IIA at a proposed valve on the south end and an existing 16” valve on the north end.

2. UNITS OF MEASUREMENT Values expressed in various units as specified in Section 01025 Measurement and Payment shall govern.

3. COORDINATION WITH PUBLIC UTILITIES AND AGENCIES. It shall be the Contractor’s responsibility to coordinate the Work with other utilities and to arrange for the relocation of power poles, telephone poles, telephone cables, telephone pedestals, and all other utilities’ facilities as necessary to complete the Work. Contractor shall be responsible for proper shoring and bracing of power poles, telephone poles, telephone cables, telephone pedestals, gas lines, and all other utilities facilities whether they have been relocated or not relocated. Requirements of public utilities shall govern relocation, shoring, and bracing work.

It shall be the Contractor’s responsibility to coordinate the Work with Monroe County.

All costs associated with coordination with public utilities, relocation, shoring, and bracing of utilities’ facilities, whether the costs are Contractor’s costs or costs payable to other public utilities, shall be borne by the Contractor and shall be included in the Contractor’s bid price unless otherwise noted on the drawings or in the specifications.

Existing underground utilities installations (including service connections) are indicated on the drawings only to the extent such information was made available to or discovered by Engineer in preparing the drawings. There is no guarantee as to the accuracy or completeness of such information and all responsibility for the accuracy and completeness thereof is expressly disclaimed.

Contractor shall be responsible for the discovery of existing underground installations, in advance of excavating or trenching, by contacting all local utilities and by prospecting.

The Owner will provided the following permits:

a. Florida Department of Environmental Protection General Permit for Construction of a Water Main Extension.
Contractor shall be responsible for complying with all terms, clearance requirements, and special conditions of these permits, which are included at the end of this section.

The Contractor is responsible for all other permits such as dewatering and rights-of-way permits, etc.

4. **OFFSITE STORAGE.** Offsite storage arrangements will not be permitted. Materials stored offsite shall not be included in the Application for Payment.

5. **SUBSTITUTES AND "OR-EQUAL" ITEMS.** Provisions for evaluation of substitutes and "or-equal" items of materials and equipment are covered in Paragraph 6.05 of the General Conditions. Requests for review of equivalency will not be accepted by Engineer from anyone except Contractor, and such requests will not be considered until after the Effective Date of the Agreement.

6. **PREPARATION FOR SHIPMENT.** All materials shall be suitably packaged to facilitate handling and protect against damage during transit and storage. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

   Each item, package, or bundle of material shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

7. **EASEMENTS AND RIGHTS-OF-WAY.** The easements and rights-of-way for the pipelines will be provided by Owner. Contractor shall confine its construction operations within the limits indicated on the Drawings. Contractor shall use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies in order to avoid damage to property and interference with traffic.

   a. **Work within Highway and Railroad Rights-of-Way.** All Work performed and all operations of Contractor, its employees, or Subcontractors within the limits of railroad and highway rights-of-way shall be in conformity with the Monroe County requirements for CR905 and be under the control (through Owner) of the railroad or highway authority owning, or having jurisdiction over and control of, the right-of-way in each case.

8. **OPERATION OF EXISTING FACILITIES.** The existing pipeline must be kept in continuous operation throughout the construction period. No interruption will be permitted which adversely affects the degree of service provided. Provided permission is obtained from Owner in advance, portions of the existing pipeline may be taken out of service for six hours corresponding with periods of minimum service demands.

   Contractor shall provide temporary facilities and make temporary modifications as
necessary to keep the existing facilities in operation during the construction period.

9. **NOTICES TO OWNERS AND AUTHORITIES.** Contractor shall, as provided in the General Conditions, notify owners of adjacent property and utilities when prosecution of the Work may affect them, at least one week prior to the work beginning unless otherwise specified.

When it is necessary to temporarily deny access to property, or when any utility service connection must be interrupted, Contractor shall give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.

Unless otherwise specified, utilities and other concerned agencies shall be notified at least two weeks prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

10. **LINES AND GRADES.** All Work shall be done to the lines, grades, and elevations indicated on the Drawings.

Basic horizontal and vertical control points will be established or designated by Engineer to be used as datums for the Work. All additional survey, layout, and measurement work shall be performed by Contractor as a part of the Work.

Contractor shall provide an experienced instrument person, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement work. In addition, Contractor shall furnish, without charge, competent persons and such tools, stakes, and other materials as Engineer may require in establishing or designating control points, in establishing construction easement boundaries, or in checking survey, layout, and measurement work performed by Contractor.

Contractor shall keep Engineer informed, a reasonable time in advance, of the times and places at which it wishes to do Work, so that horizontal and vertical control points may be established and any checking deemed necessary by Engineer may be done with minimum inconvenience to Engineer and minimum delay to Contractor.

Contractor shall remove and reconstruct work which is improperly located.

11. **MATERIALS.** Only domestic supplied materials with no lead will be accepted.

12. **CONNECTIONS TO EXISTING.** Contractor shall receive permission from Owner or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall
proceed continuously (around the clock) if necessary to complete connections in the
minimum time. Operation of valves or other appurtenances on existing utilities, when
required, shall be by or under the direct supervision of the owning utility.

Prior to each of the shutdowns and before any connection will be permitted, the
Contractor shall submit to Engineer for review and approval a detailed connection plan
and layout drawings in accordance with Section 01300 – Submittals. A submittal will
be required for each connection. The submittal shall provide sequencing details and
necessary sketches indicating the sequence of the Work to be performed as well as a
listing of the materials required for the Work with certification that all required
materials are onsite. Contractor’s schedule for shutdowns and connections shall be
acceptable to the Owner and the Engineer.

Prior to the commencement of each connection, the existing main to which the
connection is being made and any other mains connected thereto, shall be isolated from
service and dewatered.

Unless otherwise acceptable to the Engineer, each of the connections shall be scheduled
independently of one another and cannot occur concurrently.
Contractor shall provide adequate equipment and workforce to ensure that the
connection is completed within that timeframe.

Contractor shall provide any additional temporary plugs, sleeves, couplings, closure
pieces, restraining devices, bulkheads, and any other miscellaneous appurtenances as
required to perform the Work in the specified sequence at no additional cost to the
Owner.

Due to water system demands and scheduling of other related work items, specific
requirements for scheduling connections to existing facilities of the Owner are set
forth as follows.

12.1 Sequencing of Connections to Existing Facilities. Contractor shall reference
Section 01310-Construction Scheduling for detailed sequencing requirements for
connections to existing facilities.

13. UNFAVORABLE CONSTRUCTION CONDITIONS. During unfavorable weather,
wet ground, or other unsuitable construction conditions, Contractor shall confine its
operations to work which will not be affected adversely by such conditions. No portion
of the Work shall be constructed under conditions which would affect adversely the
quality or efficiency thereof, unless special means or precautions are taken by Contractor
to perform the Work in a proper and satisfactory manner.

14. CUTTING AND PATCHING. As provided in General Conditions, Contractor shall
perform all cutting and patching required for the Work and as may be necessary in
connection with uncovering Work for inspection or for the correction of defective Work.

Contractor shall perform all cutting and patching required for and in connection with the
Work, including but not limited to the following:

   Removal of improperly timed Work.

   Removal of samples of installed materials for testing. Alteration of
   existing facilities.

   Installation of new Work in existing facilities.

Contractor shall provide all shoring, bracing, supports, and protective devices necessary
   to safeguard all Work and existing facilities during cutting and patching operations.
Contractor shall not undertake any cutting or demolition which may affect the structural
   stability of the Work or existing facilities without Engineer's concurrence.

Materials shall be cut and removed to the extent indicated on the Drawings or as
   required to complete the Work. Materials shall be removed in a careful manner, with no
   damage to adjacent facilities or materials. Materials which are not salvageable shall be
   removed from the site by Contractor.

   All Work and existing facilities affected by cutting operations shall be restored with
   new materials, or with salvaged materials acceptable to Engineer, to obtain a finished
   installation with the strength, appearance, and functional capacity required. If
   necessary, entire surfaces shall be patched and refinished.

   Restoration of pavement and other surface construction shall be performed in accordance
   with the Florida Department of Transportation and Monroe County requirements shown
   in the General Notes of the Drawings.

15. **CLEANING UP.** Contractor shall keep the premises free at all times from
   accumulations of waste materials and rubbish. Contractor shall provide adequate
   trash receptacles about the Site and shall promptly empty the containers when filled.

   Roads shall be swept and cleaned daily. Dust shall be controlled by appropriate means.

   Protruding nails in boards, planks, timbers, etc. shall be removed, hammered in or bent
   over flush with the wood as the nails are exposed.

   Construction materials, such as concrete forms and scaffolding, shall be neatly stacked
   by Contractor when not in use. Contractor shall promptly remove splattered concrete,
   asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent
   marring or other damage.

   Contractor is responsible for the disposal of all hazardous materials in accordance
   with all applicable laws and regulations.
Volatile wastes shall be properly stored in covered metal containers and removed daily.

Wastes shall not be buried or burned on the Site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the Site and disposed of in a manner complying with local ordinances and antipollution laws.

Contractor and its Subcontractors shall restore their working areas of the Project to a neat and orderly condition at the end of each day’s work. Cleaning up shall be a continuing operation, performed on a daily basis throughout the construction period and shall not be left to be performed after the Work or a portion of the Work is completed.

Adequate cleanup will be a condition for recommendation of progress payment applications.

16. RECORD DRAWINGS. The contractor is responsible for collection GPS coordinates for all pipe, fittings, valves, bends, connections to existing utilities, meters, etc. on required State Coordinate System NAD 1983 HARN StatePlane Florida Eas FIPS 0901 Feet and must be deliverable as a shape file with attributes (i.e. pipe with material, size, outside and inside diameter and length of pipe segments, valves with type, size, turns to close, and fittings with type and sizes, etc.) prior to burial. The vertical and horizontal precision should be within 1-inch and 1 feet, respectively. A list of required attributes for each water appurtenance will be provided to the contractor.

17. APPLICABLE CODES. References in the Contract Documents to local codes mean the following: International Building Code

Other standard codes which apply to the Work are designated in the Specifications.

18. PRECONSTRUCTION CONFERENCE. Prior to the commencement of Work at the Site, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by:

- Contractor and its superintendent. Principal
- Subcontractors.
- Representatives of principal Suppliers and manufacturers as appropriate. Engineer.
- Representatives of Owner.
- Government representatives as appropriate.
- Others as requested by Contractor, Owner, or Engineer.

Unless previously submitted to Engineer, Contractor shall bring to the conference a preliminary schedule for each of the following:
Progress Schedule.

Procurement Schedule.

Schedule of Values for progress payment purposes. Schedule of

Shop Drawings and other submittals.

The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:

Contractor's preliminary schedules.

Transmittal, review, and distribution of Contractor's submittals. Processing

Applications for Payment.

Maintaining record documents.

Critical Work sequencing.

Field decisions and Change Orders.

Use of premises, office and storage areas, security, housekeeping, and Owner's needs.

Major equipment deliveries and priorities.

Contractor's assignments for safety and first aid.

Engineer or designee will preside at the conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

19. PROGRESS MEETINGS. Contractor shall schedule and hold regular progress meetings at least monthly and at other times as requested by Engineer or required by progress of the Work. Contractor, Engineer, and all Subcontractors active on the Site shall be represented at each meeting. Contractor may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.

Engineer or shall preside at the meetings. Meeting minutes shall be prepared and distributed by Engineer. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.
20. **NSF CERTIFICATION.** All material or products which come into contact with drinking water shall be third party certified as meeting the specifications of the American National Standards Institute/National Sanitation Foundation Standard 61, Drinking Water System Components – Health Effects. The certifying party shall be accredited by the American National Standards Institute.

21. **PROJECT SECURITY.** The Contractor shall be responsible for the security of Contractor’s own work, property and materials.

20. **CONTRACTOR’S DAILY LOG.** Each Contractor shall prepare and distribute to the Engineer daily a comprehensive daily log, on a form provided by the Engineer, during the entire project period. The daily report shall specifically alert the Engineer to items which could result in delays. Include the following data:
   
   a. Weather  
   b. Work force by trade.  
   c. Major equipment type and quantity.  
   d. Accidents or near-miss accidents.  
   e. Description, location, and quantity of work performed.  
   f. Any assistance required by Owner or Engineer.  
   g. Other information as appropriate.

21. **SITE ADMINISTRATION.** Contractor shall be responsible for all areas of the Site used by it and by all Subcontractors in the performance of the Work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to Owner or others. Contractor shall have the right to exclude from the Site all persons who have no purpose related to the Work or its inspection, and may require all persons on the Site (except Owner's employees) to observe the same regulations as Contractor requires of its employees.

End of Section
SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 PROVISIONS OF PAYMENT

A. The Contractor shall receive and accept the compensation as provided in the Bid Form and the Contract in full payment for performing all operations necessary to complete the work under the Unit Price and Aggregate Sum portions of this Contract, and also in full payment for all loss or damages arising from the nature of the work, until the final acceptance by the FKAA.

B. The Unit Prices and Aggregate Sums stated in the Bid Form include all costs and expenses for labor, equipment, materials, commissions, transportation, changes, expenses, patent fees and royalties, labor for handling materials during inspection, together with any and all costs and expenses in performing and completing the work as ordered and as shown on Contract Drawings and details and specified herein. Measurement and payment for an item at a Unit Price or Aggregate Sum shown in the Bid Form shall be in accordance with the description of that item in this section.

C. The Contractor’s attention is called to the fact that the quotations for the various items of work are intended to establish a total price for completing the work in its entirety. Should the Contractor feel that the cost for any item has not been established by the Bid Form, or this section, he shall include the cost for that work in an applicable bid item, so that his bid reflects his total Unit Prices and Aggregate Sums for completing the work in its entirety. It is the intent of this Contract that the Contractor provide a completed operating system, and any item required to accomplish this shall be included to establish a total cost.

D. The quantities for payment under this Contract shall be determined by actual measurement of the completed items, in place, ready for service and accepted by the FKAA, in accordance with the applicable method of measurement contained herein. The Contractor shall designate and provide a representative to be present at, to witness, and to assist in the making of field measurements for payment.
1.02 DESCRIPTION OF BID ITEMS

A. General Conditions-Bid Item No. 1
   a. Site Mobilization & Demobilization

   Payment for mobilization and demobilization, scheduling and temporary facilities, construction trailers and utilities (see Section 01510), permits (SFWMD dewatering, FDEP water main clearances, etc.) all other activities necessary will be made at the contract lump sum price bid for the item, which price shall be full compensation for all materials, labor, equipment, tools and all other incidentals necessary to complete this item. Includes all required mobilizations/demobilizations for all items.

   This also includes coordination between the Contractor and Power Company/Phone Company in regard to any power poles or anchors that may need to be temporarily held during construction. This includes all costs for securing the poles and anchors.

   Refer to Specifications Section 01510 for description of construction trailers required that shall be paid under this Payment Item.

   Payment item for site mobilization/demobilization shall not exceed two percent (2%) of the contract price. Should the bid price for this item exceed two percent (2%) of the Contract amount, any amount over the 2% will be paid with the Contractor’s final payment application.

   b. Bonds and Insurance

   Payment for bonds and insurance will be made at the contract lump sum price bid for the item. The contractor shall provide proof of payment for all bonds and insurance.

   c. Maintenance of Traffic(MOT)

   The quantity of traffic control to be considered for payment shall be equivalent to the percentage of the project determined by the Engineer to be complete as of the date of the pay request submitted. The percent completion of the project shall be based on the percent of the total project actually constructed and not on the percent of the Contract price completed.
Payment for traffic control shall be made on the basis of a percentage (as determined above) of the Lump Sum Price. The contract unit price shall include compensation for required labor, materials, and equipment necessary to keep roadways and property accesses in service during construction activities in accordance with the Contract Documents.

A detailed MOT plan will need to be provided by the Contractor for each Phase of construction.

This item includes maintenance of traffic plan, traffic control, flagman, detour signs, barricades, temporary signage, construction and removal of temporary access driveways to residential homes for driveway maintenance, etc. in order to provide safety and traffic access in accordance with local and state requirements.

d. As-Built Record Drawings

Payment for this item shall be on a Lump Sum Basis. One set of full size design drawings on reproducible material and an electronic file of the design drawings on compact disk and will be furnished to the Contractor by FKAA. The contractor is responsible to GPS all fittings, valves, bends, flush-out assemblies, connections to existing water mains, fire hydrants, service connections, etc. with required coordinate plane and must use compatible software to that of the FKAA’s. The Contractor shall maintain full size (24 x 36) field drawings to reflect the “as-built” items of work as the work progresses. Contractor shall provide Owner with copies of monthly updates to as-built drawings as part of pay application process. Failure to provide updates may delay payment until updates are submitted. Upon completion of the work, the contractor shall prepare a record set of “as-built” drawings on full size, reproducible material and electronic file in AutoCAD 2007 or latest version. No final payment will be made for “as-built” drawings until both the reproducible and electronic files are received and accepted by the FKAA.

Place a full size set of contract documents in the Contractor’s field office to be used for marking the actual installation location of the work and noting changes in the work. Assign one person to be in charge of the compiling and maintaining on a daily basis.

The signed and sealed As-built drawings prepared by professional surveyor are required to be submitted with each pay request. Partial
payment will be made for this item based upon the percentage of work completed. All survey work shall be performed by an independent third party surveyor, licensed to practice in the State of Florida. The surveyor shall be retained by the Contractor and approved by the Engineer.

This item does not include surveying work required for layout and alignment of utility and roadway improvements.

B. **Water Mains in Place** - Bid Item No. 2

Payment will be at the contract unit price per linear foot for the actual number of linear feet of each size and type of pipe acceptably furnished and installed. The unit price shall include all costs of excavation and backfill of trench, compaction, temporary water lines, dewatering, sheeting, pipe bedding, temporary restoration, erosion control, detectible warning tapes, preconstruction video, furnishing and installing pipe, restrained joints, polyethylene encasement, disinfection, flushing, pressure testing, bacteriological testing, pigging, site restoration including in-kind sod replacement, and appurtenances except as otherwise provided for in the Bid Form. Measurement will be along the horizontal projection of the centerline of the pipe through all fittings, valves, casings, specials, etc. Flushing and testing shall be considered to be five percent (5%) of this pay item and clean-up shall be considered to be five percent (5%) of this pay item.

C. **Valves and Valve Boxes** - Bid Item No. 3

Payment for this item shall be made at the contract unit price for each type and size of valve acceptably furnished and installed. The unit price shall include all costs of excavation and backfill, dewatering, sheeting, furnishing and installing valves, boxes, mechanical restraining devices, concrete pads, brass I.D. disc, polyethylene encasement, and all other work and material required for a complete and satisfactory installation as specified and shown on the Drawings.

**Air Release Valves and Pedestal Housings**

The unit price as specified to be paid for all 2” combination air release valves and, if above ground installation, pedestal housing enclosure as detailed in the drawings shall include furnishing all air release valves, saddles, corr stops, ball valves, connecting pipe and fittings, air release valve pedestal housing, and appurtenances. This item shall include all work including excavation, backfill, grading, and disposal of water and excess excavated materials, sheeting and shoring, installation and joining
of saddles, valves, pipe, and fittings, installation of pedestal housing covers for above ground installation, testing, clean-up, and all other operations necessary to complete the air release valves ready for operation. The actual number of 2” combination air release valves furnished and installed in the Work will be measured for payment.

D. **Ductile Iron Fittings** - Bid Item No. 4

Payment for this item shall be made at the contract unit price per fitting. The unit price shall include excavation and backfill, temporary restoration, dewatering, sheeting, furnishing and installing all mechanical restrained fittings, polyethylene encasement, flushing, testing, and disinfection at the locations indicated on the Drawings and all other items of work and materials required for a complete and satisfactory installation.

The quantity for payment shall be the total number of fittings, for the respective types, satisfactorily installed as specified and show on drawings.

E. **Connect to Existing Water Mains** - Bid Item No. 5

Payment for this item shall be made at the contract unit price for each connection made to an existing water main. The quantity for payment shall be based on each connection made to a specific size existing main. When tapping sleeves and valves are specified, the quantity shall be based on the number of each size of tapping sleeve and valve installed. The unit price shall include all excavation and backfill, dewatering, sheeting, removing existing thrust blocks and fittings, connecting to the existing water main or valve, thrust blocks as required, flushing, testing, disinfection, and all other work and materials required for a complete and satisfactory installation as specified and in accordance with the details shown on the Drawings.

F. **Master Meter Assembly** - Bid Item No. 6

Payment for this item shall be made at the contract unit price for each type and size of Master Meter Assembly. The unit price shall include labor and materials for installing the 316SS flanged master meter/PRV assembly and piping and concrete vault as depicted on the drawings. This item shall include the furnishing and installing of the two gate valves, the two PRV’s, the Neptune strainer and turbo meter, the harness coupling, the concrete pipe supports, the concrete vault, and all piping, valves/valve boxes required for connections to proposed transmission main and existing distribution water main, piping appurtenances, and all work including excavation, backfill, disposal of water and excess excavated materials,
sheeting and shoring, placing and joining of pipe, fittings, and valves furnished for this item, hydrostatic testing, disinfection, cleaning by flushing for the transmission mains and cleaning by pigging for the transmission main, clean-up, and all other operations necessary to complete the master metering assembly ready for operation.

G. Pavement Restoration - Bid Item No. 7

Payment for road pavement restoration, for the respective types, shall be made at the contract unit price, per linear foot, square foot, or square yard depending on the type. The unit price shall include all labor, materials, equipment and all operations necessary for the removal of the existing pavement, construction of a limerock base, asphaltic concrete surface course, maintenance of traffic, restriping new paving to match original, reflectors, and repainting, all in accordance with the requirements of the Monroe County.

The quantity for payment of “Pavement Restoration” shall be per linear foot based on the horizontal distance, measured along the centerline of the main from end to end and within the limits of pavement restoration, as shown on the drawings.

The quantity for payment of “Full-Lane Restoration” shall be per square yard based on the linear distance as measured for trench restoration multiplied by the width of pavement restored within the limits of pavement restoration as shown on the drawings.

H. Filter Fabric Surrounding Pipeline Bedding Material - Bid Item No. 8

The unit price as specified to be paid for the labor and materials for installing Type A filter fabric in the trench surfaces so that it completely surrounds the pipe bedding in low lying areas less than or equal to 4.0 feet NGVD. See specification 02202 for filter fabric installation requirements. The filter fabric quantity measured for payment as the actual square yards of filter fabric to completely surround the surfaces of the bedding within the trench to prevent migration of soil into the bedding material as indicated or specified.

I. 5 % Contingency Allowance-Bid Item No. 9

FKAA may utilize this pay item, as needed, to modifying scope of work, for unforeseen circumstances of authorized additional work, at the Owner’s sole discretion, and solely with prior authorization by the Owner in writing.
PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION
1. **LIST OF ABBREVIATIONS.** Abbreviations for standards and organizations used in the Contract Documents are defined as follows:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AA</td>
<td>Aluminum Association</td>
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<tr>
<td>AABC</td>
<td>Associated Air Balance Council</td>
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<tr>
<td>AAMA</td>
<td>Architectural Aluminum Manufacturers Association</td>
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<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
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<tr>
<td>ABMA</td>
<td>American Boiler Manufacturers Association</td>
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<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
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<tr>
<td>ACPA</td>
<td>American Concrete Pipe Association</td>
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<td>AEIC</td>
<td>Association of Edison Illuminating Companies</td>
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<tr>
<td>AFBMA</td>
<td>Antifriction Bearing Manufacturers Association</td>
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<tr>
<td>AFPA</td>
<td>American Forest &amp; Paper Association</td>
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<td>AGA</td>
<td>American Gas Association</td>
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<td>AGMA</td>
<td>American Gear Manufacturers Association</td>
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<td>AHA</td>
<td>American Hardboard Association</td>
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<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
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<td>AISI</td>
<td>American Iron and Steel Institute</td>
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<tr>
<td>AITC</td>
<td>American Institute of Timber Construction</td>
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<td>AMCA</td>
<td>Air Moving and Conditioning Association</td>
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<td>ANSI</td>
<td>American National Standards Institute</td>
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<td>APA</td>
<td>American Plywood Association</td>
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<tr>
<td>API</td>
<td>American Petroleum Institute</td>
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<td>AREMA</td>
<td>American Railway Engineers and Maintenance-of-Way Association</td>
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<td>ARI</td>
<td>American Refrigeration Institute</td>
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<td>ASAHC</td>
<td>American Society of Architectural Hardware Consultants</td>
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<td>ASCE</td>
<td>American Society of Civil Engineers</td>
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<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating, and Air-Conditioning Engineers</td>
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<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
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<td>ASSE</td>
<td>American Society of Sanitary Engineers</td>
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<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<tr>
<td>AVATI</td>
<td>See RTI</td>
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<td>AWG</td>
<td>American Wire Gage</td>
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<td>AWI</td>
<td>Architectural Woodwork Institute</td>
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<td>AWPA</td>
<td>American Wood-Preservers' Association</td>
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<td>AWPB</td>
<td>American Wood Preservers Bureau AWS</td>
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<td>AWWA</td>
<td>American Welding Society</td>
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<td>AWWA</td>
<td>American Water Works Association</td>
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<td>Abbreviation</td>
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<tr>
<td>BHMA</td>
<td>Builders Hardware Manufacturers Association</td>
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<td>BIA</td>
<td>Brick Institute of America (formerly SCPI)</td>
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<td>CDA</td>
<td>Copper Development Association</td>
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<td>CISPI</td>
<td>Cast Iron Soil Pipe Institute</td>
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<td>CMAA</td>
<td>Crane Manufacturers Association of America</td>
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<td>CRA</td>
<td>California Redwood Association</td>
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<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute</td>
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<td>CS</td>
<td>Commercial Standard (U.S. Department of Commerce)</td>
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<td>DHI</td>
<td>Door and Hardware Institute</td>
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<td>DIPRA</td>
<td>Ductile Iron Pipe Research Association</td>
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<td>EEI</td>
<td>Edison Electric Institute</td>
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<td>EJCDC</td>
<td>Engineers' Joint Contract Documents Committee</td>
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<td>EPA</td>
<td>Environmental Protection Agency</td>
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<td>Fluid Controls Institute</td>
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<td>IEEE</td>
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<td>IBC</td>
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<td>Instrumentation, Systems, and Automation Society</td>
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<td>Materials Handling Institute</td>
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<td>MIL</td>
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<td>SI</td>
<td>Système International des Unités (International System of Units)</td>
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<td>SIGMA</td>
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<td></td>
<td>Steel Joist Institute</td>
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<td>Abbreviation</td>
<td>Full Name</td>
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<td>SMA</td>
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<td>SMACNA</td>
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<td>Society of the Plastics Industry</td>
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<td>Southern Pressure Treaters Association</td>
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<td>SSTA</td>
<td>Southern Pressure Treaters Association</td>
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<td>SSPC</td>
<td>SSPC: The Society for Protective Coatings</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters' Laboratories</td>
</tr>
<tr>
<td>USBR</td>
<td>U.S. Bureau of Reclamation</td>
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<tr>
<td>WEF</td>
<td>Water Environment Federation</td>
</tr>
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</table>

End of Section
Section 01300

SUBMITTALS

1. SHOP DRAWINGS AND ENGINEERING DATA.

1.1. General. Shop Drawings and engineering data (submittals) covering all equipment and all fabricated components and building materials which will become a permanent part of the Work under this Contract shall be submitted to Engineer for review, as required. Submittals shall verify compliance with the Contract Documents, and shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and the operation of component materials and devices; the external connections, anchorages, and supports required; the performance characteristics; and dimensions needed for installation and correlation with other materials and equipment.

Each submittal shall cover items from only one section of the specification unless the item consists of components from several sources. Contractor shall submit a complete initial submittal including all components. When an item consists of components from several sources, Contractor's initial submittal shall be complete including all components.

All submittals, regardless of origin, shall be approved by Contractor and clearly identified with the name and number of this Contract, Contractor's name, and references to applicable specification paragraphs and Contract Drawings. Each copy of all submittals, regardless of origin, shall be stamped or affixed with an approval statement of Contractor. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly identified and inapplicable data crossed out. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.

Contractor shall be solely responsible for the completeness of each submittal. Contractor's stamp or affixed approval statement of a submittal is a representation to Owner and Engineer that Contractor accepts sole responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that Contractor has reviewed and coordinated each submittal with the requirements of the Work and the Contract Documents.

All deviations from the Contract Documents shall be identified as deviations on each submittal and shall be tabulated in Contractor's letter of transmittal using. Such submittals shall, as pertinent to the deviation, indicate essential details of all changes proposed by Contractor (including modifications to other facilities that may be a result of the deviation) and all required piping and wiring diagrams.

One electronic copy of each drawing and the necessary data shall be submitted to Engineer. Engineer will return electronically (or one marked reproducible copy) to
Contractor. Engineer will not accept submittals from anyone but Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

1.2. **Engineer's Review of Submittals.** Engineer's review of submittals covers only general conformity to the Drawings and Specifications, external connections, and dimensions that affect the layout; it does not indicate thorough review of all dimensions, quantities, and details of the material, equipment, device, or item covered. Engineer's review shall not relieve Contractor of sole responsibility for errors, omissions, or deviations in the drawings and data, nor of Contractor's sole responsibility for compliance with the Contract Documents.

Engineer's submittal review period shall be 14 consecutive calendar days and shall commence on the first calendar day following receipt of the submittal or resubmittal in Engineer's office.

When the drawings and data are returned with review status "NOT ACCEPTABLE" or "RETURNED FOR CORRECTION", the corrections shall be made as instructed by Engineer. Resubmittals electronically will be accepted. When the drawings and data are returned with review status "EXCEPTIONS NOTED", "NO EXCEPTIONS NOTED", or "RECORD COPY", no additional copies need be furnished unless specifically requested by Engineer.

1.3. **Resubmittal of Drawings and Data.** Contractor shall accept full responsibility for the completeness of each resubmittal. Contractor shall verify that all corrected data and additional information previously requested by Engineer are provided on the resubmittal.

When corrected copies are resubmitted electronically, Contractor shall direct specific attention to all revisions in writing and shall list separately any revisions made other than those called for by Engineer on previous submittals. Requirements specified for initial submittals shall also apply to resubmittals. Resubmittals shall bear the number of the first submittal followed by a letter (A, B, etc.) or a unique identification that indicates the initial submittal and correct sequence of each resubmittal.

If more than one resubmittal is required because of failure of Contractor to provide all previously requested corrected data or additional information, Contractor shall reimburse Owner for the charges of Engineer for review of the additional resubmittals. This does not include initial submittal data such as shop tests and field tests that are submitted after initial submittal.

Resubmittals shall be made within 30 days of the date of the email returning the material to be modified or corrected, unless within 14 days Contractor submits an acceptable request for an extension of the stipulated time period, listing the reasons the resubmittal cannot be completed within that time.
The need for more than one resubmittal, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Times unless delay of the Work is the direct result of a change in the Work authorized by a Change Order or failure of Engineer to review and return any submittal to Contractor within the specified review period.

1.4. **Color Selection.** Contractor shall submit samples of colors and finishes for all accepted products before Engineer will coordinate the selection of colors and finishes with Owner. Engineer will prepare a schedule of finishes that include the colors and finishes selected for both manufactured products and for surfaces to be field painted or finished and will furnish this schedule to Contractor within 60 days after the date of acceptance of the last color or finish sample.

2. **OPERATION AND MAINTENANCE DATA AND MANUALS.** Adequate operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The equipment Supplier shall prepare a project specific operation and maintenance manual for each type of equipment indicated in the individual equipment sections or the equipment schedule.

Parts lists and operating and maintenance instructions shall be furnished for other equipment not listed in the individual equipment sections or the equipment schedule.

Operation and maintenance manuals shall include the following:

- **a.** Equipment function, normal operating characteristics, and limiting conditions.
- **b.** Assembly, installation, alignment, adjustment, and checking instructions.
- **c.** Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
- **d.** Lubrication and maintenance instructions.
- **e.** Guide to troubleshooting.
- **f.** Parts lists and predicted life of parts subject to wear.
- **g.** Outline, cross section, and assembly drawings; engineering data; and wiring diagrams.
- **h.** Test data and performance curves, where applicable.

The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by Contractor.
Three hard copies of each manual shall be submitted to Engineer prior to the date of shipment of the equipment. When the O&M manuals are reviewed "RETURNED FOR CORRECTION", the corrections shall be made as instructed by the Engineer, and two copies of the corrected portion(s) and one complete corrected copy of the O&M manual returned to the Engineer. After review by Engineer is complete three hard copies of each operation and maintenance manual shall be prepared and delivered to Engineer not later than 30 days prior to placing the equipment in operation.

2.1. **Hard Copy Operation and Maintenance Manuals.** Hard copies submitted for review shall be temporarily bound in heavy paper covers bearing suitable identification. All manuals and other data shall be printed on heavy, first-quality 8-1/2 x 11 inch [215 x 279 mm] paper, with standard three-hole punching. Drawings and diagrams shall be reduced to 8-1/2 x 11 inches [215 x 279 mm] or 11 x 17 inches [279 x 431 mm]. Where reduction is not practicable, larger drawings shall be folded separately and placed in envelopes, which are bound into the manuals. Each envelope shall be suitably identified on the outside.

Each volume containing data for three or more items of equipment shall include a table of contents and index tabs. The final hard copy of each manual shall be prepared and delivered in substantial, permanent, three-ring or three-post binders with a table of contents and suitable index tabs.

2.2. **Labeling.** As a minimum, the following information shall be included on all final O&M manual materials, including CD-ROM disks, jewel cases, and hard copy manuals:

- Equipment name and/or O&M title spelled out in complete words.
- Project Name.
- City Project/Contract Number.
- Specification Section Number. Example: “Section 15500” Manufacturer’s name.
- File Name and Date.

For example:

Backwash Pump Operation and Maintenance Manual Somewhere Plant Expansion
Project/Contract No. ________
Specification Section 11110
Manufacturer
OM11110-001.pdf, 5/05/07

End of Section
1. **PROGRESS SCHEDULE.** A Progress Schedule shall be submitted to Engineer. The Progress Schedule shall indicate the sequence of the Work; the time of starting and completion of each part and the time for making connections to existing piping, structures, or facilities. An initial Progress Schedule shall be submitted after the preconstruction conference and before Work is started. The schedule shall be revised as necessary to reflect changes in the progress of the Work.

Owner shall cooperate with Contractor in arrangements for continuity of service and operation of valves and other control facilities.

Owner may require Contractor, at Contractor's expense, to add to its facilities, equipment, or construction forces, as well as increase the working hours, if operations fall behind schedule at any time during the construction period.

1.1. **Progress Reports.** A progress report shall be furnished to Engineer with each Application for Payment. If the Work falls behind schedule, Contractor shall submit additional progress reports at such intervals as Engineer may request.

Each progress report shall include sufficient narrative to describe current and anticipated delaying factors, their effect on the progress schedule, and proposed corrective actions. Any work reported complete, but which is not readily apparent to Engineer, must be substantiated with satisfactory evidence.

Each progress report shall also include three prints of the accepted graphic schedule marked to indicate actual progress.

1.2. **Shutdown and Connection Plans.** As specified in Section 01015 – Project Requirements, detailed shutdown and connection plans are required to be submitted and approved and permission must be granted from the OWNER prior to making connections to existing facilities or utilities. Prior to initial submission of the plan, a meeting shall be conducted between the CONTRACTOR and ENGINEER to discuss logistics of the shutdown. Sufficient time shall be allowed for initial review; conductance of a coordination meeting between CONTRACTOR, OWNER, and ENGINEER; correction and resubmission; and final review of all shutdown and connection plans. All temporary provisions and shutdown times shall be acceptable to OWNER. All shutdowns and connections are subject to approval by OWNER.
1.3. Project Sequencing Requirements. The following requirements shall be reflected in preparing the schedule of construction operations. The maximum time the existing transmission main can be taken out of service during a single shutdown shall be limited to 6 hours. The Contractor may propose alternate project sequencing, as long as the proposed sequence reduces the impact of construction on the Owner’s ongoing operations of the pipeline. Alternate construction sequencing shall be acceptable to the Owner and Engineer.

1. Tie-in at Stations 236+75 and 461+50:

Contractor shall install new PVC-piping between 236+75 and 461+50. After the new piping has been pressure tested, disinfected, sampled, and cleared by FDEP, Contractor shall perform the tie-ins at both stations. The combined time for the two connections is 6-hours. Contractor shall sequence his work as follows:

a. Contractor shall notify Owner one week in advance that the existing transmission main is ready to be shut down. If acceptable to Owner, Owner will shut down main. Contractor shall dewater existing main in accordance with all applicable regulations, remove a portion of the existing ductile iron transmission mains at each end and install the connections of the new transmission main. Contractor shall disinfect new pieces either by spraying or swabbing with a one percent solution of chlorine just prior to installation in accordance with AWWA C651, Section 9.1. Contractor shall notify Owner that pipeline is ready to be returned to service. Piping shall be observed for 24 hours without backfilling for visible signs of leaks.

End of Section
1. **GENERAL.**

1.1. **Units of Measurement.** The values shall be expressed in inch-pound units.

2. **SCHEDULE OF PAYMENTS.** Within 30 days after award of contract, Contractor shall furnish to Engineer a schedule of estimated monthly payments. The schedule shall be revised and resubmitted each time an Application for Payment varies more than 10 percent from the estimated payment schedule.

3. **SURVEY DATA.** All field books, notes, and other data developed by Contractor in performing surveys required as part of the Work shall be available to Engineer for examination throughout the construction period. All such data shall be submitted to Engineer with the other documentation required for final acceptance of the Work.

4. **LAYOUT DATA.** Contractor shall keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Copies of such data shall be furnished to the Resident Project Representative for use in checking Contractor's layout as provided in the project requirements section. All such data considered of value to Owner will be transmitted to Owner by Engineer with other records upon completion of the Work.

End of Section
1. **CONSTRUCTION PHOTOGRAPHS AND VIDEOS BY CONTRACTOR.** Contractor shall be responsible for the production of construction photographs and videos as provided herein. No payment will be made to Contractor until acceptable preconstruction photographs and videos are received.

1.1. **Construction Photographs.** Photographs shall be taken along the route of the pipeline before the commencement of Work, and promptly submitted to Engineer. The photographs shall be at intervals of 500 feet [30 m]. The same views shall be rephotographed upon completion of construction activities on any section of the pipeline, and submitted with Contractor's Application for Payment for Work on that section.

All photographs shall be color digital. Contractor shall submit the photographs electronically. Digital images shall be compiled on CD and provided with a descriptive index of the images. Prints shall be marked with the name and number of the Contract, name of Contractor, description and location of view, and date photographed.

1.2. **Construction Videos.** Contractor shall video tape in detail the entire route of the pipeline and submit two (2) copies of the DVD to Engineer for approval before commencement of Work. The video shall be color and DVD format. The Contract Field Representative shall be present at the time the videotape is produced. The same views shall be re-videoed upon completion of construction activities.

The video shall identify the physical conditions of the site. The video shall identify, at a minimum, all asphalt, concrete, gravel, or grassed surfaces; locations of curbs and gutters, sidewalks, wheelchair ramps, driveways, landscaped areas, retaining walls, fences, signs, and mail boxes; and locations of existing utility manholes, valve boxes, meter boxes, control panels, and power poles.
Section 01400
QUALITY CONTROL

1. **TESTING SERVICES.** Testing services shall be provided in accordance with Paragraph 13.03 of the General Conditions. All tests to determine compliance with the Contract Documents shall be performed by an independent commercial testing firm acceptable to Engineer. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped and fully qualified to perform the tests in accordance with the specified standards.

Testing services provided by Owner are for the sole benefit of Owner; however, test results shall be available to Contractor. Testing necessary to satisfy Contractor's internal quality control procedures shall be the sole responsibility of Contractor.

1.1. **Testing Services Provided by Contractor.** Unless otherwise specified, Contractor shall provide all testing services in connection with the following:

- Concrete materials and design mixtures.
- Asphalitic concrete materials and design mixtures.
- Embedment, fill, and backfill materials.
- Concrete.
- Asphalitic concrete.
- Moisture-density and relative density tests on embedment, fill, and backfill materials.

All other tests and engineering data required for Engineer's review of materials and equipment proposed to be used in the Work.

Contractor shall obtain Engineer's acceptance of the testing firm before having services performed, and shall pay all costs for these testing services. Testing, including sampling, will be performed by the testing firm's laboratory personnel, in the general manner indicated in the Specifications. Engineers shall determine the exact time, location, and number of tests, including samples.

Arrangements for delivery of samples and test specimens to the testing firm's laboratory will be made by Owner. The testing firm's laboratory shall perform all
laboratory tests within a reasonable time consistent with the specified standards and shall furnish a written report of each test.

Contractor shall furnish all sample materials and cooperate in the testing activities, including sampling. Contractor shall interrupt the Work when necessary to allow testing, including sampling, to be performed. Contractor shall have no Claim for an increase in Contract Price or Contract Times due to such interruption. When testing activities, including sampling, are performed in the field by Engineer or laboratory personnel, Contractor shall furnish personnel and facilities to assist in the activities.

1.2. Transmittal of Test Reports. Written reports of tests and engineering data furnished by Contractor for Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.

The laboratory retained by Owner will furnish electronic copy of a written report of each test. Electronic copy of each test report will be transmitted to the Resident Project Representative, Engineer, and Contractor, within 3 days after each test is completed.

3. OFFSITE INSPECTION. When the Contract Documents require inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, such services will be performed by Engineer or an independent testing firm or inspection organization acceptable to Engineer.

Owner shall arrange for and pay an independent organization to perform inspection services required.

Contractor shall give appropriate written notice to Engineer not less than 10 days before offsite inspection services are required, and shall provide for the producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.

The inspection organization will submit a written report to Engineer, with a copy to Contractor, at least once each week.

End of Section
1. **WATER.** The Contractor shall utilize an approved reduced pressure zone backflow preventer, and meter all water taken from Florida Keys Aqueduct Authority for flushing, pigging, testing, and disinfection of mains. Meters must be obtained from Florida Keys Aqueduct Authority. All water metered during construction, will be billed for construction.

2. **POWER.** Contractor shall provide all power for heating, lighting, operation of Contractor's plant or equipment, or for any other use by Contractor. Temporary heat and lighting shall be maintained until the Work is accepted.

3. **SANITARY FACILITIES.** Contractor shall furnish temporary sanitary facilities at the Site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.

Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the Site.

4. **MAINTENANCE OF TRAFFIC.** Contractor shall conduct its work to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel, and shall give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when Contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point.

In making open-cut street crossings, Contractor shall not block more than one-half of the street at a time. Whenever possible, Contractor shall widen the shoulder on the opposite side to facilitate traffic flow. Temporary surfacing shall be provided as necessary on shoulders.

Contractor shall be responsible for coordinating and obtaining all Monroe County Lane Closure Permits. Contractor shall give Owner two weeks’ notice before submitting Monroe County Lane Closure Permits.

4.1. **Temporary Bridges.** Contractor shall construct substantial bridges at all points where it is necessary to maintain traffic across pipeline construction. Bridges in public streets, roads, and highways shall be acceptable to the authority having jurisdiction.
thereover. Bridges erected in private roads and driveways shall be adequate for the service to which they will be subjected. Bridges shall be provided with substantial guardrails and with suitably protected approaches. Foot bridges shall be at least 4 feet [1.2 m] wide, provided with handrails and uprights of dressed lumber. Bridges shall be maintained in place as long as the conditions of the Work require their use for safety of the public. When necessary for the proper prosecution of the Work in the immediate vicinity of a bridge, the bridge may be relocated or temporarily removed for such period as Engineer may permit.

4.2. Detours. Where required by the authority having jurisdiction thereover that traffic be maintained over any construction work in a public street, road, or highway, and the traffic cannot be maintained on the alignment of the original roadbed or pavement, Contractor shall, at its own expense, construct and maintain a detour around the construction work. Each detour shall include a bridge across the pipe trench and all necessary barricades, guardrails, approaches, lights, signals, signs, and other devices and precautions necessary for protection of the Work and safety of the public.

5. BARRICADES AND LIGHTS. All streets, roads, highways, and other public thoroughfares which are closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest intersecting public highway or street on each side of the blocked section.

All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions, such as material piles and equipment, shall be provided with similar warning signs and lights.

All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and conduct of the Work on or alongside public streets and highways shall cause the minimum obstruction and inconvenience to the traveling public.

All barricades, signs, lights, and other protective devices shall be installed and maintained in conformity with applicable statutory requirements and, where within railroad and highway rights-of-way, as required by the authority having jurisdiction thereover.

If necessary to maintain separation of pedestrian traffic from automobiles or if requested by Owner or Monroe County, Contractor shall provide concrete barriers as required.

6. FENCES. All existing fences affected by the Work shall be maintained by Contractor until completion of the Work. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the owner of the fence, and the period the fence may be left relocated or dismantled has been agreed upon. Where fences must be maintained across the construction easement, adequate gates shall be installed. Gates shall be kept closed and locked at all times when not in use.

On completion of the Work across any tract of land, Contractor shall restore all fences to their original, new condition or to a better condition than their original, new condition and to their original locations to the satisfaction of the property owner.
7. **PROTECTION OF PUBLIC AND PRIVATE PROPERTY.** Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by its construction operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards, parkways, and medians, shall be restored to their original condition, whether within or outside the easement. All replacements shall be made with new materials.

No trees shall be removed outside the permanent easement, except where authorized by Engineer. Whenever practicable, Contractor shall tunnel beneath trees in yards and parking lots when on or near the line of trench. Hand excavation shall be employed as necessary to prevent injury to trees. Trees left standing shall be adequately protected against damage from construction operations.

Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, which may be caused by transporting equipment, materials, or workers to or from the Work or any part or site thereof, whether by Contractor or its Subcontractors. Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property concerning its repair or replacement or payment of costs incurred in connection with the damage.

All fire hydrants and water control valves shall be kept free from obstructions and available for use at all times.

8. **ACCESS ROADS.** Contractor shall establish and maintain temporary access roads to various parts of the Site as required to complete the Project. Such roads shall be available for the use of all others performing work or furnishing services in connection with the Project.

9. **PARKING.** Contractor shall provide and maintain suitable parking areas for the use of all workers and others performing work or furnishing services in connection with the Project, as required to avoid any need for parking personal vehicles where they may interfere with public traffic, Owner's operations, or construction activities.

10. **NOISE CONTROL.** Contractor shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours. All construction machinery and vehicles shall be equipped with practical sound-muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the Work.

During construction activities on or adjacent to occupied buildings, and when appropriate, Contractor shall erect screens or barriers effective in reducing noise in the building and shall conduct its operations to avoid unnecessary noise which might
interfere with the activities of building occupants.

11. **DUST CONTROL.** Contractor shall take reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. When practicable, dusty materials in piles or in transit shall be covered to prevent blowing dust.

The Contractor must have onsite at all times an operable water truck for controlling dusty conditions. The Owner or Engineer may require the Contractor to use the truck to reduce dust at any time.

Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels, or similar equipment shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

12. **TEMPORARY DRAINAGE PROVISIONS.** Contractor shall provide for the drainage of storm water and such water as may be applied or discharged on the Site in performance of the Work. Drainage facilities shall be adequate to prevent damage to the Work, the Site, and adjacent property.

Existing drainage channels and conduits shall be cleaned, enlarged, or supplemented as necessary to carry all increased runoff attributable to Contractor's operations. Dikes shall be constructed as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect Owner's facilities and the Work, and to direct water to drainage channels or conduits. Ponding shall be provided as necessary to prevent downstream flooding.

13. **EROSION CONTROL.** Contractor shall prevent erosion of soil on the Site and adjacent property resulting from its construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operation that will disturb the natural protection.

Work shall be scheduled to expose areas subject to erosion for the shortest possible time, and natural vegetation shall be preserved to the greatest extent practicable. Temporary storage and construction buildings shall be located, and construction traffic routed, to minimize erosion. Temporary fast-growing vegetation or other suitable ground cover shall be provided as necessary to control runoff.

14. **POLLUTION CONTROL.** Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. No sanitary wastes shall be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris, or other substance shall be permitted to enter sanitary sewers, and reasonable measures shall be taken to prevent such materials from entering any drain or watercourse.

End of Section
Section 01605

GENERAL EQUIPMENT REQUIREMENTS

1. **SCOPE.** All equipment furnished and installed under this Contract shall conform to the general requirements set forth in this section, except as otherwise specified in other sections.

2. **COORDINATION.** Contractor shall coordinate all details of the equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alterations in the Work required to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

3. **MANUFACTURER'S EXPERIENCE.** Unless specifically named in the Specifications, a manufacturer shall have furnished equipment of the type and size specified which has been in successful operation for not less than the past 5 years.

4. **WORKMANSHIP AND MATERIALS.** Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.

   All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.

   Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4 inch [6.3 mm] thick. When dissimilar metal components are used, consideration shall be given to prevention of galvanic corrosion.

End of Section
Section 01612

SHIPPING

1. **SCOPE.** This section covers packaging and shipping of materials and equipment.

2. **PREPARATION FOR SHIPMENT.** All equipment shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept dry at all times.

Painted and coated surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted and coated surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

Grease and lubricating oil shall be applied to all bearings and similar items.

3. **SHIPPING.** Before shipping each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

End of Section
1. **SCOPE.** This section covers delivery, storage, and handling of materials and equipment.

2. **DELIVERY.** Contractor shall bear the responsibility for delivery of equipment, spare parts, special tools, and materials to the site and shall comply with the requirements specified herein and shall provide required information concerning the shipment and delivery of the materials specified in this Contract. These requirements also apply to any subsuppliers making direct shipments to the jobsite.

Contractor shall, either directly or through contractual arrangements with others, accept responsibility for the safe handling and protection of the equipment and materials furnished under this Contract before and after receipt at the port of entry. Acceptance of the equipment shall be made after it is installed, tested, placed in operation and found to comply with all the specified requirements.

All items shall be checked against packing lists immediately on delivery to the site for damage and for shortages. Damage and shortages shall be remedied with the minimum of delay.

Delivery of portions of the equipment in several individual shipments shall be subject to review of Engineer before shipment. When permitted, all such partial shipments shall be plainly marked to identify, to permit easy accumulation, and to facilitate eventual installation.

3. **STORAGE.** Upon delivery, all equipment and materials shall immediately be stored and protected until installed in the Work.

Stacked items shall be suitably protected from damage by spacers or load distributing supports that are safely arranged. No metalwork (miscellaneous steel shapes and reinforcing steel) shall be stored directly on the ground. Pipe, fittings, and valves may be stored out of doors, but must be placed on wooden blocking. PVC pipe, geomembranes, plastic liner, and other plastic materials shall be stored off the ground on pallets and protected from direct sunlight; and covered to prevent debris and other foreign materials and critters from entering the stored pipe.

Equipment and materials shall not show any pitting, rust, decay, or other deleterious effects of storage when installed in the Work.
4. **HANDLING.** Stored items shall be laid out to facilitate their retrieval for use in the Work. Care shall be taken when removing the equipment for use to ensure the precise piece of equipment is removed and that it is handled in a manner that does not damage the equipment.

End of Section
1. **SCOPE.** This section consists of an equipment schedule for items for which a basic level of manufacturer's field services or operation and maintenance manuals are required, but not covered in other sections. When other sections indicate that manufacturer’s field services and operation and maintenance manuals are required, the requirements shall be as specified in the other sections.

Specific requirements for manufacturer's field services are covered in the Quality Control section.

Specific requirements for operation and maintenance manuals are covered in the Submittals section.

2. **SCHEDULE.** Manufacturer's field services, including equipment installation checks and training, and operation and maintenance manuals shall be provided for the items of equipment indicated in the following schedule:

<table>
<thead>
<tr>
<th>Spec Section</th>
<th>Type of Equipment</th>
<th>Mfr's. Field Services</th>
<th>O&amp;M Manual</th>
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<tr>
<td>15101</td>
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End of Section
PART 1 - GENERAL

1-1. **SCOPE.**

This section covers clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching; tunneled (trenchless construction) crossings; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary; protection of adjacent property; backfilling; pipe embedment; surfacing and grading; and other appurtenant work.

1-2. **GENERAL.**

With reference to the terms and conditions of the construction standards for excavations set forth in OSHA "Safety and Health Regulations for Construction", Chapter XVII of Title 29, CFR, Part 1926, and Contractor shall employ a competent person and, when necessary based on the regulations, a registered professional engineer, to act upon all pertinent matters of the work of this section.

1-3. **SUBMITTALS.**

Drawings, specifications, and data covering the proposed materials shall be submitted in accordance with the Submittals section.

1-3.01. **Filter Fabric Data.**

Complete descriptive and engineering data for the fabric shall be submitted in accordance with the Submittals section. Data submitted shall include:

- A 12 inch square [300 mm] sample of fabric.
- Manufacturer's descriptive product data.
- Installation instructions.

1-4. **INSURANCE.**

Professional Liability insurance shall be provided as specified in the Supplementary Conditions.
PART 2 - PRODUCTS

2-1. MATERIALS.

2-1.01. Filter Fabric.

Type A filter fabric shall be used to prevent migration of soil into the embedment material, and is intended to be used in open cut trenches to surround the granular embedment in low lying areas.

2-1.02. Polyethylene Film.

Polyethylene film beneath concrete slabs or slab base course material shall be Product Standard PS17, 6 mil [150 mm] minimum thickness.

2-1.03. Tunnel Liner Plates. Not used.

2-1.04. Smooth Steel Pipe. Not used.

2-1.05. Wood Skids. Not used.

2-1.06. Casing Insulators. Not used.

2-1.07. Stabilized Sand Backfill. Not used.

2-1.08. End Closure. Not used.

2-1.09. Inundated Sand Fill. Not used.

2-1.10. Graded Gravel Fill.

Graded gravel for compacted trench backfill shall conform to the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch [25 mm]</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch [19 mm]</td>
<td>85 – 100</td>
</tr>
<tr>
<td>3/8 inch [9.5 mm]</td>
<td>50 – 80</td>
</tr>
<tr>
<td>No. 4 [4.75 mm]</td>
<td>35 – 60</td>
</tr>
<tr>
<td>No. 40 [425 µm]</td>
<td>15 – 30</td>
</tr>
<tr>
<td>No. 200 [75 µm]</td>
<td>5 – 10</td>
</tr>
</tbody>
</table>

The gravel mixture shall contain no clay lumps or organic matter. The fraction
passing the No. 4 [4.75 mm] sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2-1.11. Controlled Low Strength Material (CLSM) Fill.

CLSM shall consist of a mixture of Portland cement, fly ash, sand, and water and shall be placed at locations indicated on the drawings or as directed by Engineer. The CLSM shall be in accordance with FDOT Section 121.

The type of cement in CLSM shall be ASTM C150 Type I. The class of fly ash in CLSM shall be ASTM C618 Class C ASTM C618 Class F, except loss on ignition shall not exceed 4 percent. Fine aggregate in CLSM shall be clean natural sand, ASTM C33, except that clay particles shall not exceed one percent. Water in CLSM shall be potable.

Contractor shall design and test the CLSM. Contractor shall submit the mix design and test results to Engineer for review and acceptance. Initial set time shall be 8 hours plus or minus one hour as determined by ASTM C403. CLSM shall have an efflux time of 10 to 26 seconds through a special flow cone with a 1/2 inch [12.7 mm] discharge tube.

The batch proportions accepted by Engineer shall apply only for materials from the same source and having the same characteristics as the materials used in the mix design. Materials from any other source shall be used only with the acceptance of Engineer.

If a change in sources of materials is proposed, a new mix design shall be developed by Contractor before the new material is used. When unsatisfactory results or other conditions make it necessary, Contractor shall develop a new mix design to get the desired results.

During the progress of the work, no change shall be made in the batch proportions of the ingredients without the acceptance of Engineer.

2-1.12. Granular Fill.

Granular fill material shall be crushed rock or gravel. Granular fill shall be free from dust, clay, organics, and trash; hard, durable, non-friable; and shall be graded 3/4 inch to No. 4 [19 to 4.75 mm] as defined in ASTM C33 for No. 67 coarse aggregate. Granular fill shall meet the quality requirements for ASTM C33 coarse aggregate.

2-2. MATERIALS TESTING.

As stipulated in the Quality Control section, all tests required for preliminary review of materials shall be made by an acceptable independent testing laboratory at the expense of Contractor. Two initial gradation tests shall be made for each type of embedment, fill, backfill, or other material, and one additional gradation test shall be made for each additional 500 tons [450 Mg] of each material delivered to the site. In addition, one set of initial Atterberg Limits test shall be made for each fill materials containing more than 20 percent by weight passing the No. 200 sieve [75 µm].

One additional Atterberg Limits test shall be made for each additional 500 tons [450 Mg] of each material delivered to the site.

All material testing on CLSM shall be made by an independent testing laboratory at the expense of Contractor.

2-2.02. Field Testing Expense.

All moisture-density (Proctor) tests and relative density tests on the materials, and all in-place field density tests, shall be made by an independent testing laboratory at the expense of Contractor. Contractor shall provide access to the materials and work area and shall assist the laboratory as needed in obtaining representative samples.

2-2.03. Required Tests.

For planning purposes, the following guidelines shall be used for frequency of field tests. Additional tests shall be performed as necessary for job conditions and number of failed tests. Test results shall be submitted as indicated in the Submittals section.

a. Two moisture density (Proctor) tests in accordance with ASTM D698 (or, when required, ASTM D1557), or two relative density tests in accordance with ASTM D4253 and D4254 for each type of general fill, designated fill, backfill, or other material proposed.

b. In-place field density and moisture tests at intervals of 500 feet [300 m] maximum along the trench.

c. One in-place field density and moisture test for every 200 cubic yards [153 m³] of backfill.

d. One in-place density and moisture test whenever there is a suspicion of a change in the quality of moisture control or effectiveness of compaction.

e. At least one test for every full shift of compaction operations on mass earthwork.

f. Additional gradation, Proctor, and relative density tests whenever the source or quality of material changes.
Testing of CLSM shall be as follows:
Compressive Strength. For every 200 cubic yards [153 cubic meters] of CLSM placed, fill four 6 by 12 inch [150 by 300 mm] plastic cylinder molds to overflowing and then tap sides lightly. Cure cylinders in the molds covered until time of testing, at least 14 days. Strip the cylinders carefully using a knife to cut away the plastic mold. Cap the cylinders with high strength gypsum plaster or other capping process that will not break these low strength materials. Test cylinders in accordance with ASTM C39. Two cylinders shall be tested at 7 days and the other two cylinders shall be tested at 56 days.
Flow of Fill. Once each day that CLSM is placed, test the fill material in accordance with ASTM C939 for the efflux time. Wet screening may be required to remove coarse particles.
Unit Weight and Yield. Once each day that CLSM is placed, determine unit weight and yield in accordance with ASTM C138.
Air Content. Once each day that CLSM is placed, determine air content in accordance with ASTM C231.
Penetration Resistance. Once each day that CLSM is placed, determine early bearing strength in accordance with ASTM C403 penetration procedure.

PART 3 - EXECUTION

3-1. CLEARING.

All clearing shall be performed as necessary for access, stringing of pipeline materials, and construction of the pipeline and appurtenant structures.

3-2. EXCAVATION.

Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

Except where exterior surfaces are specified to be damp-proofed, monolithic concrete manholes and other concrete structures or parts thereof, which do not have footings that extend beyond the outside face of exterior walls, may be placed directly against excavation faces without the use of outer forms, provided that such faces are stable and also provided that a layer of polyethylene film is placed between the earth and the concrete.
Excavations for manholes and similar structures constructed of masonry units shall have such horizontal dimensions that not less than 6 inches [150 mm] clearance is provided for outside plastering.

3-2.01. **Classification of Excavated Materials.**

No classification of excavated materials will be made for payment purposes. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition, or condition thereof.

3-2.02. **Preservation of Trees.**

No trees shall be removed outside excavated or filled areas, unless their removal is authorized by Owner. Trees left standing shall be adequately protected from permanent damage by construction operations.

3-2.03. **Blasting.**

Blasting or other use of explosives for excavation will not be permitted.

3-2.04. **Dewatering.**

Dewatering equipment shall be provided to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

As an alternative, Contractor may use shallow injection wells for the disposal of groundwater. If this alternative is selected, Contractor is responsible for all permitting and permitting fees, installation and abandonment/plugging of wells.

All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level to the minimum depth of 24 inches [600 mm], beneath such excavations. The specified dewatering depth shall be maintained below the prevailing bottom of excavation at all times.

Surface water shall be diverted or otherwise prevented from entering excavations or trenches to the greatest extent possible without causing damage to adjacent property.

Contractor shall be responsible for the condition of any pipe or conduit which he
may use for drainage purposes, and all such pipe or conduit shall be left clean and free of sediment.

Contractor shall obtain from the appropriate agencies and authorities, the dewatering and stormwater discharge permits required to remove and dispose of groundwater, surface water, and any other water used in Contractor's operations. Within 10 calendar days after Notice-to-Proceed, submit a dewatering plan to the Owner and the Engineer, which must comply with all the applicable rules and regulations of the South Florida Water Management District. Contractor shall prepare an application to the District and pay any fee, and shall provide pertinent information that may be required by the South Florida Water Management District. The permits shall be obtained prior to start of construction.

3-2.05. **Sheeting and Shoring.**

Except where banks are cut back on a stable slope, excavations for structures and trenches shall be supported with steel sheet piling and shoring as necessary to prevent caving or sliding.

Sheet piling or other excavation support systems shall be installed as necessary to limit the extent of excavations for deeper structures and to protect adjacent structures and facilities from damage due to excavation and subsequent construction. Contractor shall assume complete responsibility for, and shall install adequate protection systems for prevention of damage to existing facilities.

Sheeting, shoring and excavation support systems shall be designed by a professional engineer registered in the state where the project is located.

Trench sheeting may be removed if the pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting. Trench sheeting shall not be pulled after backfilling. Where trench sheeting is left in place, it shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed. Trench sheeting shall be removed unless otherwise permitted by Engineer. Trench sheeting will not be removed, if in the opinion of Engineer, removal of the sheeting will cause damage to the facility it is protecting. If left in place, the sheeting shall cut off 12 inches below finished grade. The design of the support system shall be such as to permit complete removal while maintaining safety and stability at all times.

3-2.06. **Stabilization.**

Sub-grades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workers.
Sub-grades for concrete structures or trench bottoms which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with crushed rock or gravel as specified for granular fills. The stabilizing material shall be placed in a manner that no voids remain in the granular fill. All excess granular fill with unfilled void space shall be removed.

The finished elevation of stabilized sub-grades shall not be above sub-grade elevations indicated on the drawings.

3-3. **TRENCH EXCAVATION.**

No more trench shall be opened in advance of pipe laying than is necessary to expedite the work. One block or 400 feet [120 m], whichever is the shorter, shall be the maximum length of open trench on any line under construction.

Except where tunneling is indicated on the drawings, is specified, or is permitted by Engineer, all trench excavation shall be open cut from the surface.

3-3.01. **Alignment, Grade, and Minimum Cover.**

The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe.

Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe of 36 inches over pipes below paved and graded streets and, of 30 inches over pipes in other locations. Greater pipe cover depths may be necessary on vertical curves or to provide adequate clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation, except where future surface elevations are indicated on the drawings.

3-3.02. **Maximum Trench Widths.** Not used.

3-3.03. **Minimum Trench Widths.**

Except when maximum trench width is required for certain conduits, trenches shall be excavated to the minimum trench widths indicated in the following table. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment.

<table>
<thead>
<tr>
<th>Nominal Pipe Size</th>
<th>Minimum Trench Width</th>
<th>Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter Range</td>
<td>Minimum Sidewall Clearance</td>
<td>Outside Diameter (or Span)</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>----------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Less than 27 in [700 mm]</td>
<td>Pipe OD plus 12 in [600 mm]</td>
<td>6 in [300 mm]</td>
</tr>
<tr>
<td>27 in through 60 in [700 mm through 1,500 mm]</td>
<td>Pipe OD plus nominal pipe size ID/2</td>
<td></td>
</tr>
<tr>
<td>Greater than 60 in [1,500 mm]</td>
<td>Pipe OD plus 70 in [1800 mm]</td>
<td>30 in [750 mm]</td>
</tr>
</tbody>
</table>

Clearance = Minimum sidewall clearance
OD = Outside diameter (or span) of conduit
ID = Inside diameter (or span) of conduit.

Specified minimum sidewall clearances are not minimum average clearances but are minimum clear distances which will be required to the trench excavation or the trench protective system.

Cutting trench banks on slopes to reduce earth load to prevent sliding and caving shall be used only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits.
3-3.04. **Mechanical Excavation.**

The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated, that the rough trench excavation bottom elevation can be controlled, and that trench alignment is such that pipe, when accurately laid to specified alignment, will be centered in the trench with adequate sidewall clearance. Undercutting the trench sidewall to obtain sidewall clearance will not be permitted.

In locations where maximum trench widths are required for designated rigid conduits, mechanical equipment shall be operated so that uniform trench widths and vertical sidewalls are obtained at least from an elevation 12 inches [300 mm] above the top of the installed pipe to the bottom of the trench.

3-3.05. **Cutting Concrete Surface Construction.**

Cuts in concrete pavement and concrete base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with a concrete saw in a manner which will provide a clean groove at least 1-1/2 inches [40 mm] deep along each side of the trench and along the perimeter of cuts for structures.

Concrete pavement and concrete base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 6 inches [150 mm] in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the center line of the trench.

Pavement removal for connections to existing lines or structures shall not exceed the extent necessary for the installation.

Where the trench parallels the length of concrete walks, and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and subsequently replaced between existing joints or between saw cuts as specified for pavement.
3-3.06. **Excavation Below Pipe Sub-grade.**

Except where otherwise required, pipe trenches shall be excavated below the underside of the pipe to provide for the installation of granular embedment, as shown in the Drawings.

Bell holes shall provide adequate clearance for tools and methods used for installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

3-3.07. **Artificial Foundations in Trenches.**

Whenever unsuitable or unstable soil conditions are encountered, trenches shall be excavated below grade and the trench bottom shall be brought to grade with suitable material. In such cases, adjustments will be made in the Contract Price in accordance with the provisions of the General Conditions.

3-4. **Pipe Embedment.**

Embedment materials both below and above the bottom of the pipe, classes of embedment to be used, and placement and compaction of embedment materials shall conform to the requirements indicated in the Drawings and to the following supplementary requirements.

Embedment material shall be clean and free from cinders, organic material, clay lumps, paving materials, or other material which may cause pipe corrosion. No rocks or stones larger than two inches in diameter shall be allowed in any backfill material and sharp edges not allowed.

3-4.01. **Embedment Classes.**

a. **Class A Arch Encasement.**

When arch encasement is indicated on the drawings, Class A arch encasement shall be used at all locations so indicated. When arch encasement is not indicated on the drawings, Class A arch encasement is not required unless improper trenching or unexpected trench conditions require its use as determined by Engineer. Concrete and reinforcing steel for Class A arch encasement shall conform to the requirements of the Cast-in-Place Concrete section.

b. **Class B Bedding.**

Class B bedding shall be used for all steel, ductile iron, pretensioned concrete and vitrified clay pipelines, and for all other pipelines not otherwise specified.
3-4.02. Embedment for Pipelines.

Granular embedment for pipelines shall be pea gravel or crushed rock with rounded or sub-rounded particles; crushed rock with sharp edges which could cause significant scratching or abrasion of the pipe or damage to the polyethylene tube protection shall not be used. Granular fill or graded gravel fill shall be used as pipe “select bedding” within the pipe zone from 8-inches below the pipe to 8-inches above the pipe, as shown on the drawings.

When excessive water is encountered the Florida Keys Aqueduct Authority Field Representative may require uniformly graded 3/8-inch limerock with a maximum particle size of 3/8-inch to be used as bedding, and shall be used as bedding as described above or to a point above the water table as directed by the FKAA Field Representative whichever is greater. Bedding above that point shall meet the requirements of select bedding as described above.

3-4.03. Placement and Compaction.

Granular embedment material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle.

After each pipe has been graded, aligned, and placed in final position on the bedding material, and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof by shovel slicing or other suitable methods to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations.

Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

Each lift of granular embedment material shall be vibrated with a mechanical probe type vibrator or shovel sliced during placement to ensure that all spaces beneath the pipe are filled. Granular embedment shall be placed in maximum lift thickness of 6 inches [150 mm] and compacted. Each lift of embedment material shall be compacted with three passes (round-trip) of a platform type vibrating compactor.

Where indicated on the drawings, or as directed by the Owner and the Engineer, migration of soil into the embedment material shall be prevented with filter fabric Type A. The use of filter fabric is intended to be used in open cut trenches to surround the granular embedment in low lying areas at elevations approximately 4 feet NGVD, or lower. Filter fabric shall be placed on the trench surfaces so that it completely surrounds the embedment material. Joints shall be lapped 12 inches [300 mm].
3-5. **TRENCH BACKFILL.**

All trench backfill above pipe embedment shall conform to the following requirements.

A layer of backfill material not more than 8 inches [200 mm] deep may be placed over concrete arch encasement or concrete reaction blocking after the concrete has reached its initial set, to aid curing. No additional backfill shall be placed over arch encasement or blocking until the concrete has been in place for at least 3 days.

3-5.01. **Compacted Backfill.**

Compacted backfill will be required for the full depth of the trench above the embedment in the following locations:

- Where beneath pavements, surfacings, driveways, curbs, gutters, walks, or other surface construction or structures.
- Where in street, road, or highway shoulders. In established lawn areas.

The top portion of backfill beneath established lawn areas shall be finished with at least 12 inches [300 mm] of topsoil corresponding to, or better than that which is underlying adjoining lawn areas.

Trench backfill material shall be suitable job excavated material graded gravel and shall be as specified herein.

3-5.01.01. **Job Excavated Material.**

Job excavated material may be used for compacted backfill when the job excavated material is finely divided and free from debris, organic material, cinders, clay marl, paving materials, any corrosive material, and stones larger than 2 inches in greatest dimension. Masses of moist, stiff clay shall not be used. Job excavated materials shall be placed in uniform layers not exceeding 8 inches [200 mm] in uncompacted thickness. Each layer of material shall have the best possible moisture content for satisfactory compaction. The material in each layer shall be wetted or dried as needed and thoroughly mixed to ensure uniform moisture content and adequate compaction. Increased layer thickness may be permitted for noncohesive material if Contractor demonstrates to the satisfaction of Engineer that the specified compacted density will be obtained. The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.

For pipelines not located under existing or proposed pavement, the job excavated
material shall be compacted to 95 percent of maximum density at a moisture content within 2 percent of the optimum moisture content, as determined by ASTM D698 modified proctor.

For pipelines located under existing pavement, for which pavement replacement will be required per Monroe County standards, or in areas of proposed paving, backfill shall be placed and compacted as specified above, except that the top 12-inches, measured downward from the level of the bottom of the required base course restoration, or proposed base course, shall be Miami Limerock, in accordance with Section 911 D.O.T. Specifications compacted to not less than 98 percent density at a moisture content within 2 percent of the optimum moisture content, as determined by ASTM D698 modified proctor.

3-5.01.02. Inundated Sand. Not used.

3-5.01.03. Graded Gravel. Not used.

3-5.02. Ordinary Backfill.

Compaction of trench backfill above pipe embedment in locations other than those specified will not be required except to the extent necessary to prevent future settlement. Contractor shall be responsible for backfill settlement as specified.

Ordinary earth backfill material to be placed above embedments shall be free from debris, organic material, cinders, clay marl, paving materials, any corrosive material, and stones larger than 2 inches.

Backfill material above embedments shall be placed by methods which will not impose excessive concentrated or unbalanced loads, shock, or impact on installed pipe, and which will not result in displacement of the pipe.

Compact masses of stiff clay or other consolidated material more than 1 cubic foot \([0.03 \text{ m}^3]\) in volume shall not be permitted to fall more than 5 feet \([1.5 \text{ m}]\) into the trench, unless cushioned by at least 2 feet \([600 \text{ mm}]\) of loose backfill above pipe embedment.

3-5.03. Water-Settled Earth Backfill.

Settlement or consolidation of trench backfill using water jetting or ponding shall not be performed.

3-5.04. Structure Backfill.

Backfill around manholes and small concrete vaults shall meet the requirements specified for compacted trench backfill.
3-5.05. **Controlled Low Strength Material (CLSM).**

Batching, mixing, and placing of CLSM may be started when weather conditions are favorable and when the temperature is at least 34°F [1°C] and rising. At time of placement, CLSM shall have a temperature of at least 40°F [4°C]. Mixing and placing shall stop when the temperature is 38°F [3°C] and falling. Each filling stage shall be as continuous an operation as is practicable.

CLSM shall be discharged from the mixer by an acceptable procedure into the area to be filled. CLSM shall be placed to limits indicated on the drawings. Mixing CLSM with in-situ soil shall be avoided.

When CLSM is placed as backfill against structures, the fill shall be placed in lifts of 2 to 3 feet [0.6 to 1 meter] and the next lift shall not be placed until the previous lift has taken initial set and at least 16 hours have elapsed from the end of placement. Lift thickness shall be reduced as necessary to prevent floatation of the structure.

When CLSM is placed over culverts or pipelines, they shall be anchored to prevent flotation during the placement of CLSM. Unless otherwise required, CLSM shall be placed to one foot below subgrade elevation if the subgrade elevation is not more than 5 feet [1.5 meters] over the top of the culvert or pipe. If the subgrade is more than 5 feet [1.5 meters] over the top of the culvert or pipe fill, CLSM shall be placed to an elevation 2 feet [0.6 meters] over the top of the culvert or pipe, and the remainder shall be backfilled with soil designated by Engineer.

3-6. **TUNNEL EXCAVATION.** Not used.

3-7. **DRAINAGE MAINTENANCE.**

Trenches across roadways, driveways, walks, or other traffic ways adjacent to drainage ditches or watercourses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the traffic way, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other watercourses crossed by the line of trench shall be removed immediately after backfilling is completed, and the original section, grades, and contours of ditches or watercourses shall be restored. Surface drainage shall not be obstructed longer than necessary.

3-8. **PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSES.**
Where trenches are constructed in ditches or other watercourses, backfill shall be protected from surface erosion. Where the grade of the ditch exceeds 1 percent, or as otherwise required, ditch checks shall be installed. Unless otherwise indicated on the drawings, ditch checks shall be concrete. Ditch checks shall extend at least 2 feet [600 mm] below the original ditch or watercourse bottom for the full bottom width and at least 18 inches [450 mm] into the side slopes, and shall be at least 12 inches [300 mm] thick.

3-9. FINAL GRADING AND PLACEMENT OF TOPSOIL.

After other outside work has been finished, and backfilling and embankments completed and settled, all areas which are to be graded shall be brought to grade at the indicated elevations, slopes, and contours. All cuts, fills, embankments, and other areas which have been disturbed or damaged by construction operations shall be surfaced with topsoil to a depth of at least 4 inches [100 mm]. Topsoil shall be of a quality at least equal to the existing topsoil in adjacent areas, free from trash, stones, and debris, and well suited to support plant growth.

Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to manual methods. All surfaces shall be graded to secure effective drainage. Unless otherwise indicated, a slope of at least 1 percent shall be provided.

Final grades and surfaces shall be smooth, even, and free from clods and stones, weeds, brush, and other debris.

3-10. DISPOSAL OF EXCESS EXCAVATED MATERIALS.

Disposal of excess material shall be as follows. Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site.

Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be installed in trench backfill, debris encountered in excavation work, and other similar wastematerials shall be disposed of away from the site.

3-11. SODDING.

All unpaved areas cut by the line of trench or damaged during the work shall be sodded, after completion of construction, to the complete satisfaction of the property owner and Owner. All sod used shall be the same type as removed or damaged, shall be best quality, and, when placed, shall be live fresh growing grass with at least 1-1/2 inches [40 mm] of soil adhering to the roots.

All sod shall be procured from areas where soil is fertile and contains a high
percentage of loamy topsoil and from areas that have been grazed or mowed sufficiently to form a dense turf.

Sod shall be transplanted within 24 hours from the time it is harvested, unless stacked at its destination in a suitable manner. All sod in stacks shall be kept moist and protected from exposure to the sun and from freezing. In no event shall more than 1 week elapse between cutting and planting.

Before placing sod, all shaping and dressing of the areas shall have been completed. After shaping and dressing, commercial fertilizer of a type acceptable to Owner shall be applied uniformly in the manner and amounts recommended by the manufacturer, and harrowed lightly. Sodding shall follow immediately.

3-12. SETTLEMENT.

Contractor shall be responsible for all settlement of trench backfill which may occur within the correction period stipulated in the General Conditions. Any settlement noted in backfill or within the limits of the excavation within the one year warranty period upon final acceptance, will be considered to be attributed to improper compaction methods and shall be corrected at no cost to the Florida Keys Aqueduct Authority.

Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from Engineer or Owner.

Pavement or structures damaged by settlement shall be restored to their original condition by the Contractor at no cost to the Florida Keys Aqueduct Authority.

3-13. PAVEMENT RESTORATION.

All paved areas cut by the line of trench or damaged during the work shall be restored per Monroe County and FDOT standards, after completion of construction, to the complete satisfaction of Monroe County and Owner, as shown in the Drawings.

End of Section
SECTION 02621

STAINLESS STEEL PIPE AND FITTINGS - AISI TYPE 316

PART 1 GENERAL

1.01 SUMMARY
A. Section Includes: Requirements for AISI Type 316 and 316L stainless steel pipe, fittings, and accessories.

1.02 REFERENCES
A. General: References to standards, specifications, manuals, or codes of any technical society, organization or association, or to the Laws or Regulations of any government authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

B. ANSI Standards
1. ANSI B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys
2. ANSI B16.9 Factory-Made Wrought Steel Buttwelding Fittings

C. ANSI/ASME Standards
1. ANSI/ASME Stainless Steel Pipe B36.19M

D. ANSI/AWS Standards
1. ANSI/AWS D10.4 Recommended Practice for Welding Austenitic Chromium-Nickel Stainless Steel Pipe and Tubing

E. ASTM Standards
1. ASTM A182 Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
2. ASTM A193 Specification for Alloy-Steel and Stainless Steel Nuts for Bolts for High-Pressure and High-Temperature Service
3. ASTM A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
4. ASTM A312 Specification for Seamless and Welded Austenitic Stainless Steel Pipe
5. ASTM A778 Specifications for Welded, Unannealed Austenitic Stainless Steel Tubular Products
6. ASTM F593 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
7. ASTM F594 Specification for Stainless Steel Nuts

F. AWWA Standards
1. AWWA C220 Stainless Steel Pipe
2. AWWA C207 Steel Pipe Flanges for Waterworks Service

1.03 DEFINITIONS
A. Buried Pipe and Fittings: Pipe and fittings installed in trenches and covered with soil. Pipe and fittings beneath structures and encased in concrete.
B. Exposed Pipe and Fittings: Pipe and fittings that are not buried. Exposed pipe and fittings include: pipe and fittings outdoors aboveground; pipe and fittings in buildings; pipe and fittings on the interior of tanks; pipe and fittings on the interior of vaults; and pipe and fittings on the interior of pits.
C. Pipe, fittings, and valve sizes and references to pipe diameter on the Drawings and in the Specifications are intended to be nominal size or diameter, and shall be interpreted as nominal size or diameter.

1.04 SUBMITTALS
A. Submit product data for AISI Type 316 or 316L stainless steel pipe and fittings, including the following:
   1. Product manufacturer’s specifications;
   2. Materials of construction;
   3. Fabrication Details;
   4. Details of restraints and attachments;
   5. Additional information required to confirm compliance with the Contract Documents;
   6. Welding certifications;
   7. List of exceptions and associated explanation, if any, to these specifications.

1.05 QUALITY ASSURANCE
A. Marking
   1. Mark pipe and fittings to verify materials and compliance with applicable standards.
B. Welder Qualifications
   1. Stainless steel piping systems welding shall be by welders qualified and certified under provisions of AWS to weld austenitic chromium-nickel stainless steel pipe and tubing.
   2. Welders shall be certified by an independent local, acceptable testing agency not more than 12 months prior to commencing work.
1.06 DELIVERY, STORAGE, AND HANDLING

A. General

1. Deliver pipe, fittings, and accessories in a clean and undamaged condition. Store pipe, fittings, and accessories off the ground.

2. Keep interior of pipe, fittings, and accessories free from dirt and foreign matter.

3. Stacking of pipe shall meet the requirements of the pipe manufacturer. Do not stack fabrications or fittings.

PART 2 PRODUCTS

2.01 AISI 316L STAINLESS STEEL PIPING AND FITTINGS, GENERAL

A. Wall thickness for pipe and fittings with weld joints, flange joints, or clamp type coupling joints shall be as follows unless otherwise shown or specified:

1. All 4-inch and 10-inch piping: Schedule 40.

B. Wall thickness for pipe and fittings with threaded joints shall be as follows unless otherwise shown or specified:

1. All Sizes: Schedule 40.

C. All stainless steel pipe and fittings shall be rated for a minimum working pressure of 250 psi, and shall have additional cyclic surge allowance capacity for a maximum anticipated pressure capability and test pressures of 300 psi.

2.02 AISI TYPE 316 and 316L STAINLESS STEEL PIPE AND FITTINGS

A. Manufacturers and Fabricators

1. Stainless Steel Pipe
   a. Avesta-Sheffield Pipe Company;
   b. Carpenter Technology;
   c. Or equal.

2. Stainless Steel Fittings
   a. Camco Fitting Company;
   b. Flowline;
   c. Or equal.

3. Stainless Steel Pipe Fabricator/Supplier
   a. Douglas Brothers;
   b. Or equal.

B. Stainless Steel Pipe

3. Pipe Dimension Standard: ............................................. ANSI/ASME B36.19M.

C. Weld Fittings for AISI 316L Stainless Steel Pipe
2. Fitting Material Standard
3. Fitting Standard
   a. Forged/Wrought Stainless Steel Fittings: ........................................... ASTM A182, Grade 316.
   b. Cast Stainless Steel Fittings: ........................................... ASTM A351, Grade CF8.
4. Fitting Dimension Standard
   a. Weld Joint Fittings
      1) Wall Thickness: ............................................. ANSI/ASME B36.19M.

2.03 STAINLESS STEEL PIPING JOINTS
A. Joints for 4-inch through 10-inch Stainless Steel Pipe and Fittings
   1. Exposed 4-inch through 10-inch Stainless Steel Pipe, Fitting, and Valve Joints
      a. Pipe to Pipe Joints: ............................................. Flanged or welded.
      b. Fitting to Fitting Joints: ............................................. Flanged or welded.
      c. Pipe to Fitting Joints: ............................................. Flanged or welded.
      d. Pipe to Valve Joints: ............................................. Flanged.
      e. Fitting to Valve Joints: ............................................. Flanged.

2.04 FLANGES AND FLANGE JOINT ACCESSORIES FOR AISI 316 and 316L STAINLESS STEEL PIPE AND FITTINGS
A. Flanges for Stainless Steel Pipe and Fittings
   1. Flange Material for AISI 316L pipe shall be AISI 316L stainless steel, UNS S31603.
   4. Flange Type
      a. Flange for Schedule 40S ............................................. Welding neck or slip-on.
5. Flange Face Type: .................................................................flat face.

B. Flange Joint Accessories

1. Flange Joint Gaskets
   a. Flange Joint Gasket Type: ..................................................Ring.
   c. Flange Joint Gasket Material
      1) Potable Water Service: .............................................EPDM.

2. Flange Joint Bolts, Studs, and Nuts
   a. Bolts for Flange Joints
      1) Type: ..............................................................hexagon head machine bolts.
      2) Material: ......................................................AISI Type 316 stainless steel.
      3) Standard: ...........................................................ASTM A193 or ASTM F593.
      4) Threads: ..............................................................UNC threads.
   b. Studs for Flange Joints
      1) Material: ..........................................................AISI 316 stainless steel.
      2) Standard: ...........................................................ASTM A193 or ASTM F593.
      3) Threads: ..............................................................UNC threads.
      4) Length: ..................................................extend through nuts a minimum of 1/4-inch.
   c. Nuts for Flange Joints
      1) Type: ..............................................................semi-finished regular hexagon nuts.
      2) Material: ..........................................................AISI 316 stainless steel.
      4) Threads: ..............................................................UNC threads.

2.05 SHOP FABRICATIONS

A. General

1. Shop fabricate 4-inch and larger stainless steel pipe and fittings in sections as large as practical while assuring fit-up of piping system without stressing flanges, pumps, valves, or devices.

2. Pipe and fitting joints in shop fabrications shall be weld joints. Ends of shop fabrications shall have flanges or plain ends. Plain ends shall be prepared for field installed couplings or field welding.

3. Where clamp type couplings are used to connect fittings to pipe or fittings to fittings, to be installed, shop fabricate fittings with straight pipe sections of sufficient length for clamp type coupling joints.
B. Shop Welding

1. Shop welding procedures for stainless steel pipe shall meet requirements of ANSI/AWS D10.4.

2. Prepare pipe edges by machine shaping or cutting. Bevel ends of pipe and fittings with wall thicknesses of 3/16-inch and larger. Bevel ends of stainless steel pipe to meet requirements of ANSI/AWS D10.4. Separate abutting pipe ends before welding, and completely fuse inside walls of pipe without overlapping. Welding shall be continuous around the joint and shall be completed without interruption. Welds shall be single vee butt type, of sound weld metal thoroughly fused into the ends of pipe and into bottom of vee. Welds shall be free from cold spots, pin-holes, oxide inclusions, burrs, snags, rough projections or other defects.

C. Protection and Finish of Fabrications

1. Passivate welded joint stainless steel pipe, fittings, and pipe assemblies in the factory using procedures specified in this Section, unless otherwise approved by the Engineer.

2. Wire brush outside weld area. Remove weld splatter. Brushes shall be stainless steel and used only on stainless steel.

3. Remove carbon deposits, grease, and oil by pickling and neutralization.

4. Completely immerse stainless steel assemblies and parts after welding and brushing. Completely immerse stainless steel assemblies and parts in pickling solution of 6% nitric acid and 3% hydrofluoric acid at 1400F for 15 to 20 minutes. Parts shall be free of iron particles or other foreign material following pickling.

5. Following pickling, completely immerse stainless steel assemblies and parts in tri-sodium phosphate rinse. Parts shall be neutralized following immersion in tri-sodium phosphate.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: Install stainless steel pipe, fittings, and accessories as specified in this Section. Pipe shall be installed without stressing or deflecting or forcing flanges or fittings, or fit-up to connecting pump flanges to make pressure tight leak free bolted connections.

3.02 CUTTING PIPE

A. General: Field cuts may be made for shorter than standard pipe lengths.

B. Stainless Steel Pipe

1. Field cut stainless steel pipe with either hand or mechanical saws or mechanical pipe cutters. Use proper tool, machine, or tool and machine for stainless steel pipe.

2. Do not cut pipe by burning.

PROJECT # 1152-17-PHASE IIB 02621-6 STAINLESS STEEL PIPE & FITTINGS
3. Do not flatten pipe ends.
4. Pipe ends shall be saw cut square and perpendicular to pipe axis.
5. Examine cut ends for damage caused by cutting.
6. Finish cut ends of pipe.
   a. Plain End Pipe for Sleeve Type and Clamp Type Couplings: Remove sharp and rough edges which might injure gasket.
   b. Weld Joint Pipe (If field weld joints are approved by the Engineer)
      1) Square and smooth pipe ends.
      2) Bevel ends of stainless steel pipe as recommended in ANSI/AWS D10.4.

3.03 CLAMP TYPE COUPLING JOINTS
   A. Cleaning Ends of Stainless Steel Pipe: Remove dirt, debris, and other deleterious substances from plain ends of pipe and wipe plain ends of pipe dry.
   B. Cleaning Clamp Type Couplings
      1. Wash and wipe coupling clean of dirt, oil, grease, and other foreign matter.
      2. Wipe coupling dry.
      3. Wipe gasket clean of dirt, dust, and other foreign matter.
   C. Joining Stainless Steel Pipe with Clamp Type Couplings
      1. Place both coupling gasket O-rings and coupling over the end of one of the pipes being joined.
      2. Align ends of pipe being joined.
      3. Slide one coupling gasket O-ring off of pipe end where gasket was previously placed. Then slide coupling gasket O-ring onto end of other pipe being joined.
      4. Adjust coupling gaskets O-rings so that O-rings are equal distance from both pipe ends and are spaced so that O-rings are centered in coupling grooves.
      5. Slide coupling over coupling gasket with coupling grooves aligned with coupling gasket O-rings and coupling joint centered on gasket filler connecting gasket O-rings.
      7. Tighten bolts and nuts so that joint will not leak.
      8. Do not over-torque bolts and nuts.
      9. Bring pipe and coupling to correct line and grade. Do not exceed deflection limits recommended by coupling manufacturer.

3.04 FLANGE JOINTS
   A. Cleaning Joint Surfaces
1. Clean joint surfaces of the pipe, fittings, and valves being joined.
2. Wipe surfaces clean of dirt, oil, grease, and other foreign matter.
3. Wipe surfaces dry.
4. Wipe each gasket clean of dirt, dust, and other foreign matter.

B. Making Flange Joints

1. Align flange of pipe, fitting, or valve being installed with flange of receiving pipe, fitting, or valve.
2. Support pipe, fittings, and valves being joined so that flanges are properly aligned.
3. Lubricate bolts and nuts prior to installation of bolts and nuts.
5. Hold gasket so that one gasket hole is aligned with one of the two flange holes nearest top of flange. Place bolt through flange and gasket hole. Carefully allow gasket to rotate into position between flanges. Place second bolt in remaining flange hole nearest top of flange and through hole in gasket. Make sure all gasket holes are properly aligned with remainder of flange holes.
6. Place remainder of bolts in flange holes.
7. Install nuts on bolts. Run-up all nuts finger tight.
8. Tighten nuts to 30 percent of specified torque in a crisscrossed pattern as follows:
   a. Tighten one nut to 30 percent of specified torque;
   b. Tighten nut 180 degrees from first nut to 30 percent of specified torque;
   c. Tighten nut 90 degrees clockwise from first nut to 30 percent of specified torque;
   d. Tighten nut 270 degrees clockwise from first nut to 30 percent of specified torque;
   e. Tighten nuts adjacent to first four nuts, in a clockwise direction, to 30 percent of specified torque in the same crisscrossed sequence; and
   f. Continue advancing crisscrossed pattern, in a clockwise direction, until all nuts are tightened to 30 percent of specified torque.
9. Tighten nuts to 60 percent of specified torque in a crisscrossed pattern identical to the crisscrossed pattern used to tighten nuts to 30 percent of specified torque.
10. Tighten nuts to 90 percent of specified torque in a crisscrossed pattern identical to the crisscrossed pattern used to tighten nuts to 30 percent of specified torque.
11. Tighten nuts, in one final pass performed in a clockwise bolt-to-bolt sequence, to the following torque:
<table>
<thead>
<tr>
<th>Size</th>
<th>Bolt Torque Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-inch through 3-inch</td>
<td>35 to 70 ft.-lbs</td>
</tr>
<tr>
<td>4-inch through 6-inch</td>
<td>40 to 80 ft.-lbs</td>
</tr>
<tr>
<td>8-inch</td>
<td>50 to 100 ft.-lbs</td>
</tr>
<tr>
<td>10-inch</td>
<td>75 to 150 ft.-lbs</td>
</tr>
<tr>
<td>12-inch</td>
<td>100 to 200 ft.-lbs</td>
</tr>
<tr>
<td>14-inch and 16-inch</td>
<td>125 to 250 ft.-lbs</td>
</tr>
<tr>
<td>18-inch and 20-inch</td>
<td>150 to 300 ft.-lbs</td>
</tr>
<tr>
<td>24-inch through 30-inch</td>
<td>200 to 400 ft.-lbs</td>
</tr>
<tr>
<td>36-inch and 42-inch</td>
<td>300 to 500 ft.-lbs</td>
</tr>
<tr>
<td>48-inch through 60-inch</td>
<td>500 to 600 ft.-lbs</td>
</tr>
</tbody>
</table>

### 3.05 THREADED JOINTS FOR STAINLESS STEEL PIPE, FITTINGS, AND VALVES

A. Do not field thread stainless steel pipe.

B. Clean stainless steel threads by brushing with a stainless steel wire brush used only on stainless steel. Remove dirt, burrs, and other substances which would interfere with joining and sealing. Do not damage threads.

C. Make joints leak-tight by use of Teflon tape. Do not apply Teflon tape to the first two threads on the pipe.

D. Do not over-tighten threaded joints. Do not damage pipe exterior with pipe wrench or other tools.

### 3.06 FIELD WELD JOINTS FOR STAINLESS STEEL PIPE AND FITTINGS

A. General

1. Do not field weld stainless steel pipe or fittings, unless field welding is approved in writing by the Engineer.
   a. Welding in field shall be performed only when requested on shop drawings and accepted by Owner and Engineer in writing as specified in this Section.
   b. Field welding of stainless steel pipe or fittings will only be considered by the Engineer if:
      1) Contractor submits documentation of welder’s certification to perform welding and documentation of welder’s experience in welding stainless steel pipe; and
      2) Contractor can demonstrate that pipe can be welded to meet requirements of referenced standards.
2. If field welding is not approved by the Engineer, provide clamp type coupling joints or flange joints, as specified in this Section and the appropriate piping material Section, at no additional cost to the Owner.

B. Field Weld Joints for Stainless Steel Pipe and Fittings, if Field Weld Joints are approved by the Engineer


2. Separate abutting pipe ends before welding, and completely fuse inside walls of pipe without overlapping. Welding shall be continuous around the joint and shall be completed without interruption. Welds shall be single vee butt type, of sound weld metal thoroughly fused into the ends of pipe and into bottom of vee. Welds shall be free from cold spots, pin-holes, oxide inclusions, burrs, snags, rough projections or other defects.

3. Protect and finish stainless steel weld joints as follows:
   a. Wire brush outside weld area. Remove weld splatter. Brushes shall be stainless steel and used only on stainless steel.
   b. Remove surface oxidation by brushing, or grinding and brushing.

4. Secure buried pipe and fittings with haunching and backfill specified in Section 02202 Trenching and Backfilling.

3.07 CLEANING EXTERIOR OF STAINLESS STEEL PIPING

A. Do not paint exterior surfaces of stainless steel pipe or fittings.

B. Wipe surfaces of stainless steel pipe and fittings clean of dirt, oil, grease, and other foreign matter. Solvent clean surfaces as required to remove oil, grease, and other foreign matter.

C. Remove paint spatter by solvent cleaning or wire brushing. Remove surface oxidation by brushing, or grinding and brushing. Brushes shall be stainless steel and used only on stainless steel.

D. Following solvent cleaning, brushing, and grinding, wash surfaces with detergent solution followed by a clean water rinse. Wipe surfaces dry.

3.08 PRESSURE AND LEAKAGE TESTS.

Pipe and fittings shall be subjected to a pressure test and a leakage test in accordance with the Pipeline Pressure and Leakage Testing section.

The Contractor shall provide all necessary pumping equipment; piping connections between the piping and the nearest available source of test water; pressure gauges; and other equipment, materials, and facilities necessary for the tests.
All pipe, fittings, valves, pipe joints, and other materials which are found to be defective shall be removed and replaced with new and acceptable materials, and the affected portion of the piping shall be retested by and at the expense of Contractor.

All joints shall be watertight and free from visible leaks. Any visible leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

3.09 CLEANING AND DISINFECTION.

After installation, all potable water piping shall be cleaned and disinfected as specified in the Cleaning and Disinfection of Water Distribution System section.

3.10 VISUAL EXAMINATION UNDER SYSTEM PRESSURE.

A. For new exposed piping that cannot be isolated from existing process piping perform visual examination of new exposed piping as follows:
   1. Visually examine exposed pipes, fittings, valves, and joints while piping is subjected to system pressure for leaks.

B. Contractor shall repair all visible leaks.

END OF SECTION
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installation of ductile iron pipe. Ductile iron pipe shall be furnished complete with all fittings, jointing materials, pipe hangers and supports, anchors, blocking, encasement, and appurtenances. Piping shall be furnished by the Contractor.

Piping furnished hereunder shall be complete with all joint gaskets, bolts, and nuts required for installation of any valves and equipment furnished by others for installation under this contract.

Pipe hangers and supports, pressure and leakage testing, cleaning, and disinfection are covered in other sections. Cast iron soil pipe is covered in the Miscellaneous Piping section. Pipe trenching, embedment, and backfill are covered in the Trenching and Backfilling section.

1-1.01. Main Pipe Supplier. All ductile iron pipe, fittings, and specials shall be fabricated, lined, coated, and furnished under the direction and management of one pipe supplier, (the Main Pipe Supplier). The Contractor shall designate the Main Pipe Supplier and notify them in writing of their responsibilities, which shall include, at a minimum; ensure and certify that all pipe, fittings, specials, and other materials specified herein, are being manufactured in full accordance with the contract documents; prepare and submit all submittal information and shop drawings; and make any corrections that may be required to submittal information and shop drawings.

1-1.02. Main Pipe Supplier’s Experience and Field Services. The Main Pipe Supplier’s minimum required experience qualifications shall include manufacture of a pipeline at least 1 mile [1.6 km] in length, of a diameter equal to or larger than the pipe to be provided, with joints, lining, and coating suitable for the same or a higher pressure rating, which has performed satisfactorily for the past 5 years.

All ductile iron pipe shall be installed in accordance with the Main Pipe Supplier recommendations.

1-2. SUBMITTALS. Drawings, details, specifications, and installation schedules covering all ductile iron pipe and accessories shall be submitted in accordance with the Submittals section. The drawings and data shall include, but shall not be limited to, the following:

Certification by manufacturer for each item furnished in accordance with the ANSI/AWWA Standards.

Restained joints details.

Certification of pipe manufacturer’s field services, including a copy of the initial services, and all subsequent inspection reports.

Certification of gaskets, certifying that gasket material is suitable for services intended.
Certification of joint lubricant.
Certification of proof-of-design tests for joints, including restrained joints.
Certification of pipe manufacturer of fabricator and certification of proof-of design tests for welded-on outlets.

Laying schedule complete with an explanation of all abbreviations used in the schedule. For long, straight pipe runs, the laying schedule shall list the pipeline station and centerline elevation at least every 100 feet.

Two samples of the polyethylene encasement, each sample clearly identified as required by the Governing Standards and test results from an independent third party laboratory of the requirements specified in ANSI/AWWA C105/A21.5.

The method that the Contractor proposes to use for measuring deflection of pipe joints.

Submittal data shall clearly indicate the country of origin of pipe, fittings, flanges, restraining devices, and accessories.

Contractor shall submit a written statement from the gasket material manufacturer certifying that the gasket materials are compatible with the joints specified herein and are recommended for the specified field test pressures and service conditions.

1-2.01. Emergency Repair Manual. [Not used.]

1-3. DELIVERY, STORAGE, AND HANDLING.

Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage the pipe and fittings. Hooks inserted in ends of pipe shall have broad, well-padded contact surfaces. Unpadded hooks, wire brushes or other abrasive tools shall not be permitted to come into contact with polyethylene lining if such lining is specified.

Contractor-furnished pipe and fittings in which the lining has been damaged shall be replaced by and at the expense of Contractor. With the concurrence of Engineer, small and readily accessible damaged areas may be repaired.

If the lining of Owner-furnished pipe or fittings is damaged by Contractor during unloading or handling, the damaged pipe or fittings shall be replaced by and at the expense of Contractor. Where the damaged areas are small and readily accessible, Contractor may be permitted to repair the lining.

Contractor shall repair any damage to pipe coatings before the pipe is installed.
PART 2 - PRODUCTS

2-1. PIPE CLASS.

<table>
<thead>
<tr>
<th>Pipe Size (inches)</th>
<th>AWWA C151/A21.51 Pressure Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 thru 14</td>
<td>300</td>
</tr>
<tr>
<td>12 and smaller</td>
<td>350</td>
</tr>
</tbody>
</table>

The specified class includes service allowance and casting allowance.

Pipe wall thickness for grooved and threaded end pipe shall be increased if necessary to comply with the following minimum thickness:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Minimum Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>mm</td>
</tr>
<tr>
<td>4-16</td>
<td>100-400</td>
</tr>
<tr>
<td>18</td>
<td>450</td>
</tr>
<tr>
<td>20</td>
<td>500</td>
</tr>
<tr>
<td>24</td>
<td>600</td>
</tr>
<tr>
<td>30-54</td>
<td>750-1400</td>
</tr>
<tr>
<td>60 &amp; 64</td>
<td>1500-1600</td>
</tr>
</tbody>
</table>

(1) Complies with ANSI/AWWA C115/A21.15 for minimum pipe wall thickness for threaded flanges.

(2) Complies with ANSI/AWWA C606 for grooved and shouldered joint ductile iron pipe.

2-2. MATERIALS.

Pipe
Ductile iron, ANSI/AWWA C151/A21.51, Table 1 or Table 3.

Gaskets – All Joint Types
Synthetic rubber; natural rubber will not be acceptable. EPDM Gaskets for potable water service shall be certified as suitable at the pipe pressure and for chlorinated and chloraminated potable water; a certificate of gasket suitability shall be submitted. Gaskets shall be furnished by the pipe manufacturer.

Gas and oil-resistant gaskets shall be made of Nitrile (NBR [Acrylonitrile
Butadiene] rubber. The name of the material shall be permanently marked or molded on the gasket. Gaskets shall be certified as suitable where soils may be contaminated with gas and oil products. A certificate of gasket suitability shall be submitted.

**Joint Lubricant**

Vegetable-based lubricant recommended by the pipe manufacturer. Petroleum or animal-based lubricants will not be acceptable. Lubricants that will be in contact with treated or potable water shall be certified as being in compliance with ANSI/NSF 61.

**Fittings**

ANSI/AWWA C110/A21.10 (except shorter laying lengths will be acceptable for U.S. Pipe), or ANSI/AWWA C153/A21.53, minimum working pressure rating as follows, unless indicated otherwise on the drawings.

<table>
<thead>
<tr>
<th>Fitting Size</th>
<th>Material</th>
<th>Type</th>
<th>Min. Working Pressure Rating, psi [kPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 to 24 [100 to 600]</td>
<td>DI</td>
<td>Mechanical and Push-on joints</td>
<td>350 [2,400]</td>
</tr>
<tr>
<td>4 to 24 [100 to 600]</td>
<td>DI</td>
<td>Flanged joints</td>
<td>250 [1,700]</td>
</tr>
<tr>
<td>30 to 48 [750 to 1,200]</td>
<td>DI</td>
<td>All joints</td>
<td>250 [1,700]</td>
</tr>
<tr>
<td>54 to 64 [1,350 to 1,600]</td>
<td>DI</td>
<td>All joints</td>
<td>150 [1,000]</td>
</tr>
</tbody>
</table>

All fittings shall be ductile iron and suitable for a factory test pressure of rated working pressure plus 100 psi or 1.5 times rated working pressure, whichever is less, without leakage or damage.

**Push-on Joints**

ANSI/AWWA C111/A21.11.

Restrained Push-on Joints, gaskets with stainless steel gripping segments, (4 inch through 12 inch) [100 mm through 300 mm] American “Fast Grip” or "Field Lok 350Gasket" manufactured by U.S. Pipe and furnished to licensed Tyton® joint manufacturer.
<table>
<thead>
<tr>
<th>Component</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flanged Joints</strong></td>
<td>ANSI/AWWA C115/A21.15.</td>
</tr>
<tr>
<td><strong>Flanges</strong></td>
<td></td>
</tr>
<tr>
<td>Class 250(where identified)</td>
<td>Ductile iron, flat faced, with ANSI/ASME B16.1, Class 250 diameter and drilling.</td>
</tr>
<tr>
<td>All Others</td>
<td>Ductile iron, Class 125, ANSI/AWWA C115/A21.15.</td>
</tr>
<tr>
<td>Flanges</td>
<td>All flanges shall be suitable for test pressure of 1.5 times rated pressure without leakage or damage.</td>
</tr>
<tr>
<td><strong>Bolts</strong></td>
<td>ASTM A307, chamfered or rounded ends projecting 1/4 to 1/2 inch [6.3 to 12.7 mm] beyond outer face of nut.</td>
</tr>
<tr>
<td><strong>Nuts</strong></td>
<td>ASTM A307, hexagonal, ANSI/ASME B18.2.2, heavy semifinished pattern.</td>
</tr>
<tr>
<td><strong>Gaskets</strong></td>
<td>ASTM D1330, Grade I rubber, full face type, 1/8 inch [3 mm] thick. Gaskets shall be furnished by the pipe manufacturer.</td>
</tr>
<tr>
<td>Gaskets</td>
<td>Gaskets for potable water service shall be certified as suitable for chlorinated potable water; a certificate of gasket suitability shall be submitted.</td>
</tr>
<tr>
<td><strong>Insulated Flanges</strong></td>
<td>As specified herein, except bolt holes shall be enlarged as needed to accept bolt insulating sleeves.</td>
</tr>
<tr>
<td><strong>Insulation Kits</strong></td>
<td>As manufactured by Central Plastics or Pipeline Seal and Insulator, Inc.</td>
</tr>
<tr>
<td>Insulating Gaskets</td>
<td>Type E, NEMA G-10 glass reinforced epoxy, 1/8 inch [3 mm] thick, with Buna-N sealing element for water and air service. For wastewater service use Viton sealing element. Gaskets shall be furnished by the pipe manufacturer.</td>
</tr>
<tr>
<td><strong>Bolt Insulating Sleeves</strong></td>
<td>Mylar, 1/32 inch [0.79 mm] thick.</td>
</tr>
<tr>
<td>Insulating Washers</td>
<td>Phenolic laminate, 1/8 inch [3 mm] thick, two for each flange bolt.</td>
</tr>
</tbody>
</table>
Backers Washers
Steel, 1/8 inch [3 mm] thick, two for each flange bolt.

Mechanical Joints
ANSI/AWWA C111/A21.11.

Restrained Mechanical Joints (factory prepared spigot), (4 inch through 48 inch) [100 mm through 1,200 mm]
American "MJ coupled Joints", or Griffin "Mech-Lok".

Restrained Mechanical Joints, (field cut spigot), (4 inch through 24 inch) [100 mm through 600 mm]
EBAA Iron "Megalug" Series 1100, without exception.

Wall Pipes or Castings
Mechanical joint with water stop and tapped holes; single casting or fabricated ductile iron pipe; holes sized in accordance with the details on the drawings and provided with removable plugs.

Mechanical Joints with Tie Rods
As indicated on the drawings.

Tie Rods
ASTM A307.

Steel Pipe
ASTM A53, Schedule 40 or 80 as indicated on the drawings.

Washers
ANSI/ASME B18.22.1, plain steel. ANSI/ASME B1.20.1, NPT; with boss or tapping saddle wherever wall thickness minus the foundry tolerance at the tapped connection is less than that required for 4-thread engagement as set forth in Table A.1, Appendix A, of ANSI/AWWA C151/A21.51.

Threaded Connections

Mechanical Couplings

Couplings
Dresser "Style 38"; Smith-Blair "r 411 Steel Coupling"; or Romac “Style 400” or "Style 501"; without pipe stop.

Gaskets
Oil-resistant synthetic rubber. Gaskets shall be furnished by the pipe manufacturer. Gaskets for potable water service shall be certified as suitable for chlorinated potable water; a certificate of gasket suitability shall be submitted.

Grooved-End Joints
AWWA C606.
<table>
<thead>
<tr>
<th>Component</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Ends (rigid joints)</td>
<td>Grooved, with dimensions conforming to AWWA C606, Table 3.</td>
</tr>
<tr>
<td>Pipe Ends (flexible joints)</td>
<td>Shouldered, with dimensions conforming to AWWA C606, Table 4.</td>
</tr>
<tr>
<td>Couplings (non-shouldered pipe)</td>
<td>Tyco/Grinnell &quot;Figure 772,&quot; or Victaulic &quot;Style 31.&quot;</td>
</tr>
<tr>
<td>Couplings (shouldered pipe)</td>
<td>Victaulic &quot;Style 41&quot; or &quot;Style 44&quot;.</td>
</tr>
<tr>
<td>Flanged Coupling Adapters</td>
<td>Smith-Blair &quot;Type 912&quot; or Romac &quot;Style FCA501&quot;, with anchor studs.</td>
</tr>
<tr>
<td>Dismantling Joints</td>
<td>Romac &quot;DJ400&quot;; Dresser &quot;Style 131 Dismantling Joint&quot; or Viking Johnson. For use in potable water systems, coating to be in accordance with NSF- 61. Bolts, nuts, and tie rods shall be stainless steel ASTM A316. ]</td>
</tr>
<tr>
<td>Unrestrained (14 inch and larger)</td>
<td>Smith-Blair &quot;Type 913&quot; or Romac &quot;Style FC400&quot;, 14 inches [350 mm] and larger.</td>
</tr>
<tr>
<td>Tapping Saddles</td>
<td>Ductile iron, with steel straps and rubber sealing gasket, 350 psi [1,700 kPa] pressure rating.</td>
</tr>
<tr>
<td>Watertight/Dusttight Pipe Sleeves</td>
<td>PSI &quot;Thunderline Link-Seal&quot;, insulating type with modular rubber sealing elements, nonmetallic pressure plates, and stainless steel bolts and nuts.</td>
</tr>
<tr>
<td>Shop Coating and Lining</td>
<td>ANSI/AWWA C104/A21.4.</td>
</tr>
<tr>
<td>Cement Mortar Lining with Seal Coat</td>
<td>Induron &quot;Protecto 401 Ceramic Epoxy&quot;.</td>
</tr>
<tr>
<td>Ceramic Epoxy Lining</td>
<td>Two-coat system applied over blastcleaned surface; ground and finish coats separately fired; finished lining thickness at least 8 mils [200 μm], Mohs’ Hardness 5 to 6 density [2,500 to 3,000 kg/m3] as determined by ASTM D792; Fast Fabricators, Inc. &quot;MEH 32&quot; or &quot;SG-14&quot;.</td>
</tr>
<tr>
<td>Glass Lining</td>
<td></td>
</tr>
</tbody>
</table>

PROJECT # 1152-17-PHASE IIB 02625-7 DUCTILE IRON PIPE
<table>
<thead>
<tr>
<th>Material</th>
<th>Details and Compliance Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal Primer</td>
<td>Manufacturer’s standard. If in contact with treated or potable water, certify as being in compliance with ANSI/NSF 61.</td>
</tr>
<tr>
<td>Asphalitic Coating</td>
<td>Manufacturer’s standard.</td>
</tr>
<tr>
<td>Coal Tar Epoxy</td>
<td>Manufacturer’s standard.</td>
</tr>
<tr>
<td>Liquid Epoxy</td>
<td>ANSI/AWWA C210, non-coal tar modified, or when in contact with treated or potable water, certify as being in compliance with ANSI/NSF 61.</td>
</tr>
<tr>
<td>Medium Consistency Coal Tar</td>
<td>Carboline &quot;Bitumastic 50&quot; or Tnemec &quot;46-465 H.B. Tnemecol.&quot;</td>
</tr>
<tr>
<td>Polyethylene Encasement</td>
<td>Seamless, ANSI/AWWA C105/A21.5; LLDPE - 12 mil [200 μm].</td>
</tr>
</tbody>
</table>

All materials for potable water piping must be “lead free”, with no lead content no more than 0.25% in the wetted surface material.

2-3. **SHOP COATING AND LINING.** The interior of all pipe and fittings, unless noted otherwise, shall be cement mortar lined and seal coated.

Lining for pipe and fittings for potable water facilities services shall be as specified below:

- **Potable Water Transmission Main piping.** Cement Mortar (Standard Thickness).
- **Potable Water Distribution piping.** Cement Mortar (Standard Thickness)

The exterior surfaces of all pipe and fittings which will be exposed in interior or exterior locations shall be shop primed. Flange faces shall be coated with a suitable rust preventive compound. Exterior surfaces of all underground ductile iron pipe and fittings shall be shop coated with asphaltic coating.

2-4. **FIELD COATING OF EXPOSED PIPING.** The exterior surfaces of all exposed pipe and fittings, unless noted otherwise, shall be properly prepared per the coating system manufacturer’s requirements prior to field-applying coatings. All exposed ductile iron piping shall be field-coated with two coats of Epoxy Enamel, with a 10 mils DFT, followed by a finished coat of Aliphatic Polyurethane, with a 2 mils DFT, resulting in an overall system DFT of 12 mils. Coating color shall be Light Blue, for potable water service.
2-5. FIELD TAPING OF ALL BURIED METAL PIPE AND FITTINGS. To prevent corrosion, the exterior surfaces of all buried metal pipe and fittings shall be field-taped with #1 wax tape, minimum 40-mils thickness, in accordance with AWWA C217.

PART 3 - EXECUTION

3-1. INSPECTION. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation; pipe ends shall be examined with particular care. All defective pipe and fittings shall be removed from the site.

3-2. PREPARATION. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign matter prior to installation. Before jointing, all joint contact surfaces shall be wire brushed if necessary, wiped clean, and kept clean until jointing is completed.

Precautions shall be taken to prevent foreign material from entering the pipe during installation. Debris, tools, clothing, or other objects shall not be placed in or allowed to enter the pipe.

3-3. CUTTING PIPE. Cutting shall be done in a neat manner, without damage to the pipe or the lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the ends of the pipe shall be dressed with a file or a power grinder to remove all roughness and sharp edges. The cut ends of push-on joint pipe shall be suitably beveled. All field cutting of existing gray cast iron pipe shall be done with mechanical pipe cutters, except where the use of mechanical cutters would be difficult or impracticable.

Contractor shall use factory prepared pipe ends unless a field cut is required for connections.

Ends of ductile iron pipe shall be cut with a portable guillotine saw, abrasive wheel, saw, milling cutter, or oxyacetylene torch. The use of hydraulic squeeze type cutters will not be acceptable. Field-cut holes for saddles shall be cut with mechanical cutters; oxyacetylene cutting will not be acceptable.

3-5. LAYING PIPE. Buried pipe shall be protected from lateral displacement by placing the specified pipe embedment material installed as specified in the Trenching and Backfilling section. Under no circumstances shall pipe be laid in water, and no pipe shall be laid under unsuitable weather or trench conditions.

Whenever pipe laying is stopped, the open end of the pipe shall be sealed with a watertight plug, which will prevent trench water from entering the pipe.

Pipe shall be laid with the bell ends facing the direction of laying, except where reverse laying is specifically acceptable by Engineer.

3-6. FIELD JOINTS. Joints in buried and tunnel locations shall be mechanical or push-on type unless otherwise indicated on the drawings or where required to connect to existing piping or to valves. Bells on wall castings and wall sleeves shall be mechanical joint type, with tapped holes for tie rods or stud bolts. All other joints shall be flanged unless otherwise indicated on the drawings.
Certification of joint design shall be provided in accordance with ANSI/AWWA C111/A21.11, Section 4.5, Performance Requirements, as modified herein. The joint test pressure shall be not less than 2 times the working pressure or 1-1/2 times the test pressure of the pipeline, whichever is higher. The same certification and testing shall also be provided for restrained joints. For restrained joints, the piping shall not be blocked to prevent separation and the joint shall not leak or show evidence of failure. It is not necessary that such tests be made on pipe manufactured specifically for this project. Certified reports covering tests made on other pipe of the same size and design as specified herein and manufactured from materials of equivalent type and quality may be accepted as adequate proof of design.

Restrained joints shall be extended after they are assembled to minimize further takeup.

Field closure pieces shall be located away from the bends beyond the length over which joints are to be restrained.

3-7. **MECHANICAL JOINTS.** Mechanical joints shall be carefully assembled in accordance with the manufacturer’s recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Bolts shall be uniformly tightened to the torque values listed in Appendix A of ANSI/AWWA C111/A21.11. Overtightening of bolts to compensate for poor installation practice will not be acceptable. The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top (or side for vertical piping) centerline. The top (or side) centerline shall be marked on each flange and mechanical joint piece at the foundry.

3-8. **PUSH-ON JOINTS.** The pipe manufacturer’s instructions and recommendations for proper jointing procedures shall be followed. All joint surfaces shall be lubricated with a soap solution provided by the pipe manufacturer immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean. Each spigot end shall be suitably beveled to facilitate assembly.

Pipe ends for restrained joint pipe shall be prepared in accordance with the pipe manufacturer’s recommendations.

3-9. **FLANGED JOINTS.** Pipe shall extend completely through screwed-on flanges. The pipe end and flange face shall be finish machined in a single operation. Flange faces shall be flat and perpendicular to the pipe centerline.

When bolting flanged joints, care shall be taken to avoid restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually and at a uniform rate, to ensure uniform compression of the gasket.

Special care shall be taken when connecting piping to any pumping equipment to ensure that piping stresses are not transmitted to the pump flanges. All connecting piping shall be permanently supported to obtain accurate matching of bolt holes and uniform contact over the entire surface of flanges before any bolts are installed in the flanges. Pump connection piping
shall be free to move parallel to its longitudinal centerline while the bolts are being tightened. Each pump shall be leveled, aligned, and wedged into position which will fit the connecting piping, but shall not be grouted until the initial fitting and alignment of the pipe, so that the pump may be shifted on its foundation if necessary to properly install the connecting piping. Each pump shall, however, be grouted before final bolting of the connecting piping. After final alignment and bolting, the pump connections shall be tested for applied piping stresses by loosening the flange bolts which, if the piping is properly installed, should result in no movement of the piping relative to the pump or opening of the pump connection joints. If any movement is observed, the piping shall be loosened and re-aligned as needed and then the flanges bolted back together. The flange bolts shall then be loosened and the process repeated until no movement is observed.

3-10. FLANGED COUPLING ADAPTERS. Flanged coupling adapters shall be installed in strict accordance with the coupling manufacturer’s recommendations. After the pipe is in place and bolted tight, the proper locations of holes for the anchor studs shall be determined and the pipe shall be field drilled. Holes for anchor studs shall be drilled completely through the pipe wall. Hole diameter shall be not more than 1/8 inch [3 mm] larger than the diameter of the stud projection. Unless indicated on the drawings, all flange coupling adapters shall be restrained.

The inner surfaces of couplings shall be prepared for coating in accordance with instructions of the coating manufacturer and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210. The remaining surfaces, except flange mating surfaces, shall be cleaned and shop primed with universal primer.

3-11. DISMANTLING JOINTS. Dismantling joints shall be provided for restrained coupling 14 inch and larger and where indicated on the drawings and as specified herein. Dismantling joints shall comply with AWWA C219 and shall be restrained flange by flange couplings manufactured as a single unit. Dismantling joints shall be installed in accordance with the manufacturer’s recommendations.

3-12. MECHANICAL COUPLINGS. Mechanical couplings shall be carefully installed in accordance with the manufacturer’s recommendations. A space of at least 1/4 inch [6 mm], but not more than 1 inch [25 mm], shall be left between the pipe ends. Pipe and coupling surfaces in contact with gaskets shall be clean and free from dirt and other foreign matter during assembly. All assembly bolts shall be uniformly tightened so that the coupling is free from leaks, and all parts of the coupling are square and symmetrical with the pipe. Following installation of the coupling, damaged areas of shop coatings on the pipe and coupling shall be repaired to the satisfaction of Engineer.

The interior surfaces of the middle rings shall be prepared for coating in accordance with instructions of the coating manufacturer and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210. The remaining components shall be cleaned and shop primed with universal primer.

3-13. GROOVED-END JOINTS. [Not used.]
3-14. POLYETHYLENE ENCASEMENT. All buried ductile iron pipe, including all straight pipe, bends, tees, adapters, closure pieces, and other fittings or specials, and all valves, shall be provided with at least one wrap of 12 mil polyethylene encasement. Locations where ductile iron pipe shall be double wrapped with polyethylene encasement are indicated on the drawings and/or as specified in the provisions for Corrosion Protection section.

Polyethylene tube protection shall be installed in accordance with ANSI/AWWA C105/A21.5, Method A. Preparation of the pipe shall include, but shall not be limited to, removal of lumps of clay, mud, cinders, etc., prior to installation.

Where ductile iron pipe is also embedded or encased in concrete, the polyethylene tube shall be installed over the pipe for 5 feet [1.5 m] either side of each end of the concrete encasement.

The terms "polyethylene tube protection" and "polyethylene encasement" are interchangeable and shall have the same meaning in these Contract Documents.

3-14.01. Inspection and Testing. Tests for preliminary acceptance of polyethylene encasement materials as required in the submittal paragraph shall be made at the expense of the Contractor.

The Owner may obtain samples from the material supplied in the field and have test conducted by an independent third-party laboratory, at the Owner's expense, of the requirements specified in ANSI/AWWA C105/A21.5.

3-15. OUTLETS. Where a 12 inch [300 mm] or smaller branch outlet is indicated and the diameter of the parent pipe is at least twice the diameter of the branch, a tee, a factory welded-on boss, or a tapping saddle will be acceptable.

Where a 4 inch [100 mm] or larger branch outlet is indicated on the drawings and the diameter of the branch pipe for a given diameter of parent pipe is less than equal to the maximum diameter listed herein, a factory welded-on outlet fabricated from centrifugally cast ductile iron pipe will be acceptable.

<table>
<thead>
<tr>
<th>Parent Pipe Diameter [mm]</th>
<th>Max Branch Pipe Dia [mm]</th>
<th>Parent Pipe Dia [mm]</th>
<th>Max Branch Pipe Dia [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 [200]</td>
<td>4 [100]</td>
<td>30 [750]</td>
<td>20 [500]</td>
</tr>
<tr>
<td>10 [250]</td>
<td>6 [150]</td>
<td>36 [900]</td>
<td>24 [600]</td>
</tr>
<tr>
<td>12 [300]</td>
<td>8 [200]</td>
<td>42 [1050]</td>
<td>30 [750]</td>
</tr>
<tr>
<td>16 [400]</td>
<td>10 [250]</td>
<td>54 [1350]</td>
<td>36 [900]</td>
</tr>
<tr>
<td>18 [450]</td>
<td>12 [300]</td>
<td>60 [1500]</td>
<td>36 [900]</td>
</tr>
</tbody>
</table>
### Parent Pipe Diameter Versus Maximum Branch Pipe Diameter for Welded-On Outlets

<table>
<thead>
<tr>
<th>Parent Pipe Dia</th>
<th>Max Branch Pipe Dia</th>
<th>Parent Pipe Dia</th>
<th>Max Branch Pipe Dia</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
</tr>
<tr>
<td>20 [500]</td>
<td>14 [350]</td>
<td>64 [1600]</td>
<td>36 [900]</td>
</tr>
<tr>
<td>24 [600]</td>
<td>16 [400]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All 30 inch [750 mm] and smaller branch pipe diameter welded-on outlets shall be rated for a working pressure of 350 psi [1,700 kPa], 36 inch [900 mm] branch diameter welded-on outlets shall be rated for a working pressure of 200 psi [5,000 kPa], and all outlets shall have a minimum factor of safety of 2.0. The pipe manufacturer shall provide test data and certification of proof of design. It is not necessary that these tests be performed on pipe manufactured specifically for this project. Certified reports covering tests made on other pipe of the same size and design as specified herein and manufactured from materials of equivalent type and quality may be accepted as adequate proof of design. Welded-on outlets may be provided as a radial (tee) outlet, a tangential outlet, or a lateral outlet fabricated at a specific angle to the parent pipe (in 15 degrees increments between 45 degrees and 90 degrees from the axis of the parent pipe), as indicated on the drawings. The fillet weld dimensions for welded-on outlets shall be as specified herein. Parent pipe and branch pipe shall meet hydrostatic test requirements in accordance with ANSI/AWWA C151/A21.51, Sec. 5.2, prior to fabrication.

### Welded-on Outlet Fillet Weld Dimensions for Specified Outlet Configurations

#### Radial and Lateral Outlets

<table>
<thead>
<tr>
<th>Parent Pipe Dia</th>
<th>Branch Pipe Dia</th>
<th>Weld Fillet Size</th>
<th>Parent Pipe Dia</th>
<th>Branch Pipe Dia</th>
<th>Weld Fillet Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
</tr>
<tr>
<td>24 [600] and smaller</td>
<td>24 [600] and smaller</td>
<td>1 x 1</td>
<td>8-30</td>
<td>24 [600] and smaller</td>
<td>1-1/4 x 1-1/4</td>
</tr>
<tr>
<td>30-48 [750-1200] and smaller</td>
<td>24 [600] and smaller</td>
<td>1-1/4 x 1-1/4</td>
<td>36-54</td>
<td>24 [600] and smaller</td>
<td>1-1/2 x 1-1/2</td>
</tr>
<tr>
<td>54-64 [1350-1600] and smaller</td>
<td>24 [600] and smaller</td>
<td>2-1/4 x 2-1/2</td>
<td>60-64</td>
<td>24 [600] and smaller</td>
<td>2-1/2 x 2-1/2</td>
</tr>
<tr>
<td>42-64 [1050-1600]</td>
<td>30 [750] and smaller</td>
<td>2-1/2 x 2-1/2</td>
<td>42-54</td>
<td>30 [750] and smaller</td>
<td>2-1/2 x 2-1/2</td>
</tr>
<tr>
<td>54-64 [1350-1600]</td>
<td>36 [900] and smaller</td>
<td>2-3/4 x 2-3/4</td>
<td>60-64</td>
<td>30 [750] and smaller</td>
<td>2-3/4 x 2-3/4</td>
</tr>
</tbody>
</table>

#### Tangential Outlets

<table>
<thead>
<tr>
<th>Parent Pipe Dia</th>
<th>Branch Pipe Dia</th>
<th>Weld Fillet Size</th>
<th>Parent Pipe Dia</th>
<th>Branch Pipe Dia</th>
<th>Weld Fillet Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
</tr>
<tr>
<td>24 [600] and smaller</td>
<td>24 [600] and smaller</td>
<td>1 x 1</td>
<td>8-30</td>
<td>24 [600] and smaller</td>
<td>1-1/4 x 1-1/4</td>
</tr>
<tr>
<td>30-48 [750-1200] and smaller</td>
<td>24 [600] and smaller</td>
<td>1-1/4 x 1-1/4</td>
<td>36-54</td>
<td>24 [600] and smaller</td>
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</tr>
<tr>
<td>54-64 [1350-1600] and smaller</td>
<td>24 [600] and smaller</td>
<td>2-1/4 x 2-1/2</td>
<td>60-64</td>
<td>24 [600] and smaller</td>
<td>2-1/2 x 2-1/2</td>
</tr>
<tr>
<td>42-64 [1050-1600]</td>
<td>30 [750] and smaller</td>
<td>2-1/2 x 2-1/2</td>
<td>42-54</td>
<td>30 [750] and smaller</td>
<td>2-1/2 x 2-1/2</td>
</tr>
<tr>
<td>54-64 [1350-1600]</td>
<td>36 [900] and smaller</td>
<td>2-3/4 x 2-3/4</td>
<td>60-64</td>
<td>30 [750] and smaller</td>
<td>2-3/4 x 2-3/4</td>
</tr>
</tbody>
</table>

All joints on welded-on branch outlets shall be made in accordance with the latest revision of ANSI/AWWA C111/A21.11 and/or ANSI/AWWA C115/A21.15, as applicable. All outlets shall be fabricated from centrifugally cast ductile iron pipe designed in accordance with PROJECT # 1152-17-PHASE IIB 02625-13 DUCTILE IRON PIPE
ANSI/AWWA C150/A21.50 and manufactured and tested in accordance with ANSI/AWWA C151/A21.51. Ni-Rod FC 55® electrodes manufactured by International Nickel Corporation (or an electrode with equivalent properties) shall be used in the manufacture of the fillet welds. Carbon steel electrodes will not be acceptable. Special Thickness Class 53 pipe shall be used for all branch pipe and parent pipe in 4 to 54 inch [100 to 1350 mm] sizes. Pressure Class 350 pipe shall be used for 60 inch and 64 inch [1,500 and 1,600 mm] parent pipe. After welding, each fabricated outlet shall be subjected to a 15 psi [100 kPa] air test. A soap and water solution shall be applied during the testing procedure to inspect the weld for leakage. Any welds that show air seepage shall be refabricated and retested.

Welded-on outlets shall be fabricated by the pipe manufacturer at its production facilities. Manufacturers of welded-on outlets shall have at least 5 years of satisfactory experience in the manufacture and performance of these products. The manufacturer shall have a documented welding quality assurance system and shall maintain resident quality assurance records based on ANSI/AWS D11.2, the Guide for Welding Iron Castings. The manufacturer shall also maintain appropriate welding procedure specifications (WPS) and procedure qualification (PQR), and welder performance qualification test (WPQR) records.

The type of pipe end for the branch outlet shall be as specified or indicated on the drawings. The maximum size and laying length of the welded-on branch outlet shall be as recommended by the pipe manufacturer and shall be acceptable to Engineer for the field conditions and the connecting pipe or valve. Pipe embedment material and trench backfill shall be placed and compacted under and around each side of the outlet to hold the pipe in proper position and alignment during the subsequent pipe jointing, embedment, and backfilling.

At locations acceptable to Engineer, drilling and tapping of the pipe wall for 2 inch [50 mm] and smaller pipe connections will also be acceptable, provided that the wall thickness, minus the casting allowance, at the point of connection equals or exceeds the wall thickness required for 4-thread engagement in accordance with Table A.1, Appendix A of ANSI/AWWA C151/A21.51.

3-16. WALL PIPES OR CASTINGS. Wall pipes or castings shall be provided where ductile iron pipes pass through concrete walls, unless otherwise indicated on the drawings.

Where a flange and mechanical joint piece is to connect to a mechanical joint wall pipe or casting, the bolt holes in the bell of the wall pipe or casting shall straddle the top (or the side for vertical piping) centerline of the pipe or casting and shall align with the bolt holes in the flange and mechanical joint piece. The top centerline shall be marked on the wall pipe or casting at the foundry.

3-17. REDUCERS. Reducers shall be eccentric or concentric as indicated on the drawings. Reducers of eccentric pattern shall be installed with the straight side on top, so that no air traps are formed.

3-18. CONNECTIONS WITH EXISTING PIPING. As shown in the Drawings.

3-19. INSULATED FLANGED JOINTS. Insulated flanged joints shall be installed where indicated on the drawings. In addition to one full-faced insulated gasket, each flange insulating assembly shall consist of one full-length sleeve, two insulating washers, and two backing
washers for each flange bolt. The insulating gasket ID shall be 1/8 inch [3 mm] less than the ID of the flange in which it is installed. The insulated flanged joint accessories shall be installed in accordance with the instructions and recommendations of the manufacturer.

3-20. CONCRETE ENCASEMENT. Concrete encasement shall be installed where indicated on the drawings. A pipe joint shall be provided within 12 inches [300 mm] of each end of the concrete encasement. Concrete and reinforcing steel shall be as specified in the Cast-in-Place Concrete section. All pipe to be encased shall be suitably supported and blocked in proper position, and shall be anchored to prevent flotation.

3-21. REACTION ANCHORAGE AND BLOCKING. As shown in the Drawings.

3-22. PRESSURE AND LEAKAGE TESTS. Pipe and fittings shall be subjected to a pressure test and a leakage test in accordance with the Pipeline Pressure and Leakage Testing section.

The Contractor shall provide all necessary pumping equipment; piping connections between the piping and the nearest available source of test water; pressure gauges; and other equipment, materials, and facilities necessary for the tests.

All pipe, fittings, valves, pipe joints, and other materials which are found to be defective shall be removed and replaced with new and acceptable materials, and the affected portion of the piping shall be retested by and at the expense of Contractor.

All joints shall be watertight and free from visible leaks. Any visible leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

3-23. CLEANING AND DISINFECTION. After installation, all potable water piping shall be cleaned and disinfected as specified in the Cleaning and Disinfection of Water Distribution System section.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installation of 4 through 30 inch buried polyvinyl chloride (PVC) pressure pipe. PVC pressure pipe shall be furnished complete with all fittings, jointing materials, anchors, blocking, encasement, and other necessary appurtenances.

Pressure and leakage tests, cleaning, and disinfection, are covered in other sections. Pipe trenching, bedding, and backfill are covered in the Trenching and Backfilling section.

Pipe shall be furnished where indicated in the pipeline schedule or where indicated on the drawings.

1-2. GOVERNING STANDARDS. Except as modified or supplemented herein, all PVC pressure pipe shall conform to the applicable requirements of ANSI/AWWA C900.

The supplementary information required in the governing standards is as follows:
   Affidavit of Compliance Required.
   Plant Inspection Not required.
   Special Markings Not required.
   Special Preparation for Shipment Not required.
   Certification Required.

1-3. SUBMITTALS. Drawings and data shall be submitted in accordance with the Submittals section. Drawings and data shall include, but shall not be limited to, the following:
   Gasket material.
   Pipe length.
   Affidavit of Compliance (ANSI/AWWA C900, Sec. 6.3).
   Certification (ANSI/AWWA C900, Sec. 4.2.3).

1-4. DELIVERY, STORAGE AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

Pipe, fittings, and accessories shall be handled in accordance with Chapter 6 of AWWA Manual M23, to ensure installation in sound, undamaged condition. Pipe shall not be stored uncovered in direct sunlight.

PART 2 - PRODUCTS

PROJECT # 1152-17-PHASE IIB 02630-1 PVC PRESSURE PIPE
2-1. **DIMENSIONS.** The dimension ratios (DRs: outside diameter to wall thickness) of PVC pressure pipe shall be as indicated in the Drawings.

2-2. **MATERIALS.**

<table>
<thead>
<tr>
<th>Component</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe</td>
<td>ANSI/AWWA C900; ductile iron pipe OD, dimension ratio as specified herein.</td>
</tr>
<tr>
<td>Fittings</td>
<td>Ductile iron; ANSI/AWWA C110/A21.10, 350 psi pressure rating, except shorter laying lengths will be acceptable. Compact DI fittings, per AWWA C153 also acceptable.</td>
</tr>
<tr>
<td>Joints</td>
<td>PVC to PVC ANSI/AWWA C900, stab type, with elastomeric synthetic rubber gaskets. Gaskets of natural rubber will not be acceptable. For Potable Water service, gaskets shall be EDPM for chloramine resistance.</td>
</tr>
<tr>
<td></td>
<td>PVC to Ductile Iron ANSI/AWWA C111/A21.11, except gaskets shall be synthetic rubber. Natural rubber will not be acceptable. For Potable Water service, gaskets shall be EDPM for chloramine resistance.</td>
</tr>
<tr>
<td></td>
<td>Tapping Saddles Ductile iron, with galvanized steel straps and synthetic rubber sealing gasket, 350 psi pressure rating.</td>
</tr>
<tr>
<td></td>
<td>Restrained Joints ASTM F1674, EBAA Iron 2000 series (4 inch through 20 inch), Star Grip 4000, or concrete thrust blocking.</td>
</tr>
<tr>
<td></td>
<td>Tapping Sleeves Ductile iron, 350 psi pressure rating.</td>
</tr>
<tr>
<td></td>
<td>Polyethylene Encasement Tube or sheet, ANSI/AWWA C105/A21.5.</td>
</tr>
<tr>
<td></td>
<td>Joint Tape Self-sticking, PVC or polyethylene, 10 mils thick; Chase &quot;Chasekote 750&quot;, Kendall &quot;Polyken 900&quot;, or 3M &quot;Scotchrap 50&quot;.</td>
</tr>
<tr>
<td></td>
<td>Coal Tar Epoxy High-build coal tar epoxy; Ameron &quot;Amercoat 78HB Coal Tar Epoxy&quot;, Carboline &quot;Bitumastic 300 M&quot;, Tnemec</td>
</tr>
</tbody>
</table>
"46H-413 Hi-Build Tneme-Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy".

Conductive Tracer Detection tape, 3 inches wide; aluminum foil core, 0.5 mil thick, encased in a protective inert plastic jacket; 5,000 psi min tensile strength; 2.5 lbs per inch per 1,000 feet min mass; color coded in accordance with APWA Uniform Color Code; Allen Systems "Detectatape", Lineguard "Type III", or Reef Industries "Terra Tape D".

All materials for potable water piping must be “lead free”, with no lead content no more than 0.25% in the wetted surface material. Manufacturing quality control shall be maintained by frequent, regularly scheduled sampling and testing. Testing shall comply with the governing standards.

2-3. SHOP COATING AND LINING. The exterior surfaces of cast iron fittings shall be coated with a bituminous coating. The interior surfaces of cast iron fittings shall be lined with cement mortar.

PART 3 - EXECUTION

3-1. INSPECTION. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation; spigot ends and bells shall be examined with particular care. All defective pipe and fittings shall be removed from the site of the work.

3-2. LAYING PIPE. Pipe shall be protected from lateral displacement by pipe embedment material installed as specified in the Trenching and Backfilling section. Pipe shall not be laid in water or other unsuitable conditions.

Pipe shall be laid with bell ends facing the direction of laying, except when reverse laying is specifically permitted by Engineer.

Foreign matter shall be prevented from entering the pipe during installation.

Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug. All water shall be removed from the trench prior to removing the plug.

A conductive tracer shall be buried above PVC pressure pipe, not more than 18 inches below the ground surface.

3-2.01. Cleaning. The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted.
3-2.02. **Alignment.** Piping shall be laid to the lines and grades indicated on the drawings. Pipelines or runs intended to be straight shall be laid straight.

Deflections from a straight line or grade shall not exceed the maximum deflections specified by the manufacturer.

Unless otherwise specified or indicated on the drawings, and subject to acceptance by Engineer, either shorter pipe sections or fittings shall be installed as required to maintain the indicated alignment or grade.

3-3. **CUTTING PIPE.** Cutting shall comply with the pipe manufacturer's recommendations and with Chapter 7 of AWWA Manual M23. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed to remove all roughness and sharp corners and shall be beveled in accordance with the manufacturer's instructions.

3-4. **JOINTS.** Joints shall be stab-type unless otherwise indicated on the drawings.

3-4.01. **Stab Type Joints.** Jointing shall conform to the instructions and recommendations of the pipe manufacturer. All surfaces for gasketed joints shall be lubricated immediately before the joint is completed. Gaskets and lubricants shall be supplied by the pipe manufacturer, shall be suitable for use in potable water, shall be compatible with the pipe materials, shall be stored in closed containers, and shall be kept clean. For PVC in Potable Water service applications, all gaskets shall be EPDM for chloramine resistance. Each spigot shall be suitably beveled to facilitate assembly.

3-4.02. **Mechanical Joints.** Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Over-tightening of bolts to compensate for poor installation practice will not be permitted.

3-5. **POLYETHYLENE ENCASEMENT.** All below-grade ductile iron fittings, tapping saddles, tapping sleeves, valves, or other ductile iron accessories shall be provided with 12-mil polyethylene tube or sheet protection installed in accordance with ANSI/AWWA C105/A21.5, Method A or C.

3-6. **CONNECTIONS WITH EXISTING PIPING.** Connections with existing pipes shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by Owner.

Facilities shall be provided for proper dewatering and for disposal of water removed from the dewatered lines and excavations without damage to adjacent property.

Special care shall be taken to prevent contamination of potable water lines when dewatering, cutting into, and making connections with existing pipe. No trench water, mud, or other contaminating substances shall be permitted to enter the lines. The interior of all pipe, fittings,
and valves installed in such connections shall be thoroughly cleaned and then swabbed with, or
dipped in, a 200 mg/L chlorine solution.

3-7. SERVICE CONNECTIONS. Tapping saddles or tapping sleeves shall be used for all
service connections 2 inches and smaller. Direct tapping of PVC pipe will not be permitted.
Fittings shall be used for service connections larger than 2 inches.

3-8. CONCRETE ENCASEMENT. Concrete encasement shall be installed as indicated on the
drawings. Concrete and reinforcing steel shall be as specified in the Cast-in-Place Concrete
section. All pipe to be encased shall be suitably supported and blocked in proper position and
shall be anchored against flotation.

3-9. RESTRAINED JOINTS. All bell-and-spigot or all-bell tees, Y-branches, bends deflecting
11-1/4 degrees or more, valves, and plugs which are installed in piping subjected to internal
hydrostatic heads in excess of 30 feet shall be provided with suitable restraint.

Concrete blocking shall extend from the fitting to solid, undisturbed earth and shall be installed
so that all joints are accessible for repair.

Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable
ground shall be provided as indicated by the drawings or as directed by Engineer.

All steel clamps, rods, bolts, and other metal accessories used in tapping saddles or reaction
anchorages subject to submergence or in contact with earth or other fill material, and not encased
in concrete, shall be protected from corrosion by two coats of medium consistency coal tar
applied to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat
is applied.

3-10. PRESSURE AND LEAKAGE TESTS. After installation, PVC pressure piping shall be
hydrostatically tested for defective workmanship and materials as specified in the Pipeline
Pressure and Leakage Testing section.

3-11. LEAKAGE. All PVC piping shall be watertight and free from leaks. Leakage testing per
the Pipeline Pressure and Leakage Testing specification.

3-12. CLEANING AND DISINFECTION. After installation, all PVC pressure piping shall be
cleaned as specified in the Cleaning and Disinfection of Water Distribution System section.
PVC potable water piping shall be disinfected as specified in the Cleaning and Disinfection of
Water Distribution System section.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers cleaning and disinfection of all potable water lines installed under this contract.

1-2. GENERAL.

1-2.01. Coordination. Contractor shall coordinate flushing and disinfection work with adjacent work as necessary to preclude work interferences or duplication of effort and to expedite the overall progress of the work.

Contractor shall provide all necessary piping, piping connections, temporary valves, backflow preventers, flowmeters, sampling taps, pumps, disinfectant, neutralization agents, chlorine residual test apparatus, and all other items of equipment or facilities necessary to complete the disinfection work.

Water for flushing and disinfection work will be provided as stipulated in the Temporary Facilities section.

In all cases where it is necessary to interrupt service, permission of Owner shall be obtained at least two weeks before the service will be interrupted.

Unless otherwise specified, final cleaning work shall not be performed until after hydrostatic testing of the lines and any resulting repair work completed.

Contractor shall notify Owner and Engineer prior to the work to allow their representatives to be present during cleaning and/or disinfection of the water lines.

1-2.02. Related Work. Other sections directly related to Work covered in this section are 02621 – Stainless Steel Pipe, 02625 Ductile Iron Pipe, and 02630 – Polyvinyl Chloride (PVC) Pressure Pipe.

1-2.03. Governing Standard. All disinfection work shall conform to the requirements of ANSI/AWWA C651, and the requirements of the Florida Department of Environmental Protection, except as modified herein. If any state or local requirements conflict with the provisions of this section, the state and local requirements shall govern.
1-3. SUBMITTALS.

1-3.01. Disinfection Plan. Prior to starting any disinfection work, Contractor shall submit to Engineer a detailed disinfection plan. The plan shall cover the method and procedure proposed, necessary coordination, qualification of personnel performing the disinfection, sequence of operations, equipment to be used, manner of filling and flushing the lines, chlorine injection points, sample points, testing schedule, potable water source, neutralization, and disposal of wasted water. Personnel performing the disinfection shall demonstrate a minimum of 5 years’ experience in the chlorination and dechlorination of similar pipelines.

3.02. Testing. Bacteriological testing shall be performed by Owner.

The chlorine residual test shall be performed by Contractor. The test log shall be made available to Owner or Engineer upon request and shall be provided to Engineer upon completion of all chlorine residual testing.

1-4. QUALITY ASSURANCE.

1-4.01. Chlorine Residual Tests. Contractor shall provide the necessary apparatus for making the chlorine residual tests by the drop dilution method as set forth in Appendix A of ANSI/AWWA C651. Test results shall be recorded in a logbook that includes for each test: the location, date, time, test results, and test kit manufacturer.

1-4.02. Bacteriological Tests. Sampling and testing of water in the lines shall be performed after final flushing in accordance with Section 5 of ANSI/AWWA C651. Samples shall be taken in suitable sterilized containers on two consecutive days (24 hours apart) and forwarded to a State certified testing lab for bacterial examination for the presence of total coliform.

1-4.03. Re-disinfection. Should the bacteriological tests indicate the presence of coliform organisms at any sampling point, the lines shall be re-flushed, resampled and retested. If check samples show the presence of coliform organisms, then the lines shall be re-chlorinated until acceptable results are obtained for two consecutive days.

PART 2 - PRODUCTS

2-1. MATERIALS. All materials furnished by Contractor shall conform to the requirements of ANSI/AWWA C651 and shall be clean and free of debris which could infer questionable test results.

2-1.01. Liquid Chlorine. Liquid chlorine shall conform to AWWA B301.
2-1.02. Calcium Hypochlorite (Dry). Calcium hypochlorite shall conform to AWWA B300.

2-1.03. Sodium Hypochlorite (Solution). Sodium hypochlorite shall conform to AWWA B300.

2-1.04. Chlorine Residual Test Kit. Chlorine, residual concentration shall be measured using an appropriate range, drop count, titration kit or an orthotolidine indicator comparator with wide range color discs. The color disc range shall be selected to match chlorine concentration limits. Test kits shall be maintained in good working order and available for immediate test of residuals at point of sampling. Test kits manufactured by Hach Chemical or Hellige are acceptable.

PART 3 - EXECUTION

3-1. APPLICATION.

3-1.01. Disinfection Procedure. The new lines shall be disinfected by the tablet method, continuous feed method, or slug method. Potable water shall be used in conjunction with the chlorination agent. Construction meter and RPZ are required for water supply.

For the continuous feed or slug method, the chlorination agent shall be injected into the line at the supply end of each new line or valved section thereof.

Admission of disinfectant solution into or the flushing thereof through existing mains shall be held to the minimum possible, and then only after adequate measures have been taken to prevent any such solution of wastewater from entering branch service connections to water customers.

During disinfection, all valves and hydrants shall be operated to ensure that all appurtenances are disinfected. Valves shall be operated such that the chlorine solution in the line being chlorinated will not flow back into the supply line. Check valves shall be used if needed.

Existing mains which may become contaminated during work requiring connections to the new water line, involving either tapping or cutting into operations, shall be flushed and disinfected in accordance with Section 4 of ANSI/AWWA C651.

3-1.02. Final Flushing. Upon completion of chlorination, but before sampling and bacteriological testing, all heavily chlorinated water shall be removed from the lines by flushing with potable water until the chlorine residual in the lines is not higher than that generally prevailing in the adjacent existing system.

Small pipelines shall be flushed with water at the maximum velocity which can be developed, but not less than 2.5 feet per second [0.76 m/s], unless otherwise permitted by
Engineer. Flushing shall be accomplished through the installed valves or fittings, or through corporation cocks in accordance with the details indicated on the drawings.

Pipelines may be flushed as specified, cleaned with a hose, or by other methods acceptable to Engineer.

Booster pumps shall be used if needed to obtain the necessary volume or velocity of water. Pumping equipment installed under this contract shall not be used for flushing, nor shall the flushing water be passed through them; temporary bypass piping at each pump shall be provided as needed.

3-1.03. **Cleaning.** The potable water mains installed under this contract, including all associated valves and fittings, shall be flushed or cleaned to the satisfaction of Owner and Engineer.

All new piping shall be cleaned by flushing with water at the maximum velocity which can be developed until the piping is free of dirt, debris, and other foreign materials. Cleaning shall precede disinfection. Flushing shall be accomplished through the installed valves or fittings, or through corporation cocks furnished and installed for that purpose.

In addition, Contractor shall pig the newly installed pipeline before it is placed into service. Contractor shall supply all pigging launch and retrieval stations as necessary to pig the entire length of the line. All pigging launch and retrieval stations shall be removed before placing the line in service. At a minimum, a Bare Type, B3 style pig shall be used as manufactured by Pipeline Pigging Products, Inc. or approved equal.

3-1.04. **Disposal of Chlorinated Wastewater.** All chlorinated wastewater to be discharged shall be neutralized by chemical treatment and disposed in accordance with the requirements of the applicable governing agency. Schedule and coordinate rates of flow and locations of discharge of disinfection and flushing water with Engineer and cognizant state and local regulatory agencies to ensure compliance with all applicable rules and regulations.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers field hydrostatic pressure and leakage testing of piping. The term "piping" shall be used in this section to refer to piping systems, pipelines, or sections thereof.

1-2. GENERAL. Unless otherwise specified, testing of piping shall be completed prior to final cleaning and disinfection.

Contractor shall notify federal, state, and local regulatory agencies to determine if any special procedures or permits are required for disposal of water used for pressure and leakage testing and to identify acceptable locations for disposal of the water. All requirements and costs associated with notifications and obtaining any discharge permit or approvals shall be the responsibility of Contractor.

Engineer or Engineer's representative shall be present during testing and shall be notified of the time and place of testing at least 3 days prior to commencement of the work. All work shall be performed to the satisfaction of Engineer.

1-2.01. Testing Schedule and Procedure. A testing schedule and test procedure shall be submitted to Engineer for review and acceptance not less than 21 days prior to commencement of testing. The schedule shall indicate the proposed time and sequence of testing of the piping. The testing procedure shall establish the limits of the piping to be tested, the positions of all valves during testing, the locations of temporary bulkheads, and all procedures to be followed in performing the testing.

1-2.02. Special Testing Requirements. Special testing requirements include the following:

Unless otherwise acceptable to Engineer, the general sequence of work for each pipeline, or valved or bulkheaded section thereof, shall be as follows:

- Initial flushing and cleaning of pipeline. Filling pipeline.
- Hydrostatic pressure and leakage testing.
- Disinfection.
- Final cleaning, flushing, and neutralization of heavily chlorinated water.
- Bacteriological tests.
Unless otherwise acceptable, during testing of the pipeline, all valves, except for the auxiliary hydrant valve, shall be in the open position.

Unless otherwise acceptable, temporary bulkheads shall be provided during testing so that the test pressures are not applied to existing or new valves and hydrants, or to existing water lines, or to any portion of water lines installed under this Contract that have already been put into service.

A temporary pressure gauge shall be installed at each end of the limits of the pipeline to be tested.

The tests shall be conducted before connections are made to existing water lines, or to any portion of water lines installed under this Contract that have already been put into service.

Unless otherwise acceptable, upon completion of testing and disinfection, connections made to existing water lines or to any portion that has been put into service of new water lines installed under this Contract, shall be visually inspected for leakage after placing the water line into service and before backfilling the connection.

1-2.03. Water. Water for testing shall be furnished as stipulated in the Temporary Facilities section. Following completion of testing, the water shall be disposed of in a manner acceptable to Engineer. Unless otherwise permitted, the water shall be kept out of the remainder of the piping.

PART 2 - PRODUCTS

2-1. TEST EQUIPMENT. All necessary connections between the piping to be tested and the water source, together with pumping equipment, water meter, pressure gauges, and all other equipment, materials, and facilities required to perform the specified tests, shall be provided. All required flanges, valves, bulkheads, bracing, blocking, and other sectionalizing devices shall also be provided. All temporary sectionalizing devices shall be removed upon completion of testing. Vents shall be provided in test bulkheads where necessary to expel air from the piping to be tested.

Test pressures shall be applied by means of a force pump sized to produce and maintain the required pressure without interruption during the test.

Water meters and pressure gauges shall be accurately calibrated and shall be subject to review and acceptance by Engineer. Permanent gauge connections shall be installed at each location where test gauges are connected to the piping during the required tests. Drilling and tapping of pipe walls will not be permitted. Upon completion of testing, each gauge connection shall be fitted with a removable plug or cap acceptable to Engineer.
The Contractor shall utilize an approved reduced pressure zone backflow preventer, and meter all water taken from Florida Keys Aqueduct Authority for flushing, pigging, testing, and disinfection of mains. Meters must be obtained from Florida Keys Aqueduct Authority. All water metered during construction, will be billed for construction.

PART 3 - EXECUTION

3-1. Filling and Venting. Before filling the piping with water, care shall be taken to ensure that all air release valves and other venting devices are properly installed and in the open position. Hand-operated vent valves shall not be closed until an uninterrupted stream of water is flowing from each valve. The rate of filling the piping with water must not exceed the venting capacity of the installed air vent valves and devices.

3-2. Blocking and Backfilling. Piping shall be adequately blocked, anchored, and supported before the test pressure is applied.

3-3. PRESSURE TESTING. After the piping to be tested has been filled with water, the test pressure shall be applied and maintained without interruption within plus or minus 5 psi of test pressure for 2 hours plus any additional time required for Engineer to examine all piping being tested and for Contractor to locate any defective joints and pipe materials. The test pressure for this high pressure transmission main shall be 300 psi.

3-3.01. Pipeline Test Pressure. A test pressure of 300 psi shall be maintained for all high pressure transmission main piping, fittings, and appurtenances. A test pressure of 150 psi shall be maintained for all potable water distribution system piping, fittings, and appurtenances.


3-5. PIPELINE LEAKAGE TESTING. Following completion of pressure testing and acceptance by Engineer, the pipeline piping shall be subjected to a leakage test. The duration of the leakage test shall be 2 hours plus the additional time required for Engineer to make an accurate determination of leakage.

3-5.01. Leakage Test Pressure. The hydrostatic pressure maintained during the leakage test shall be at least 75 percent, but not more than 100 percent, of the pressure specified for pressure testing of the piping and shall be maintained within plus or minus 5 psi [35 kPa] during the entire time that leakage measurements are being performed.

3-5.02. Leakage Measurement. Measurement of leakage shall not be attempted until all trapped air has been vented and a constant test pressure has been established. After the
pressure has stabilized, piping leakage shall be measured with a suitable water meter installed in the pressure piping on the discharge side of the force pump.

3-5.03. Allowable Leakage. The term "leakage", as used herein, refers to the total amount of water which must be introduced into the piping during the leakage test to maintain the test pressure.

No piping will be accepted if and while it exhibits a leakage rate in excess of that determined by the indicated formulas:

\[ Q = 0.0075 \, DLN \] (using inch-pound units)

Where

- \( Q \) = allowable leakage in gallons per hour
- \( D \) = nominal diameter of pipe in inches
- \( L \) = length of section tested in thousand feet
- \( N \) = square root of average test pressure in pounds per square inch

\[ Q = 1.4 \times 10^{-6} \, DLN \] (using SI units)

Where

- \( Q \) = allowable leakage in liters per hour
- \( D \) = nominal diameter of pipe in millimeters
- \( L \) = length of section tested in meters
- \( N \) = square root of average test pressure in kilopascals

Whenever the piping to be tested contains pipe of different diameters, the allowable leakage shall be calculated separately for each diameter and the corresponding length of piping. The resulting allowable leakage rates shall be added to obtain the total allowable leakage for the entire piping.

All joints in piping shall be watertight and free from visible leaks during the leakage test. Each leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor regardless of the amount that the total leakage may have been below the specified allowable leakage rate during the leakage test.

If the leakage test indicates a higher than allowable leakage rate, Contractor shall locate and repair leaking joints and other defective work to the extent necessary to reduce the leakage to an acceptable value.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers seeding and sodding to be performed after backfilling and final grading are complete. All areas disturbed by construction operations shall be treated as specified herein.

All lawn, ditch, and street shoulder areas within street right-of-way and temporary construction easements that are damaged during the Work shall be restored, after completion of construction, to the complete satisfaction of Owner. All areas disturbed by Contractor outside the temporary construction easements shall be restored, at Contractor's expense, to the satisfaction of the property owner, except that if the temporary construction easement through the ownership is sodded all disturbed areas outside the construction easement shall also be sodded. Occupying areas outside temporary construction easements, street right-of-way, and utility easements for any purpose shall be done only with the written approval of the property owner.

1-2. GENERAL.

1-2.01. Governing Standard. The governing standard for the seeding and sodding Work shall be the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest version.

1-2.02. Experience. All Work shall be performed by a licensed seeding, sodding Contractor who is experienced in the type of Work required.

1-2.03. Completion. Sodding requirements are as follows:

Locations to be sodded. All disturbed areas.

1-3. SUBMITTALS.

1-3.01. Soil Test. A soil test for pH made of a composite sample of topsoil after finish grading shall be submitted to Engineer. Testing shall be performed through the State Extension Service or an independent agricultural soil testing lab. Samples shall be taken and submitted in accordance with instructions from the extension service or lab. Recommendations accompanying the test shall be used for application rates of lime.

1-3.02. Invoices and Analysis Labels. A copy of supplier’s invoices for all seed, mulch, and fertilizer which shows the quantity by weight purchased for the project and representative labels bearing the manufacturer’s or vendor’s guaranteed statement of
analysis shall be submitted to Engineer for review and approval to assure compliance with specified requirements for quality and application rates.

1-4. GUARANTEE.

1-4.01. Seeding. Not used.

1-4.02. Sodding. Contractor shall guarantee the sodding Work to the extent that all transplanted sod shall be uniform in color, leaf texture, shoot density, and reasonably free of visible imperfections at acceptance.

1-5. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

Prior to use, all products shall be kept dry and in a weatherproof location so that their effectiveness will not be impaired.

PART 2 - PRODUCTS

2-1. MATERIALS. All materials shall conform to the requirements of the Governing Standard, except where otherwise specified. The source of materials shall be submitted to Engineer for review.

2-1.01. Starter Fertilizer. In accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest version.

2-1.02. Seed. Not used.

2-1.03. Sod. Sod shall have been planted on cultivated agricultural land and grown specifically for sod purposes and shall conform to the quality standards of Nursery Grown Sod as defined by the American Sod Producers Association. Sod shall be free of objectionable grassy and broad leaf weeds. Sod shall be considered free of such weeds if less than five such plants are found per 100 square feet [9.2 m²] of area. The sod species shall be in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest version.

2-1.04. Lime. Material used for soil neutralization shall be commercial ground agricultural limestone, with no less than 90 percent passing the No. 8 [2.36 mm] sieve and containing no less than 65 percent calcium carbonate equivalent.
PART 3 - EXECUTION

3-1. GENERAL. Execution of seeding and sodding Work shall conform to the Governing Standard, or shall be as specified herein, whichever is the most stringent.

3-2. SEEDING. Not used.

3-3. HYDROSEEDING. Not used.

3-4. SODDING. Sodding shall be in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest version.

3-4.01. Preparation. The Work specified herein shall not be started until substantially all earth work has been completed. Backfills and fills shall be allowed to settle and the topsoil spread and finish grading completed before the Work is started.

3-4.02. Application of Fertilizer and Lime. Any fertilizer and lime specified shall be applied prior to the tilling operation. The fertilizer shall be distributed uniformly over the entire area to be sodded in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest version. Lime shall be applied at a rate based on a soil test for pH. The rate shall be adequate to neutralize the acidity of the soil.

3-4.03. Preparation of Sod Bed. After fertilizer and lime have been applied, the areas to be sodded shall be tilled to a true depth of 6 inches [150 mm] by diskig, harrowing, or other accepted methods to thoroughly incorporate the lime and fertilizer, destroy vegetation, and pulverize the soil. After tilling, the bed shall be smoothed by dragging or floating. The surface shall be cleared of all stones, stumps or other objects larger than 1-1/2 inches [38 mm] in thickness or diameter; roots, wire, grade stakes, and other objects that might be a hindrance to maintenance operations. Paved areas over which hauling operations are conducted shall be kept clean and dirt that may be brought upon the surface shall be removed.

When results are not satisfactory because of drought, excessive moisture or other causes, the Work shall be stopped until such conditions have improved or have been corrected.

All operations shall be done in a direction parallel to the contour lines and not uphill and downhill.

3-4.04. Application of Sod. Sod shall be placed after preparation of the sodbed. Sod shall be cut in strips or rectangular sections which may vary in length but shall be of equal width and of size that will permit the sections to be lifted and rolled without breaking. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. When the soil is too dry, the sod shall be cut only after Contractor has watered the sod sufficiently to moisten the soil to the depth at which the
sod is to be cut.

Care shall be exercised at all times to retain the native soil on the roots of the sod during the process of stripping, transporting, and planting. Dumping from vehicles will not be permitted.

The sod shall be transplanted within 24 hours from the time of stripping, unless stored in a satisfactory manner. During delivery and while in stacks, the sod shall be kept moist and shall be protected from exposure to the air and sun.

Sod shall be laid smoothly, edge-to-edge, and with staggered joints. The sod shall be immediately pressed firmly into contact with the sod bed by tamping or rolling with acceptable equipment so as to eliminate all air pockets, provide a true and even surface, and assure knitting.

Staking is not required, except in ditch flow lines; however, Contractor will be responsible for replacing all sod that is displaced by erosion during the maintenance period. Only wooden (lath) stakes shall be used.

3-5. WATERING.

3-5.01. Seeded Areas. Not used.

3-5.02. Sodded Areas. Contractor shall provide all water, labor, and equipment for watering sodded areas. Sodded areas representing one day’s planting shall be watered sufficiently to wet the sod pads and at least 2 inches [50 mm] of the sod bed. Thereafter, in the absence of adequate rainfall, watering shall be performed daily and as often as necessary to keep the sod pads moist at all times. Watering of sod shall continue as needed until final acceptance.

3-6. REPLANTING.

3-6.01. Seeded Areas. Not used.

3-6.02. Sodded Areas. Prior to acceptance, sodded areas that show signs of substantial desiccation as evident by a loss of color and a distinct yellowing shall be resodded and shall continue to be resodded until an acceptable sod cover is obtained. Replanting operations shall be as specified except that fertilizer and lime shall be deleted from the operation.

3-7. MAINTENANCE. All areas shall be maintained until final acceptance of the project.

3-7.01. Seeded Areas. Not used.

3-7.02. Sodded Areas. Original grades of the sodded areas shall be maintained after commencement of planting operations and until acceptance. Any damage to the
finished surface shall be repaired. In the event erosion occurs from either watering operations or rainfall, such damage shall be repaired. Ruts, ridges, tracks, and other surface irregularities shall be corrected and areas resodded.

During the maintenance period prior to acceptance, all sodded areas shall be mowed to height of 3 inches [75 mm] as soon as, and each time that, the grass reaches an average height of 5 inches [125 mm]. Clippings shall be collected and removed from the site.

End of Section
1-1. SCOPE. This section covers procurement of all cast-in-place concrete, including concrete materials, limiting requirements, mixture design, and performance requirements, and delivery to the site through discharge at the end of the delivery truck chute. Work beyond the end of the delivery truck chute is covered in Sections 03100, 03200, 03250, and 03350.

Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

1-2. GENERAL. All cast-in-place concrete shall conform to the limiting requirements of this specification including Tables 1A, 1B, 2A and 2B.

1-2.01. Concrete Classifications. Concrete classifications shall be defined and used as indicated for the following classes:

Class Description

A. Structural Concrete

A1. Concrete for Liquid Containing Structures. Concrete for liquid containing environmental structures, liquid containing tanks, and interior suspended slabs in high humidity areas, headwalls, and all other concrete not otherwise indicated.

A2. Small Aggregate Concrete; Congested Areas. Not Used.

A3. Concrete for Non-Liquid Containing Structures. Concrete for footings, foundations, manholes, catch basins, pan-formed joists, and all other structural concrete other than for liquid containing structures.

A4. Mortar Puddle. Placed in a lift 2 inches or more deep at the bottom of forms for walls and columns immediately before structural concrete is placed.

A5. Drilled Pier Concrete. Not Used.
B. **Exterior Flatwork Concrete.** Concrete for exterior slabs on grade, plant pavement, sidewalks, curbs and gutters, and small equipment pads.

C. **Architectural Concrete.** All non-liquid containing concrete that will be visible to the public on the Operations Building, as indicated on the architectural drawings

D. **Miscellaneous Concrete**

D1. **Ductbanks, Pipe Blocking, Concrete Fill, and Pipe Encasement Concrete.** Concrete used in ductbanks, pipe blocking, concrete fill and pipe encasements.

D2. **Underwater Concrete.** Not Used. Unless otherwise permitted by Engineer, concrete shall not be deposited under water.

D3. **Massive Concrete.** Not Used.

D4. **Pan Stairs Concrete.** Not Used.

D5. **Wash Water Trough Concrete.** Not Used.

D6. **Composite Topping Concrete.** Not Used.

D7. **Lean Concrete.** Used as a fill material for over-excavations.

1-3. **SUBMITTALS.**

1-3.01. **Drawings and Data.** All submittals of drawings; manufacturers' certificates of compliance, recommendations, and test data; reports; catalog data sheets; and other data shall be in accordance with the submittals section, unless otherwise specified herein.

Reports and certifications on proposed materials and mixture proportions for each concrete mixture design shall be submitted for review within 30 days after the preconstruction conference and prior to conducting the laboratory trial batches for each mixture design.

Water-soluble chlorine ion shall be determined in the concrete mix in accordance with ASTM C1218 within the 6 week period prior to the start of placing concrete on the project. This test shall be in addition to the testing described in paragraph 2-3.02.02. Testing shall be in accordance with paragraph 2-1.12. Concrete placing shall not proceed until testing demonstrates acceptable results.

1-3.02. **Manufacturer's Certificate of Compliance.** A manufacturer's certificate of compliance, which includes the name of the project and copies of independent test results confirming compliance with specified requirements, shall be submitted to the Engineer.
for the following materials when used:

Cement.
Admixtures.
Fly Ash.
Slag Cement.

1-4. STORAGE AND HANDLING. Cement, slag cement and fly ash shall be stored in suitable moisture proof enclosures. Cement, slag cement and fly ash which have become caked or lumpy shall not be used.

Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.

PART 2 - PRODUCTS

2-1. LIMITING REQUIREMENTS. Unless otherwise specified, each concrete mixture shall be designed and controlled, within the following limits, to provide a dense, durable concrete suitable for the expected service conditions.

Concrete materials shall be selected and concrete shall be proportioned, batched, mixed, and delivered in a manner that will minimize shrinkage and cracking as specified herein, and in accordance with Chapters 3 and 8 of ACI 224R. Concrete temperatures shall be controlled before and until delivery at the end of the delivery truck chute to minimize cracking. Any rise in concrete temperature caused by environmental conditions that will be conducive to excessive shrinkage shall be controlled.

For each class of concrete, each concrete mixture shall be designed and concrete shall be controlled within the limits in the specification and in Tables 1A and 1B.

2-1.01. Cementitious Material Content Limits. The minimum quantity of Portland cement in the concrete shall be as indicated in Tables 1A and 1B.

Contractor may substitute fly ash for Portland cement within the percentage ranges indicated in Tables 1A and 1B, on the basis of 1.0 lbs of fly ash added for each lb of Portland cement reduction.

Contractor may substitute slag cement for Portland cement within the percentage ranges indicated in Tables 1A and 1B on the basis of 1.0 lbs of slag cement added for each lb of Portland cement reduction.

Mixtures using slag cement in combination with fly ash will not be acceptable.
Maximum cementitious material content, when ASTM C150 Type I Portland cement is used, shall not be more than 1.15 times the minimum Portland cement content specified. When a Type II, Type I/II, or Type V Portland cement is used, the cementitious material content shall not be increased more than necessary to achieve the required $f'_c$.

2-1.02. Maximum Water-Cementitious Material Ratio. The maximum water-cementitious ratio shall be on a cement mass basis, or, if fly ash or slag cement is used, the combined mass of cement plus fly ash or slag cement shall be used to determine the water-cementitious materials ratio. Limiting maximum water-cementitious material ratios are indicated in Tables 1A and 1B.

2-1.03. Aggregates. Aggregates shall comply with ASTM C33 except as specified herein. Fine aggregate shall be clean natural sand. Artificial or manufactured sand will not be acceptable. Coarse aggregate shall be crushed rock, washed gravel, or other inert granular material, meeting Class 4S requirements, except that clay and shale particles shall not exceed values indicated in Tables 1A and 1B.

When ASTM C33 gradations are specified, final gradation of the coarse aggregate shall conform to maximum nominal size grading requirements of ASTM C33, when one size of aggregate or a combination of two or more sizes is used.

When the 18-8 combined aggregate gradation is required, the combined aggregates shall be well graded from the coarsest to the finest. Not more than 18 percent nor less than 8 percent (18-8 requirement) of the combined aggregate shall be retained on any individual sieve with the exceptions that the No. 50 may have less than 8 percent retained, sieves finer than No. 50 shall have less than 8 percent retained, and the coarsest sieve may have less than 8 percent retained.

Aggregates used in concrete shall have a combined aggregate distribution similar to the aggregates used in the concrete trial mixtures. Reports of individual aggregates shall include sieve sizes 1-1/2 inch, 1 inch, 3/4 inch, 1/2 inch, 3/8 inch, No. 4, No. 8, No. 16, No. 30, and No. 50 in accordance with ASTM E11.

When available aggregates are elongated or slivered and cause interference with mixture mobility, or available aggregate gradations will not comply with the 18-8 requirement and when permitted by Engineer, the combined aggregate percentages may be changed to not more than 22 percent nor less than 6 percent retained on any individual sieve.

Specified sand equivalent for fine aggregate shall be not less than indicated in Tables 1A and 1B for an average of 3 samples tested in accordance with ASTM D2419.

The maximum coarse aggregate content consistent with workability and minimizing shrinkage shall be used in the mixture. To comply with the specified concrete shrinkage test requirements, the clay and shale content of the aggregates may need to be reduced by washing the aggregate.
2-1.04. **Ratio of Fine to Total Aggregates.** The ratio of fine to total aggregates, based on solid volumes (not weights), shall be as follows:

<table>
<thead>
<tr>
<th>Coarse Aggregate Size</th>
<th>Minimum Ratio</th>
<th>Maximum Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>0.45</td>
<td>0.60</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>0.40</td>
<td>0.55</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>0.35</td>
<td>0.50</td>
</tr>
<tr>
<td>1 inch</td>
<td>0.30</td>
<td>0.46</td>
</tr>
<tr>
<td>1-1/2 inch</td>
<td>0.25</td>
<td>0.40</td>
</tr>
</tbody>
</table>

2-1.05. **Slump.** Concrete slump shall be kept as low as possible, consistent with proper handling and thorough consolidation. Slump shall be at least 2 inches and shall not exceed the maximum slump as indicated in Tables 1A and 1B.

When superplasticizer is dispensed at the ready-mix plant, the concrete mixture design shall be based on a maximum slump as indicated in Tables 1A and 1B; and when superplasticizer is dispensed at the site, slump shall not exceed the maximum slump as indicated in Tables 1A and 1B before superplasticizer is added.

2-1.06. **Initial Set.** The initial set, as determined by ASTM C403, shall be attained 5-1/2 hour’s ±1 hour after the water and cement are added to the aggregates for each concrete mixture. The quantity of retarding admixture shall be adjusted to compensate for variations in temperature and job conditions.

2-1.07. **Total Air Content.** The total volumetric air content of concrete after placement shall be as indicated in Tables 1A and 1B, and within ±1 percent. Air-entraining admixture may be omitted from concrete for interior slabs which are to be trowel finished, and from Classes D1, D2, and D7 concrete.

2-1.08 **Admixtures.** Only approved or specified admixtures shall be used.

Unless otherwise acceptable to the Engineer, all admixtures shall be from one manufacturer and shall be compatible. Admixtures that are compatible with other admixtures and concrete materials shall not have an adverse affect on the required properties of the concrete nor the specified limiting requirements. The admixture content, batching method, and time of introduction to the mixture shall comply with these specifications and with the manufacturer's recommendations for minimum shrinkage. The admixture manufacturer shall provide qualified field services as necessary, at no additional
Admixtures used in the concrete shall be as recommended in writing by the admixture manufacturer prior to conducting the laboratory trial concrete mixture testing and the shrinkage test. No calcium chloride nor admixture containing chloride from sources other than residual impurities in admixture ingredients will be permitted. Admixtures containing unrefined or raw lignosulfonic acids ("lignins") or their salts will not be acceptable.

Combination of admixtures which cause premature or local dehydration or post-compaction settlement of the concrete surface shall not be used. If any such undesirable characteristics are observed, the use of the mixture shall be discontinued and an alternate mixture design used.

A water-reducing admixture shall be included in all concrete, except Classes D1 and D7 concrete. A superplasticizer shall be used in all liquid-containing (Class A1) concrete and shall be used in small aggregate (Class A2) concrete that is placed in liquid-containing structures. Unless otherwise required, a mid-range plasticizing admixture or a superplasticizer may be used, at the option of Contractor, in all other concrete except Classes D1 and D7. When a mid-range plasticizing admixture is used as a superplasticizer or when a superplasticizer is used, the admixture manufacturer shall recommend to Engineer, in writing, the type of superplasticizer to be used with the required water-reducing admixture to achieve the specified initial-set times.

Superplasticizer may be dispensed into the concrete at the plant or on the job site and shall be mixed in accordance with the admixture manufacturer's recommendations. Each superplasticizer dose, when dispensed at the site, shall be easily verifiable and recorded on the delivery ticket. The superplasticizer for each load shall be accurately proportioned into a separate container prior to dispensing the admixture into the concrete. When truck-mounted dispensers are used, the system shall not be flushed or cleaned with water until after the entire load of concrete has been discharged. When permitted by Engineer, redoing of concrete with superplasticizer shall be done only once. Redoing procedures shall be as recommended by the admixture manufacturer.

A shrinkage reducing admixture may be added to concrete class A1. If used, it shall replace an equal volume of mixing water or as otherwise recommended by the admixture manufacturer. The quantity of air entrainment admixture shall be adjusted as required by the admixture manufacturer to keep mix air content within specified limits.


2-1.10. Strength. In addition to the other limiting requirements to achieve durability and minimize shrinkage, the minimum acceptable compressive strengths of concrete tested at the end of the delivery truck chute using 6 by 12 inch site-cast cylinders, as determined by ASTM C39, shall be as indicated in Tables 1A and 1B.

Adequate test cylinders taken at the point of placement shall also be made to verify that
the construction contractor's concreting procedures comply with applicable industry standard procedures.

2-1.11. Pumped Concrete. Coarse aggregate size for pumped concrete mixtures shall be limited to a maximum of 1-1/2 inch.

The slump of concrete, with or without a superplasticizer that is discharged into the pump may exceed the specified maximum slump value by the amount of slump loss in the pumping system, up to a maximum of 1 inch. The slump loss shall be determined by tests made at each end of the pumping system.

2-1.12. Water-Soluble Chloride. Maximum water-soluble chloride ion concentrations in hardened concrete at an age of 28 days shall not exceed the limits expressed as a percentage of mass of cement as indicated in Tables 1A and 1B.

Test results shall be reported as the percentage of water-soluble chloride ions in the concrete and as a percentage of chloride ion relative to the mass of cement in the concrete.

Testing of the concrete components, except aggregates, for water-soluble chloride ions will be done at the discretion of Contractor. Copies of the reports on such tests shall be furnished to Engineer.

The hardened concrete and each gradation of aggregate used in the concrete shall be tested each time a chloride ion test is conducted on a concrete mixture.

2-1.13. Laboratory Shrinkage Limits. Based on the modified ASTM C157 test procedures as specified herein, the shrinkage limits of concrete shall be the average drying shrinkage of each set of three test specimens cast in the laboratory from a trial batch as measured at the 21 days drying age, and shall not exceed the values in Tables 1A and 1B.

The average drying shrinkage of each set of test specimens cast in the field from concrete delivered to the site, and sampled at the end of the delivery truck chute, as measured at the 21 days drying age shall not exceed the values in Tables 1A and 1B.


2-1.15. Cold Weather Concrete. Except as modified herein, cold weather concrete shall comply with ACI 306R. The temperature of concrete at the point of delivery at the end of the delivery truck chute shall be not less than that indicated in ACI 306R for corresponding outdoor temperature (in shade) at the time of placement:

When delivered, heated concrete shall be not warmer than 80°F.

2-1.16. Hot Weather Concrete. Except as modified herein, hot weather concrete shall comply with ACI 305R. At air temperatures of 90°F or above, concrete shall be kept as cool as possible before and during delivery. The temperature of the concrete at the time of
delivery at the end of the delivery truck chute shall not exceed the values indicated in Tables 1A and 1B.

2-2. MATERIALS

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>ASTM C 150, Type II or Type I/II. Low Alkali.</td>
</tr>
<tr>
<td>Fly Ash</td>
<td>ASTM C618, Class F or ASTM C618, Class C that passes ASTM C1012 testing for moderate sulfate resistance, except loss on ignition shall not exceed 4 percent.</td>
</tr>
<tr>
<td>Slag Cement (GGBFS)</td>
<td>ASTM C989, Grade 100 or Grade 120.</td>
</tr>
<tr>
<td>Aggregates, Fine and Coarse</td>
<td>As specified in Limiting Requirements paragraph.</td>
</tr>
<tr>
<td>Water</td>
<td>Potable.</td>
</tr>
<tr>
<td>Admixtures</td>
<td></td>
</tr>
<tr>
<td>Water Reducing/Normal Set</td>
<td>ASTM C494, Type A, except as otherwise specified herein.</td>
</tr>
<tr>
<td>Water Reducing/Retarding</td>
<td>ASTM C494, Type D, except as otherwise specified herein.</td>
</tr>
<tr>
<td>Air-Entraining</td>
<td>ASTM C260.</td>
</tr>
<tr>
<td>Superplasticizing/Normal Set</td>
<td>ASTM C494, Type F, extended slump life type, except as otherwise specified herein.</td>
</tr>
<tr>
<td>Superplasticizing/Retarding</td>
<td>ASTM C494, Type G, extended slump life type, except as otherwise specified herein.</td>
</tr>
<tr>
<td>Shrinkage Reducing Admixture</td>
<td>Grace “Eclipse Plus” or BASF (Master Builders) “Tetraguard AS20”.</td>
</tr>
<tr>
<td>Mineral Coloring</td>
<td>Not Used.</td>
</tr>
</tbody>
</table>

2-3. PROPORTIONING.

2-3.01. Mixture Design. Using concrete materials acceptable to Engineer, a tentative concrete mixture shall be designed and tested in the laboratory for each size and combined gradation of aggregates and for each consistency as indicated and intended for use on the work and as specified. Concrete proportions shall be established based on laboratory trial mixtures that meet the following requirements:

a. The combination of materials shall be as proposed for use in the work.
b. Mixtures shall conform with the limiting requirements specified herein.

c. The required average compressive strength, $f'_{cr}$, of the trial mixture, using 6 X 12 cylinders, shall exceed the specified minimum acceptable compressive strength, $f'_{cr}$, as required in Tables 1A and 1B.

d. Trial mixtures of the proportions and consistencies specified for the work shall be prepared. When a three point curve is required by Tables 2A and 2B, the three concrete trial mixtures shall reflect the cement content proposed for the project and for the indicated concrete class at three water-cementitious material ratio contents at or lower than indicated in Tables 1A and 1B. The compressive strength of the cylinders made from the three trial mixtures shall produce a range of compressive strengths exceeding or encompassing the $f'_{cr}$ required for the work.

e. For each proposed concrete mixture that is required to be tested as indicated in Tables 2A and 2B, at least three 6 by 12 inch compressive strength test cylinders shall be made for each age. Each change in the water-cementitious materials ratio shall be considered a new concrete mixture. Each mixture shall be tested at the ages of 7 days and 28 days with two test cylinders broken at 28 days.

f. When a three point curve is required in Table 2A or 2B, the results of the cylinder tests for each water-cementitious materials ratio at each age shall be plotted as a curve showing the relationship between compressive strength (along y-axis) and the water-cementitious materials ratio (along x-axis). The water-cementitious materials ratio for the concrete mixture to be used in the work shall be selected from the 28 day curve to produce the required average compressive strength. The cement content and mixture proportions to be used shall be such that the selected water-cementitious materials ratio will not be exceeded at specified maximum slump. These concrete mixture proportions shall be submitted for review in accordance with the submittals section. When a shrinkage reducing admixture is proposed, trial batches shall be prepared with and without the shrinkage reducing admixture.

If acceptable in Table 2A or 2B, concrete mixtures may utilize prior field test data in lieu of laboratory trial mixtures. Field test data records shall be from the production facility being used on current project and shall have been performed in the past 12 months. Field test data records shall represent a single group of at least 10 consecutive strength tests for one mixture, using the same materials, under the same conditions, and encompassing a period of not less than 60 days.

Mixtures shall be adjusted in the field as necessary, within the limits specified, to meet the
requirements of these specifications.

2-3.02. Preliminary Review. Reports covering the source and quality of concrete materials and the concrete proportions proposed for the work shall be submitted to Engineer for review before performing the required trial mixture designs and before concrete work is started. The reports required shall be as indicated in Tables 2A and 2B. Review of these reports will be for general acceptability only, and continued compliance with all contract provisions will be required.

2-3.02.01. Aggregate Reports. Reports on aggregates shall include the information listed in Tables 2A and 2B. Aggregate reports shall be project specific and shall be no more than 90 days old at time of submittal.

2-3.02.02. Mixture Design Report. Design quantities and test results on each mixture shall be submitted for review and shall be accepted before concrete work is started. The report on each tentative concrete mixture and on the proposed concrete mixture shall contain the information in Tables 2A and 2B, and shall be submitted to Engineer.

2-3.02.03. Mixture Design Testing. As stipulated in the Quality Control section, all tests and reports required for preliminary review shall both be made by an independent testing laboratory at the expense of Contractor specifically for this project. All materials shall be tested in accordance with the specified test methods and reports for these tests shall be prepared specifically for this project. If the source of any concrete materials is changed during the contract, the materials and the new mixture design shall be tested in accordance with the specified preliminary review requirements and reports shall be submitted for review.

Aggregates shall be sampled and tested in accordance with ASTM C33. In addition, the bulk specific gravity of each aggregate shall be determined in accordance with ASTM C127 and ASTM C128.

Concrete test specimens shall be made, cured, and stored in accordance with ASTM C192 and tested in accordance with ASTM C39.

Slump shall be determined in accordance with ASTM C143. Total air content shall be determined in accordance with ASTM C231 and verified in accordance with ASTM C138. Concrete temperature shall be determined in accordance with ASTM C1064 and unit weight (mass) shall be determined in accordance with ASTM C138. Water-soluble chloride ion shall be determined in accordance with ASTM C1218.

Initial set tests shall be made at ambient temperatures of 70°F and 90°F to determine compliance with the specified time for initial set. The test at 70°F shall be made using concrete containing the specified normal set/water-reducing admixture and, when required, air-entraining admixture. The test at 90°F shall be made using concrete containing the specified retarding/water-reducing admixture and, when required, air-entraining admixture. Initial set shall be determined in accordance with ASTM C403.
A preliminary test on a trial batch shall be conducted at the project site, using the proposed superplasticizer in the accepted mixture design to determine the correct dosage. When superplasticizer is not included in the trial mixture, the trial batch tested at the site shall be used to determine compatibility of the superplasticizer with the other materials used in the concrete, including the other admixtures.

A drying shrinkage test shall be conducted on the preliminary trial batch with the maximum water-cementitious materials ratio used to qualify each proposed concrete mixture design using the concrete materials, including admixtures that are proposed for the project. Three test specimens shall be prepared for each test. Drying shrinkage specimens shall be 4 inch by 4 inch by 11 inch prisms with an effective gauge length of 10 inches, fabricated, cured, dried, and measured in accordance with ASTM C157 except with the following modifications:

Specimens shall be removed from the molds at an age of 23 hours ±1 hour after trial batching, shall be placed immediately in water at 73°F ±3°F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in lime-saturated water as specified in ASTM C157. Measurement to determine expansion expressed as a percentage of original length shall be taken at age 7 days. The length at 7 days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity controlled room maintained at 73°F ±3°F and 50 percent ±4 percent relative humidity for the remainder of the test.

Measurements to determine shrinkage expressed as a percentage of the base length shall be reported separately for 7, 14, and 21 days ±4 hours of drying from "0" days after 7 days of moist curing for a total of 28 days from the date of casting. Drying shrinkage deformation for each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. Results of the shrinkage test shall be reported to the nearest 0.001 percent. If drying shrinkage of any specimen deviates from the average for that test age by more than 0.004 percent, the results for that specimen shall be disregarded.

The average drying shrinkage of each set of 4 inch by 4 inch by 11 inch test specimens made in the laboratory from a trial batch shall not exceed the values required in Tables 1A and 1B. Drying shrinkage tests will only be required for concrete mixtures indicated in Tables 1A, 1B, 2A, and 2B.

Alkali-aggregate reactivity potential shall be determined in accordance with Appendix XI of ASTM C33. Aggregates shall be tested in accordance with ASTM C289 and C295 or ASTM C1260 to determine potential reactivity. Aggregates which do not indicate a potential for alkali reactivity or do not have reactive constituents may be used without further testing. Aggregates which indicate a potential for alkali reactivity shall be further tested in accordance with ASTM C227 or C1105, as appropriate, using a cement.
containing less than 0.6 percent alkalies. At the discretion of Engineer, testing in addition to that indicated in Appendix XI of ASTM C33 may be performed on potentially reactive aggregates. Nonreactive aggregates shall be imported if, in the opinion of the Engineer, local aggregates exhibit unacceptable potential reactivity.

2-4. **ARCHITECTURAL CONCRETE.** Architectural concrete shall conform to the applicable requirements of Section 6 of ACI 301 and to the additional requirements specified herein.

2-4.01. **General Requirements.** Architectural concrete shall be free from holes, sand streaks, mortar leakage, offsets, irregularities, and other defects.

2-5. **BATCHING AND MIXING.** Concrete shall conform to ASTM C94 and shall be furnished by an acceptable ready-mixed concrete supplier.

2-5.01. **Consistency.** The consistency of concrete shall be suitable for the placement conditions. Aggregates shall float uniformly throughout the mass, and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.

2-5.02. **Delivery Tickets.** A delivery ticket shall be prepared for each load of ready-mixed concrete and a copy of the ticket shall be handed to Engineer by the truck operator at the time of delivery. Tickets shall indicate the name and location of Contractor, the project name, the mixture identification, the quantity of concrete delivered, the quantity of each material in the batch, the outdoor temperature in the shade, the time at which the cement was added, and the numerical sequence of the delivery.

**PART 3 – EXECUTION**

3-1. **CONTRACTOR’S ONGOING MATERIAL CONTROL TESTING.** The following tests and the test reports are required during the progress of the work and shall be made at the expense of Contractor. The frequency specified herein for each field control test is approximate and subject to change as determined by Engineer.

3-1.01. **Aggregate Gradation.** Each 200 tons of fine aggregate and each 400 tons of coarse aggregate shall be sampled and tested in accordance with ASTM D75 and C136. If lesser quantities of aggregates are used the sampling and testing shall occur at least once every 6 months.

3-1.02. **Sand Equivalent.** The sand equivalent test shall be conducted each time the sand gradation tests are conducted.

3-1.03. **Fly Ash.** Each 400 tons of fly ash shall be sampled and tested in accordance with ASTM C618 and C311. Contractor shall supply ENGINEER with certified copies of supplier's (source) test reports showing chemical composition and physical analysis for each shipment delivered to Contractor and certifying that the fly ash complies with the specifications. The certificate shall be signed by both the fly ash supplier and Contractor.
3-1.04 **Cement.** Contractor shall supply Engineer with certified copies of supplier's (source) test reports showing chemical composition and physical analysis for each shipment delivered to Contractor, and certifying that the cement complies with ASTM C150 and these specifications. The certificate shall be signed by both the cement manufacturer and Contractor.

3-1.05 **Slag Cement.** Contractor shall supply Engineer with certified copies of supplier’s (source) test reports showing chemical composition and physical analysis for each shipment delivered to Contractor and certifying that the slag cement complies with ASTM C989 and these specifications. The certificate shall be signed by both the slag cement manufacturer and the Contractor.

3-2. **CONTRACTOR’S FIELD CONTROL TESTING.** Field control tests, including aggregate gradation (if needed), slump, air content, making compression test cylinders, and other listed tests shall be performed by testing laboratory personnel. Contractor shall provide all facilities and the services of one or more employees as necessary to assist with the field control testing.

Testing shall be in accordance with the Florida Building Code and completed by Qualified Technicians employed by an Approved Agency.

As stipulated in the quality control section, tests required during the progress of the work shall be made at the expense of Contractor.

The frequency specified herein for each field control test is approximate and subject to change as determined by Engineer.

Engineer may require field testing prior to the addition of superplasticizer at the site to determine compliance with the specifications. Field testing after the addition of superplasticizer shall be conducted as specified and as needed to determine that the concrete is in compliance with the specifications. Air tests shall be conducted whenever field tests are conducted.

3-2.01 **Slump.** A slump test shall be made for each 50 cubic yards of concrete. Slump shall be determined in accordance with ASTM C143.

3-2.02 **Air Content.** An air content test shall be made on concrete from one of the first three batches mixed each day and on concrete from each batch of concrete from which concrete compression test cylinders are made. Air content shall be determined in accordance with ASTM C231 and verified in accordance with ASTM C138.

3-2.03 **Unit Weight.** A unit weight test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Unit weight shall be determined in accordance with ASTM C138.
3-2.04. **Concrete Temperature.** A concrete temperature test shall be made on concrete from the first batch of concrete mixed each day and on concrete from each batch of concrete from which concrete compression test cylinders are made. Concrete temperature shall be determined in accordance with ASTM C1064.

3-2.05. **Water-Soluble Chloride Ion.** Water-soluble chloride ion testing shall be performed once for each 500 cubic yards of concrete in accordance with ASTM C1218.

3-2.06. **Compression Tests.** One set of four concrete compression test cylinders shall be made each day when 25 to 50 cubic yards of concrete is placed. One additional set of test cylinders shall be made from each additional 50 cubic yards, or major fraction thereof, placed in any one day. Two cylinders of each set shall be tested at an age of 7 days and the remaining cylinders shall be tested at an age of 28 days.

Test cylinders shall be 6 inches in diameter by 12 inches high and shall be made, cured, stored, and delivered to the laboratory in accordance with ASTM C31 and tested in accordance with ASTM C39.

Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders was placed, the number of the delivery truck or batch, the air content, the slump, the unit weight, and the concrete temperature.

3-2.07. **Shrinkage Tests.** Concrete shrinkage tests shall be performed once for each 1,000 cubic yards of concrete with controlled shrinkage that is placed and shall be made on concrete from a batch of concrete from which concrete compression test cylinders are made. Shrinkage testing shall be conducted as specified for the preliminary trial mixes.

The average drying shrinkage of each set of test specimens cast in the field from concrete delivered to the site as measured at the 21 days' drying age shall not exceed the values indicated in Tables 1A and 1B.

3-2.08. **Test Reports.** Five copies of each test report shall be prepared and distributed by the testing laboratory to the Resident Project Representative (two copies), Engineer, and Contractor, in accordance with the quality control section.

3-3. **EVALUATION AND ACCEPTANCE OF CONCRETE.** Concrete will be evaluated for compliance with all requirements of the specifications. Concrete strength will be only one of the criteria used for evaluation and acceptance of the concrete. The results of all tests performed on the concrete and other data and information concerning the procedures for handling, placing, and curing concrete will be used to evaluate the concrete for compliance with the specified requirements.

Compression tests will be evaluated in accordance with ACI 318 and as specified herein. A strength test shall be the average of the compressive strengths of two cylinders made from the same concrete sample tested at 28 days.
3-3.01. **Compression Test Evaluation.** Compressive strength test results will be evaluated for compliance with the specified strength requirements. The strength level of the concrete will be considered satisfactory when the averages of all sets of three consecutive strength tests equal or exceed the specified compressive strength, $f'_{C}$, and no individual strength test result falls below the specified compressive strength by more than 500 psi.

3-3.02. **Inspection of Concrete Supplier.** Both scheduled and unscheduled visits by inspectors on days of concrete pours shall be accommodated. Inspectors shall be allowed access to mix tickets and mix proportions.
## TABLE 1A - LIMITING REQUIREMENTS

<table>
<thead>
<tr>
<th>Concrete Classification</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Class</td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
</tr>
<tr>
<td>1. Minimum Cement Content, lbs/cubic yard; based on maximum slump and maximum water-cementitious material ratio.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Nominal Aggregate Size, ASTM C33 aggregate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Size No. 467 (1-1/2&quot;)</td>
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</tr>
<tr>
<td>B</td>
<td>Size No. 57 (1&quot;)</td>
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<td>514</td>
</tr>
<tr>
<td>C</td>
<td>Size No. 67 (3/4&quot;)</td>
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<td>526</td>
</tr>
<tr>
<td>D</td>
<td>Size No. 7 (1/2&quot;)</td>
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<td>601</td>
<td>555</td>
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<td>E</td>
<td>Size No. 8 (3/8&quot;)</td>
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<td>636</td>
<td>564</td>
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<tr>
<td>F</td>
<td>Fine Aggregate, Sand)</td>
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<td>2. Compressive Strength, minimum; psi</td>
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<td></td>
<td></td>
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<td>A</td>
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<td>3,000</td>
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<tr>
<td>B</td>
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<td>4,000</td>
<td>4,000</td>
</tr>
<tr>
<td>C</td>
<td>Laboratory, 28 days; f\text{cr}</td>
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<td>1-1/2</td>
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<td>5. Aggregate gradation requirements</td>
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<td>Concrete Classification</td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
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<td>----</td>
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<td>Yes</td>
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<td>A  ASTM C33</td>
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<tr>
<td>aggregate size</td>
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<td>gradation required.</td>
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<td>B  &quot;18-8&quot; combined</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>gradation required.</td>
<td></td>
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<td>6. Maximum slump, inches</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A  Slump before</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>6</td>
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<tr>
<td>superplasticizer added</td>
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<td></td>
</tr>
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<td>B  Slump after adding superplasticizer</td>
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<td>8</td>
<td>8</td>
<td>8</td>
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<td>7. Air entrainment, percent, (±1 percent)</td>
<td>6</td>
<td>6</td>
<td>6</td>
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<tr>
<td>replacement, percent</td>
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</tr>
<tr>
<td>10 Testing limits</td>
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<td>A  Sand equivalent, min. percent</td>
<td>75</td>
<td>75</td>
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<td>75</td>
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<tr>
<td>B  Chloride ion, max. percent</td>
<td>0.10</td>
<td>0.10</td>
<td>0.15</td>
<td>0.10</td>
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<td>C  Shrinkage, max. percent; based 4 x 4 x 11 inch specimen</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Laboratory</td>
<td>0.036</td>
<td>0.036</td>
<td>0.048</td>
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<tr>
<td>Field</td>
<td>0.048</td>
<td>0.048</td>
<td>0.064</td>
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</table>
### D Coarse Aggregate:
Clay and shale combined particles shall not exceed, max. percent

<table>
<thead>
<tr>
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<th>Coarse Aggregate: Clay and shale combined particles shall not exceed, max. percent</th>
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### 11 Concrete Temperature, max. °F

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>A</td>
<td>Temperature at time of delivery, max.</td>
</tr>
<tr>
<td></td>
<td>85</td>
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<tr>
<td>B</td>
<td>Temperature at time of placement, max.</td>
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<tr>
<td></td>
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<td>Concrete Classification</td>
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<td>-------------------------</td>
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</tr>
<tr>
<td>1. Minimum Cement Content, lbs/cubic yard; based on maximum slump and maximum water-cementitious material ratio.</td>
<td></td>
</tr>
<tr>
<td>Maximum Nominal Aggregate Size, ASTM C33 aggregate</td>
<td></td>
</tr>
<tr>
<td>A Size No. 467 (1-1/2&quot;)</td>
<td>---</td>
</tr>
<tr>
<td>B Size No. 57 (1&quot;)</td>
<td>460</td>
</tr>
<tr>
<td>C Size No. 67 (3/4&quot;)</td>
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<tr>
<td>D Size No. 7 (1/2&quot;)</td>
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<td>E Size No. 8 (3/8&quot;)</td>
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<td>2. Compressive Strength, minimum; psi</td>
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<tr>
<td>A Field, 7 days;</td>
<td>2,250</td>
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<tr>
<td>B Field, 28 days; $f'c$</td>
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<td>C Laboratory, 28 days; $f'c_{cr}$</td>
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<td>3. Maximum water-cementitious material ratio</td>
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<td>4. Maximum coarse aggregate size; inches.</td>
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<tr>
<td>5. Aggregate gradation requirements</td>
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<tr>
<td>Concrete Classification</td>
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<td>-------------------------</td>
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</tr>
<tr>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>---</td>
</tr>
<tr>
<td>6. Maximum slump, inches</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
</tr>
<tr>
<td>7. Air entrainment, percent (±1 percent)</td>
<td>---</td>
</tr>
<tr>
<td>10 Testing limits</td>
<td>A</td>
</tr>
<tr>
<td>B</td>
<td>Chloride ion, max. percent</td>
</tr>
<tr>
<td>C</td>
<td>Shrinkage, max. percent; 4 x 4 x 11 inch specimen</td>
</tr>
<tr>
<td>D</td>
<td>Coarse Aggregate: Clay and shale combined particles shall not exceed, max. percent</td>
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<tr>
<td>11</td>
<td>Concrete temperature, max °F</td>
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### A Temperature at time of delivery

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<tr>
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<th>95</th>
<th>95</th>
<th>90</th>
<th>90</th>
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<tbody>
<tr>
<td>A</td>
<td>Temperature at time of placement</td>
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<td>95</td>
<td>90</td>
<td>90</td>
<td>85</td>
<td>85</td>
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</tbody>
</table>

#### NOTES:

# "D2" (Underwater concrete) - Limit aggregate to 3/4" for reinforced concrete, up to 1-1/2" for unreinforced concrete.

* "D2" (Underwater concrete) - Reduce cement content 100 lbs. per cubic yard for each aggregate size listed for 2,500 psi.

ª "D5" Wash water trough top edge water-cementitious ratio, 100 percent sand passing No. 8 sieve.

### TABLE 2A - SUBMITTAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Concrete Class</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>B</th>
<th>C</th>
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<tbody>
<tr>
<td>1 Aggregate reports (ASTM C33)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>A Fine aggregate</td>
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<td>Gradation</td>
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<td>X</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>B Coarse aggregate</td>
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<td>Gradation</td>
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<td>D &quot;18-8&quot; requirement</td>
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<td>2 Cement, mill report</td>
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<td>X</td>
<td>X</td>
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<td>X</td>
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<td>3 Cementitious material, type, data sheet, and test report (fly ash, slag cement)</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers procurement and installation of grout. Unless otherwise specified, only nonshrinking grout shall be furnished.

Epoxy grouting of anchor bolts, threaded rod anchors, and reinforcing bars is covered in the anchorage in concrete and masonry section. Grouting of masonry is covered in the building masonry section.

1-2. SUBMITTALS. A letter of certification indicating the types of grout to be supplied and the intended use of each type shall be submitted in accordance with the submittals section.

1-3. DELIVERY, STORAGE, AND HANDLING. Materials shall be handled, transported, and delivered in a manner which will prevent damage of any kind. Materials shall be protected from moisture.

PART 2 - PRODUCTS

2-1. MATERIALS.

| Nonshrinking Grout | Cementitious grout with demonstrated non-shrinking properties; L&M "Crystex", Master Builders "Masterflow 713" or "Set Grout", Sauereisen "F-100 Level Fill Grout", Sonneborn "Sonogrout 10K", Hilti “CG 200 PC”, or Five Star Products "Five Star Grout". |
| Water              | Clean and free from deleterious substances. |

2-2. NONSHRINKING GROUT. Nonshrinking grout shall be furnished factory premixed so that only water is added at the jobsite.

PART 3 - EXECUTION

3-1. PREPARATION. The concrete foundation to receive nonshrinking grout shall be saturated with water for at least 12 hours preceding grouting unless additional time is required by the grout manufacturer.
3-2. INSTALLATION.

3-2.01. Mixing. Grout shall be mixed in a mechanical mixer. No more water shall be used than is necessary to produce a flowable grout.

3-2.02. Placement. Unless otherwise specified or indicated on the drawings, grout under baseplates shall be 1-1/2 inches thick. Grout shall be placed in strict accordance with the directions of the manufacturer so that all spaces and cavities below the baseplates are completely filled without voids. Forms shall be provided where structural components of baseplates will not confine the grout.

3-2.03. Edge Finishing. In all locations where the edge of the grout will be exposed to view, the grout shall be finished smooth after it has reached its initial set. Except where shown to be finished on a slope, the edges of grout shall be cut off flush at the baseplate.

3-2.04. Curing. Nonshrinking grout shall be protected against rapid loss of moisture by covering with wet clothes or polyethylene sheets. After edge finishing is completed, the grout shall be wet cured for at least 3 days and then an acceptable membrane curing compound shall be applied.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the installation of new valves and actuators purchased by Contractor as part of this Work or purchased by others under the valve specifications. The equipment to be furnished by others for installation by Contractor is identified in the applicable valve schedules.

Cleaning, disinfection, pressure and leakage testing, insulation, and pipe supports are covered in other sections.

The following specification sections are applicable to valves to be installed:

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>15091</td>
<td>Miscellaneous Ball Valves</td>
</tr>
<tr>
<td>15101</td>
<td>AWWA Butterfly Valves</td>
</tr>
<tr>
<td>15104</td>
<td>Resilient-Seated Gate Valves</td>
</tr>
<tr>
<td>15108</td>
<td>Air Release/Combination Air Valves</td>
</tr>
</tbody>
</table>

1-2. GENERAL. Equipment installed under this section shall be erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

1-2.01. Coordination. When manufacturer's field services or installation check services are provided by the valve manufacturer, Contractor shall coordinate the services with the valve manufacturer. Contractor shall give Engineer written notice at least 30 days prior to the need for manufacturer's field services.

Flanged connections to valves including the bolts, nuts, and gaskets are covered in the appropriate pipe specification section.

1-3. DELIVERY, STORAGE, AND HANDLING.

1-3.01. Storage. Upon delivery, all equipment and materials shall immediately be stored and protected by Contractor in accordance with Handling and Storage section and the manufacturer’s instructions until installed in the Work. Stored equipment shall be protected by Contractor against damage and exposure from the elements. At no time shall the equipment be stored on earth or grass surfaces or come into contact with earth or grass. Contractor shall keep the equipment dry at all times.
PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3-1. INSPECTION. All valves and accessories shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and re-cleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

3-2. INSTALLATION.

3-2.01. General. Valves shall be installed with sufficient clearance for proper operation of any external mechanisms, and with sufficient clearance to dismantle the valve for in-place maintenance. Installation shall be in accordance with the valve manufacturer’s recommendations.

3-2.02. Installation Checks. When specified in the valve sections, installation checks will be provided by a manufacturer’s representative. The specified services shall be furnished at no charge to the Contractor. Any additional services in connection with the installation of the equipment which are required by reason of Contractor's progress shall be paid for by Contractor.

Contractor shall perform no Work related to the installation or operation of materials or equipment furnished by others without direct observation and guidance of the field representative, unless Engineer and manufacturer furnishing such materials concur otherwise.

3-2.03. AWWA Butterfly Valves. Butterfly valves shall be installed with the shaft horizontal unless otherwise necessary for proper operation or as acceptable to Engineer.

Whenever an actuator must be removed to permit installation of a valve, the actuator shall be promptly reinstalled and shall be inspected and readjusted by a representative of the valve manufacturer.


3-2.05. Eccentric Plug Valves. Not Used.
3-2.06. Resilient Seated Gate Valves. Valves shall be handled and installed in accordance with the recommendations set forth in the Appendix to ANSI/AWWA C509 and with the recommendations of the manufacturer.


3-2.08. Air Release and Combination Air Valves. The exhaust from each valve shall be piped to a suitable point acceptable to Engineer. Air release valve exhaust piping leading to a trapped floor drain shall terminate at least 6 inches [150 mm] above the floor.

3-2.09. Valve Boxes. Valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves, with the top of the box brought flush with the finished grade. After each valve box is placed in proper position, earth fill shall be placed and thoroughly tamped around the box.


3-3. VALVE ACTUATORS. Valve actuators and accessories shall be installed in accordance with the equipment manufacturer's recommendations.

3-4. FIELD QUALITY CONTROL.

3-4.01. Field Testing. After installation, all valves shall be tested in conjunction with the Pipeline Pressure and Leakage Testing section.

3-4.01.01. Pressure Tests. Pressure testing shall be in accordance with the Pipeline Pressure and Leakage Testing section.

3-4.01.02. Leakage Tests. All valves shall be free from leaks. Each leak that is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor. This requirement applies whether pressure testing is required or not.

End of Section
Section 15020

MISCELLANEOUS PIPING AND ACCESSORIES INSTALLATION

PART 1 - GENERAL

1-1. SCOPE. This section covers the installation of piping and accessories as indicated on the drawings for the following piping sections:

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15060</td>
<td>Miscellaneous Piping and Accessories</td>
</tr>
</tbody>
</table>

Contractor shall furnish all necessary jointing materials, coatings, and accessories that are specified herein.

Pipe trenching and backfilling are covered in the Trenching and Backfilling section.

1-2. GENERAL.

1-2.01. Coordination. Materials installed under this section shall be installed in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the manufacturer, unless exceptions are noted by Engineer.

1-3. SUBMITTALS.

1-3.01. Drawings and Data. Complete specifications, data, and catalog cuts or drawings shall be submitted in accordance with the Submittals section. Items requiring submittals shall include, but not be limited to, the following:

   Materials as specified herein.


1-3.03. Spool Drawings. Not Used.

1-4. QUALITY ASSURANCE.

1-4.01. Welding and Brazing Qualifications. Not Used.

1-4.02. Tolerances. These tolerances apply to in-line items and connections for other lines.

   The general dimension, such as face-to-face, face or end-to-end, face- or end-to center, and center-to-center shall be 1/8 inch [3 mm].
The inclination of flange face from true in any direction shall not exceed 3/64 inch per foot [4 mm per meter].

Rotation of flange bolt holes shall not exceed 1/16 inch [1.5 mm].

1-5. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section. All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.

PART 2 - PRODUCTS

2-1. SERVICE CONDITIONS. Pipe, tubing, and fittings covered herein shall be installed in the services indicated in the various pipe sections.

2-2. MATERIALS.

Threaded Fittings

| Anti-Seize Thread Lubricant | Jet-Lube "Nikal", John Crane "Thred Gard Nickel", Never-Seez "Pure Nickel Special", or Permatex "Nickel Anti-Seize". |
| Teflon Thread Sealer | Paste type; Hercules "Real-tuff", John Crane "JC-30", or Permatex "Thread Sealant with Teflon". |
| Teflon Thread Tape | Hercules "Tape Dope" or John Crane "Thread-Tape". |

Solvent Welded Fittings

| Solvent cement for PVC Systems | ASTM D2564. |
| Solvent cement for CPVC Systems | ASTM F493. |
| Sodium Hypochlorite, Sodium Hydroxide, and Sodium Bisulfite Service | IPS Corporation "Weld-On 724" |
| Primer for PVC Systems | ASTM F656. |
### Solder or Brazed Fittings

**Solder**
Solid wire, ASTM B32, ANSI/NSF 61 certified, Alloy Grade Sb5, (95-5).

**Soldering Flux**
Paste type, ASTM B813.

**Brazing Filler Metal**
AWS A5.8, BCuP-5; Engelhard "Silvaloy 15", Goldsmith "GB-15", or Handy & Harman "Sil-Fos".

**Brazing Flux**
Paste type, Fed Spec O-F-499, Type B.

### Insulating Fittings

**Threaded**
Dielectric steel pipe nipple, ASTM A53, Schedule 40, polypropylene lined, zinc plated; Perfection Corp. "Clearflow Fittings".

**Flanged**
Epco "Dielectric Flange Unions" or Central Plastics "Insulating Flange Unions".

### Pipe Insulation
See Mechanical Insulation section.

### Watertight/Dusttight Pipe Sleeves
O-Z Electrical Manufacturing "Thruwall" and "Floor Seals", or Thunderline "Link-Seals"; with modular rubber sealing elements, nonmetallic pressure plates, and galvanized bolts.

### Pipe Sleeve Sealant
Polysulfide or urethane, as specified in the Caulking section or as indicated on the drawings.

### Protective Coatings

**Tape Wrap**
ANSI/AWWA C209, except single ply tape thickness shall not be less than 30 mils [760 µm]; Protecto Wrap "200" or Tapecoat "CT".

**Primer**
As recommended by the tape manufacturer.
PART 3 - EXECUTION

3-1. INSPECTION. All piping components shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and recleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

3-2. PREPARATION.

3-2.01. Field Measurement. Pipe shall be cut to measurements taken at the site, not from the drawings. All necessary provisions shall be made in laying out piping to allow for expansion and contraction. Piping shall not obstruct openings or passageways. Pipes shall be held free of contact with building construction to avoid transmission of noise resulting from expansion.

3-3. INSTALLATION.

3-3.01. General. All instruments and specialty items shall be installed according to the manufacturer’s instructions and with sufficient clearance and access for ease of operation and maintenance.

Flat faced wrenches and vises shall be used for copper tubing systems. Pipe wrenches and vises with toothed jaws will damage copper materials and shall not be used. Bends in soft temper tubing shall be shaped with bending tools.

3-3.02. Pipe Joints. Pipe joints shall be carefully and neatly made in accordance with the indicated requirements.

3-3.02.01. Threaded. Pipe threads shall conform to ANSI/ASME B1.20.1, NPT, and shall be fully and cleanly cut with sharp dies. Not more than three threads at each pipe connection shall remain exposed after installation. Ends of pipe shall be reamed after threading and before assembly to remove all burrs. Unless otherwise indicated, threaded joints shall be made up with teflon thread tape, thread sealer, or a suitable joint compound.
Threaded joints in plastic piping shall be made up with teflon thread tape applied to all male threads. Threaded joints in stainless steel piping shall be made up with teflon thread sealer and teflon thread tape applied to all male threads. Threaded joints in steel piping for chlorine service shall be made up with teflon thread tape or litharge and glycerine paste applied to all male threads.


3-3.02.03. Flared. Not Used.


3-3.02.05. Solvent Welded. Not Used.

3-3.02.06. Epoxy and Adhesive Bonded. Not Used.


3-3.02.08. Flanged. Flange bolts shall be tightened sufficiently to slightly compress the gasket and effect a seal, but shall not be torqued less than the minimum value required by the gasket manufacturer. Flange bolts shall not be so tight as to fracture or distort the flanges. A plain washer shall be installed under the head and nut of bolts connecting plastic pipe flanges. Anti-seize thread lubricant shall be applied to the threaded portion of all stainless steel bolts during assembly.

Flange bolt holes shall be oriented as follows, unless otherwise indicated on the spool drawings:

- **Vertical flange face:** Bolt holes to straddle the vertical centerlines.
- **Horizontal flange face:** Bolt holes to straddle plant north-south centerlines.

Pipe sealants, thread compounds, or other coatings shall not be applied to flange gaskets unless recommended by the gasket manufacturer for the specified service and approved by Engineer.

Welds at orifice flanges shall have internal surfaces ground smooth to the pipe wall.

Slip-on flanges shall be welded inside and outside. There shall be a distance of approximately 1/16 to 1/8 inch [1.5 to 3 mm] between the edge of the fillet weld and the face of the flange. The seal weld shall be applied so that the flange face shall be free of weld spatter and does not require refacing.

Flat-faced flanges shall be used when mating to Class 125 flanges. Full-face gaskets shall be used with flat-faced flanges and ring gaskets shall be used with raised faced flanges.
Weld neck flanges shall be used with butt-weld fittings. The bore of weld neck flanges shall match the pipe wall thickness.

Insulating joints connecting submerged (buried) piping to exposed piping shall be installed above the maximum water surface elevation and before the first pipe support not having coated anchor bolts or adhesive-bonded concrete anchors. All submerged (buried) metallic piping shall be isolated from the concrete reinforcement. Insulating flanges shall be tested for electrical isolation after installation and bolt-up but prior to introduction of conducting fluid.


3-3.03. Pipe. Pipe shall be installed as specified, as indicated on the drawings, or, in the absence of detail piping arrangement, in a manner acceptable to Engineer.

Piping shall be installed without springing or forcing the pipe in a manner which would induce stresses in the pipe, valves, or connecting equipment.

Piping shall be connected to equipment by flanges or unions as specified in the various piping sections. Piping connecting to equipment shall be supported by a pipe support and not by the equipment.

Piping shall be provided with a shutoff valve and union to permit isolation and disconnection of each item without disturbing the remainder of the system.

A union shall be provided within 2 feet [600 mm] of each threaded-end valve unless there are other connections which will permit easy removal of the valve. Unions shall also be provided in piping adjacent to devices or equipment which may require removal in the future and where required by the drawings or the specifications.

In all piping insulating fittings shall be provided to prevent contact of dissimilar metals, including but not limited to, contact of copper, brass, or bronze pipe, tubing, fittings, valves, or appurtenances, or stainless steel pipe, tubing, fittings, valves, or appurtenances with iron or steel pipe, fittings, valves, or appurtenances. Insulating fittings shall also be provided to prevent contact of copper, brass, or bronze pipe, tubing, fittings, valves or appurtenances with stainless steel pipe, tubing, fittings, valves, or appurtenances.

Buried PVC piping shall be "snaked" in the trench and shall be kept as cool as possible during installation. PVC pipe shall be kept shaded and shall be covered with backfill.
immediately after installation.

Piping adjacent to flow sensors shall be installed in accordance with the requirements of the manufacturer of the flow sensor and commonly accepted design practices of the appropriate straight pipe runs both upstream and downstream.

Drains required for operation are shown on the drawings. However, vents at all high points and drains at all low points in the piping that are required for complete draining for pressure test may not be shown on these drawings. Contractor shall add such items as found to be necessary during detail piping design and/or piping installation.

3-3.04. Valves. Isolation valves provided with equipment and instruments shall be located in a manner which will allow ease of access and removal of the items to be isolated. Prior to soldering or brazing valves, Teflon and elastomer seats and seals shall be removed to prevent damage.

3-4. PIPING ASSEMBLY

3-4.01. General. Contractor shall only use labor that has been qualified by training and experience to capably perform the specified activities required to accomplish the work in a satisfactory manner.


3-5. PROTECTIVE COATING. Not Used.

3-6. PRESSURE AND LEAKAGE TESTING. All specified tests shall be made by and at the expense of Contractor in the presence, and to the satisfaction of Engineer. Each piping system shall be tested for at least 1 hour with no loss of pressure. The Contractor shall coordinate this section with the Pipeline Pressure and Leakage Testing section. Piping shall be tested at the indicated pressures:

<table>
<thead>
<tr>
<th>Service</th>
<th>Test Pressure</th>
<th>Test Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Supply</td>
<td>1-1/2 times working Pressure but not less than 120 psi [828 kPa]</td>
<td>Water</td>
</tr>
</tbody>
</table>
Leakage may be determined by loss-of-pressure, soap solution, chemical indicator, or other positive and accurate method acceptable to Engineer. All fixtures, devices, or accessories which are to be connected to the lines and which would be damaged if subjected to the specified test pressure shall be disconnected and the ends of the branch lines plugged or capped as needed during the testing.

All necessary testing equipment and materials, including tools, appliances and devices, shall be furnished and all tests shall be made by and at the expense of Contractor and at the time directed by Engineer.

All joints in piping shall be tight and free of leaks. All joints which are found to leak, by observation or during any specified test, shall be repaired, and the tests repeated.

3-7. CLEANING. The interior of all pipe, valves, and fittings shall be smooth, clean, and free of blisters, loose mill scale, sand, dirt, and other foreign matter when installed. Before being placed in service, the interior of all lines shall be thoroughly cleaned, to the satisfaction of Engineer.

3-8. ACCEPTANCE. Owner reserves the right to have any section of the piping system which he suspects may be faulty cut out of the system by Contractor for inspection and testing. Should the joint prove to be sound, Owner will reimburse Contractor on a time-and-material basis as specified in the Contract. Should the joint prove to be faulty, the destructive test will continue joint by joint in all directions until sound joints are found. Costs for replacement of faulty work and/or materials shall be the responsibility of Contractor.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of miscellaneous piping and pipe accessories. Miscellaneous piping shall be furnished complete with all fittings, flanges, unions, and other accessories specified herein.

1-2. SUBMITTALS.

1-2.01. Drawings and Data. Complete specifications, data and catalog cuts or drawings shall be submitted in accordance with the submittals section. Submittals are required for all piping, fittings, gaskets, sleeves, and accessories, and shall include the following data:

   Name of Manufacturer
   Type and model
   Construction materials, thickness, and finishes
   Pressure and temperature ratings

Contractor shall obtain and submit a written statement from the gasket material manufacturer certifying that the gasket materials are compatible with the joints specified herein and are recommended for the specified field test pressures and service conditions.

1-3. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section. All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.

PART 2 - PRODUCTS

2-1. MATERIALS. Miscellaneous piping materials shall be as specified herein. 2-1.01.

Material Classification CSG-2.

| CSG-2 – Standard Weight Galvanized Steel with Threaded Fittings | Pipe | ASTM A53, Type E, standard weight, Grade A or B; or ASTM A106, of equivalent thickness, galvanized. |
distribution system piping.

| Fittings         | Malleable iron threaded, galvanized. Fittings shall conform to ANSI/ASME B16.3, Class 150, or Fed Spec WW-P-521, Type II. |

2-1.02. Material Classification SS-6.

| SS-6 – Schedule 40S with Threaded Ends. | Pipe | ASTM A312, TP316. |
| All piping associated with the combination air valves. | Fittings | Threaded, material to match pipe. Fittings shall conform to ANSI/ASME B16.3, Class 150. |
| 3 inch [50 mm] and smaller. |

PART 3 - EXECUTION

3-1. INSTALLATION. Materials furnished under this section will be installed in accordance with the Miscellaneous Piping and Accessories Installation section.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of manually operated or remote activated two position (open-close) ball valves as specified herein.

Miscellaneous ball valves shall be provided on all combination air release valve assemblies.

Piping, pipe supports, insulation, and accessories that are not an integral part of the valves or are not specified herein are covered in other sections.

1-2. GENERAL.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If the requirements in this section are different from those in the General Equipment Stipulations, the requirements in the section shall take precedence.

1-2.02. Permanent Number Plates. Not used.

1-3. SUBMITTALS. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals section. Included in the submittal shall be drawings by the valve manufacturer to indicate the position of the valve actuator and valve shaft. Submittal drawings shall clearly indicate the country of origin of all cast gray iron and ductile iron valve components.

1-4. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

PART 2 – PRODUCTS. Ball valves shall be Apollo Model 87A-900, or approved equal.

2-1. CONSTRUCTION. Ball valves shown on the drawing, but not specified herein, shall be selected to match piping material they are installed in.

2-1.01. Length Tolerance. Unless otherwise specified, the actual length of valves shall be within plus or minus 1/16 inch [1.6 mm] of the specified or theoretical length.
2-1.02. **Shop Coatings.** All ferrous metal surfaces of valves and accessories, both interior and exterior, shall be shop coated for corrosion protection. The valve manufacturer’s standard coating will be acceptable, provided it is functionally equivalent to the specified coating.

### Coating Materials

<table>
<thead>
<tr>
<th>Coating Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Varnish</td>
<td>Fed Spec TT-C-494.</td>
</tr>
<tr>
<td>Coal Tar Epoxy</td>
<td>High-build coal tar epoxy; Ameron &quot;Amercoat 78HB Coal Tar Epoxy&quot;, Carboline &quot;Bitumastic 300 M&quot;, Tnemec &quot;46H-413 Hi-Build Tneme-Tar&quot;, or Sherwin-Williams &quot;Hi-Mil Sher-Tar Epoxy&quot;.</td>
</tr>
<tr>
<td>Epoxy Enamel (for liquid service)</td>
<td>Ameron &quot;Amerlock 400 High-Solids Epoxy Coating&quot;, Carboline &quot;Carboguard 891&quot;, or Tnemec &quot;Series N140 Pota-Pox Plus&quot;.</td>
</tr>
<tr>
<td>Rust-Preventive Compound</td>
<td>As recommended by the manufacturer.</td>
</tr>
</tbody>
</table>

### Surfaces To Be Coated

#### Unfinished Surfaces

- **Exterior Surfaces of Valves To Be Buried, Submerged, or Installed in Manholes or Valve Vaults**
  - Asphalt varnish or coal tar epoxy.
- **Exterior Surfaces of all other valves**
  - Universal primer.

2-2. **VALVE ACTUATORS.** Ball valves shall be provided with manual actuator. Unless otherwise specified or indicated on the drawings, each manual actuator shall be equipped with a lever operator.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** Materials furnished under this section shall be installed in accordance with the Valve Installation section.

End of Section
SECTION 15100

VALVES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide all tools, supplies, materials, equipment, and labor necessary for furnishing, epoxy coating, installing, adjusting, and testing of all valves and appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents. Where buried valves are shown, the Contractor shall furnish and install valve boxes to grade, with covers, extensions, and position indicators.

B. The provisions of this Section shall apply to all valves and valve operators specified in the various Sections of these Specifications except where otherwise specified in the Contract Documents. Valves and operators in particular locations may require a combination of units, sensors, limit switches, and controls specified in other sections of these Specifications.

C. All below grade valves installed in water, wastewater or drainage systems owned and maintained by the Florida Keys Aqueduct Authority (FKAA) shall be equipped with identification markers/tag. All valve information shall be approved by FKAA prior to installation. Valve tags shall be 2-inch square or circular aluminum or 1/16-inch tick fiberglass manufactured by W.H. Brady B-60, Seton Name Plat Corp. Series SVT, or equal.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

   ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

   ANSI B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.

   ANSI B16.21 Nonmetallic Flat Gaskets for Pipe Flanges

   ANSI B18.21 Square and Hex Bolts and Screws - Inch Series

   ANSI/ASME B1.20.1 General Purpose Pipe Threads (Inch).


ASTM A 536 Specification for Ductile Iron Castings.

ASTM B 62 Specification for Composition Bronze or Ounce Metal Castings.


AWWA C550 Protective Interior Coatings for Valves and Hydrants.

1.03 SUBMITTALS

A. Shop Drawings: Shop drawings of all valves and operators including associated wiring diagrams and electrical data, shall be furnished as specified in Section 01300, "Submittals".

B. Data to be submitted shall include but not be limited to:

1. Catalog data consisting of specifications, assembly and installation drawings, and a parts schedule that identifies the materials to be used various parts and accessories. The illustrations shall be in sufficient detail to serve as a guide for assembly and disassembly.

2. Weight of all component parts and assembled weight.

3. Listing of all lubricants required for the equipment.

4. Spare parts and special tools.

5. Operation and maintenance manuals as required by Section “Submittals”.

1.04 QUALITY ASSURANCE

A. Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

B. Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62, or, where not subject to dezincification, to ASTM B 584.
1.05 TOOLS

A. Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2 - PRODUCTS

2.01 VALVES – GENERAL REQUIREMENTS

A. The Contractor shall furnish all valves, stem extensions, and other accessories as shown or specified. All valves shall be new and of current manufacture.

B. All valves shall have a minimum design pressure rating of 150 psi and capable of a test pressure of 300 psi. For service applications with pressures in excess of 150 psi, valves shall have a minimum pressure rating in excess of the service application working pressure.

C. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

D. Cast iron parts of valves shall meet the requirements of ASTM A 126, "Standard Specifications for Grey Iron Castings for Valves, Flanges and Pipe Fittings, Class 'B'". Flanged ends shall be flat-faced and have bolt circle and bolt patterns conforming to ANSI B16.1 Class 125 unless otherwise specified hereinafter.

E. All castings shall be clean and sound, without defects of any kind and no plugging, welding or repairing of defects will be permitted. All bolt heads and nuts shall be hexagonal conforming to ANSI B18.2.1. Gaskets shall be full face and made of natural or synthetic elastomers in conformance with ANSI B16.21 suitable for the service characteristics, especially chemical compatibility and temperature. Nonferrous alloys of various types shall be used for parts of valves as specified. Where no definite specification is given, the material shall be the recognized acceptable standard for that particular application.

F. All buried valves shall have mechanical joint pipe ends and shall be provided with cast-iron valve boxes unless otherwise indicated. Valve boxes shall be as specified elsewhere in this Section.

G. All buried valves shall have an operator shaft extension from the valve or valve operator to finish grade, a 2-inch square AWWA operating nut, and cover or box and cover as may be required.

H. Where subject to dezincification, gate valve stems shall be of bronze to ASTM B 62, containing not more than 5 percent of zinc nor more than 2 percent of
aluminum. Where dezincification is not a problem, bronze to ASTM B 584 may be used. For valve stems with a minimum tensile strength of 60,000 psi, a minimum yield strength of 40,000 psi, and an elongation of at least 10 percent in 2 inches, as determined by a test coupon poured from the same ladle from which the valve stems to be furnished are poured.

I. Except where otherwise specified, ferrous surfaces, exclusive of stainless steel surfaces, in the water passages of all valves 4 inch and larger, as well as the exterior surfaces of all submerged valves, shall receive a fusion-bonded epoxy coating in accordance with AWWA C550. Flange faces of valves shall not be epoxy coated. The Contractor, through the valve manufacturer, shall certify in writing that such coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with these Specifications.

2.02 OPERATORS, GENERAL

A. Valves and gates shall be furnished with operators, provided by the valve or gate manufacturer. All operators of a given type shall be furnished by the same manufacturer. All valve operators, regardless of type, shall be installed, adjusted, and tested by the valve manufacturer at the manufacturing plant. Operator orientation shall be verified with the Engineer prior to installation. If this requirement is not met, changes to orientation shall be made at no additional cost.

B. All operators, unless otherwise specified, shall turn counter-clockwise to open. Operators shall have the open direction clearly and permanently marked. All valve operators, manual, electric and pneumatic, shall be provided with the valve by the valve manufacturer. The Contractor, through the valve manufacturer, shall be solely responsible for the selection of the proper operator to meet the operating conditions specified herein. Field calibration and testing of the operators and valves to ensure a proper installation and an operating system shall be the responsibility of the Contractor.

C. All manual operators shall have levers or handwheels, unless otherwise shown. Where buried, the valves shall have extensions with square nuts or floor stands. Valves mounted higher than 6 feet above floor or operating level shall have chain operators. Chains shall extend to within three (3) feet from operating floor. Unless otherwise shown or specified, valves of sizes 4-inch and larger shall have gear-assisted operators. Valves over five (5) feet to center line shall be rolled toward the operating side to make the handwheel or wrench more accessible.

D. Operation of valves and gates shall be designed so that the effort required to operate the handwheel, lever or chain shall not exceed 40 pounds applied at the extremity of the wheel or lever. The handwheels on valves 14 inches and smaller shall not be less than 8 inches in diameter, and on valves larger than 14 inches the handwheel shall not be less than 12 inches in diameter.
E. Chainwheel operator shall be fabricated of malleable iron and pocketed type chainwheels with chain guards and guides. Chainwheel operators shall be marked with an arrow and the word "open" indicating direction to open. The operators shall have galvanized smooth welded link type chain. Chain that is crimped or has links with exposed ends shall not be acceptable.

F. Floor stands shall be cast iron, non-rising stem type with lockable hand wheel operator, valve position indicator and steel extension stem. Hand wheel shall be lockable in the full closed position. The floor stand shall be furnished with an armored padlock and six keys. Lock shall be as manufactured by Master, Schlage or equal. Floor stand shall be standard pattern type as manufactured by Clow Corporation, or equal.

2.03 VALVE BOXES

A. Valve boxes shall be of the adjustable telescope type, cast iron, suitable to withstand heavy traffic. They shall be Model No. F-2452, as manufactured by James B. Clow & Sons, Mueller, U.S. Foundry No. 7615, No. 7630, or approved equal. The covers shall be marked as indicated on the Detail Drawings or other depending on service.

B. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by the Engineer. The boxes shall be installed perpendicularly, centered around and covering the upper portions of the valve or valve operator, or the pipe.

C. Valve boxes shall be provided with concrete base and valve nameplate with suitable anchors for casting in concrete. Nameplate shall be 3-inch diameter bronze disk with raised lettering 1/8-inch high as manufactured by Wagco Markers; or equal.

D. The interior and exterior surfaces of valve boxes shall be coated with asphalt.

2.04 BRONZE BALL VALVES

A. Bronze

1. Ball valves for service unless otherwise indicated shall be end entry type with bronze body and trim, TFE seats, TFE or Viton Stem seals and flanged or threaded end connections as indicated.

   a. Valve body shall be either two or three piece design; no design with an internal retaining ring for the ball shall be acceptable.

   b. Valves shall be Class 150.

   c. Valves shall be as manufactured by Hills McCanna, or equivalent by Jamesbury, WKW, Whitey, NIBCO, or Watts Regulator
d. Valves shall be supplied with manual lever or "T" handle.
e. Valves shall be non-lubricated, and capable of sealing in either flow direction.

B. Stainless Steel

1. Ball valves for use with stainless steel piping systems, including air lines release lines and moisture drains, shall be end entry type with type 316 stainless steel body and trim, TFE seats and seals and flanged or threaded connections as indicated.
   a. Valve body shall be either two or three piece design. No internal ring for the ball shall be acceptable.
   b. Valves shall be class 150.
   c. Valves shall be McCannaflot series 602 by Hills McCanna or equivalent models by Jamesbury, WKM or Whitey.
   d. Valves shall be supplied with manual lever or "T" handle.
      1) Valves used as moisture drain valves shall be installed at low points of the line and plugged or capped.

2.05 PLUG VALVES

A. Eccentric plug valves, 1/2 inch through 3 inches, shall be non lubricated type. Minimum pressure rating shall be 175 psi. Bodies shall be made of cast iron per ASTM A 126, Class B. Ends shall be threaded or flanged (ASNI B16.1, Class 125). Plug shall be cast iron (ASTM A 1-26, Class B) with neoprene coating. Body capscrews and bolts and nuts shall be Type 316 stainless steel. Packing shall be nitrile butadiene-filled Teflon. Valves shall be DeZurik Figure 118, Clow, Pratt "Ballcentric," or equal.

B. Eccentric plug valves, 4 inches through 12 inches, shall be nonlubricated type. Minimum pressure rating shall be 175 psi. Bodies shall be cast iron per ASTM A 126, Class B. Ends shall be flanged, Class 125 per ANSI B 16.1. Plugs shall be cast iron (ASTM A 126, Class B), or ductile iron (ASTM A 536, Grade 65-45-12) with neoprene facing. Valve body seats shall be Type 304 or 316 stainless steel or have a raised welded-in overlay at least 1/8-inch thick of not less than 90% nickel. Body capscrews and bolts and nuts shall be Type 316 stainless steel. Packing shall be butadiene-filled Teflon. Provide 100% port area. Valves shall be DeZurik Figure 118, Clow F-5412, Milliken "Millcentric," or equal.

C. Valve ends shall be flanged (or grooved end couplings) or mechanical joint for above ground and underground installation, respectively. Valve body seats shall have a welded-in overlay of not less than 90-percent nickel for all parts, which
comes in contact with the plug face. Packing shall be safely adjustable and replaceable without removing the valve from service, with the body pressurized to its full rated pressure. Bearings shall be permanently lubricated 316 stainless steel in both upper and lower journals in accordance with AWWA Standard C-507. The valve supplied shall have drip tight shut off with flow in either direction at the full pressure rating of the valves. All exposed nuts, bolts, springs and washers on buried and on above ground outdoor service valves shall be 316 stainless steel.

D. Plug coating shall be Teflon or nylon, permanently bonded to the plug. Body, gland, and cover cap screws and bolts and nuts shall be Type 316 stainless steel. Provide operating for buried valves.

E. Valves shall be bolted design and be provided with lever operators for interior and exposed service with nominal pipe sizes six (6) inches and less.

F. Interior and exposed service with nominal pipe sizes eight (8) inches and larger shall be provided with totally enclosed worm gear actuators with permanently lubricated bronze bearings. The actuators shall be properly sized to suit the maximum differential across the valve in either direction.

G. For buried or submerged service, valves shall be provided with an AWWA operating nut. Valves with nominal pipe sizes eight (8) inches and larger shall have permanently lubricated totally enclosed worm gear actuators.

H. Flanged valves shall be faced and drilled conforming to ANSI B16.1 Class 125. Mechanical joint bells shall conform to AWWA C111. Threaded ends shall conform to the NPT Standard.

I. All exposed nuts, bolts, springs, washers, etc. shall by type 316 stainless steel.

J. Valves shall have the standard face to face dimensions of AWWA gate valves for nominal pipe sizes three (3) to twelve (12) inches with flanged end connection.

K. Valve bodies and plugs shall be semi-steel conforming to the requirements of ASTM A126 Grade B cast iron. Plugs shall be covered with neoprene for general service.

L. Valve seats shall be corrosion resistant consisting of a welded-in overlay of 90 percent pure nickel.

M. Valve bearings shall be replaceable type 316 stainless steel for both the upper and lower journals.

N. Shaft seals shall be multiple ring V-Type Buna-N packing. The stuffing box shall be designed to allow the packing to be adjusted and replaced when the valve is in service.
O. Where required, valve operators shall be provided with extension bonnets.

2.06 **SWING CHECK VALVES (3-INCH AND LARGER) FOR LIQUID SERVICE**

A. Unless otherwise indicated or specified, check valves 3-inches and larger shall be cushion swing check with outside lever and weights. Valves shall have Class 125 flanged ends faced and drilled in accordance with ANSI Standard. Check Valves shall have cast iron bodies, with the following components of stainless steel: body ring, disc ring, clapper hinge shaft, high shaft key, clapper spacers, disc stud, disc stud nut and bushing, disc retaining washer and cotter pin. The hinge pin shall extend outside the cast iron body through lubricated stainless steel bushings and outside packed glands on each side of the valve. Each bushing shall be provided with a button head grease fitting. Stainless steel shall be at least 18-8 nickel-chromium content. Check valves shall be tested at the factory and shall be drip tight under a hydrostatic pressure of 200 psi applied to the downstream side of the disc. A certified test report shall be furnished with each valve.

B. Suppliers, or Equal
   1. APCO; Series 6000
   2. G.A. Industries

2.07 **SWING CHECK VALVES (2-1/2-INCH AND SMALLER) FOR LIQUID SERVICE**

A. Swing check valves for steam, water, oil, or gas in sizes 2-1/2-inch and smaller shall be suitable for a steam pressure of 150 psi and a cold water pressure of 300 psi. They shall have screwed ends, unless otherwise shown, and screwed caps.

B. The valve body and cap shall be of bronze to ASTM B 61 with threaded ends to ANSI/ASME BI.20.1.

C. Valves for steam service shall have bronze discs, and for cold water, oil, and gas service replaceable composition discs.

D. The hinge pins shall be of bronze or stainless steel.

E. Suppliers or Equal
   1. Crane Company.
   3. Stockham Valves and Fittings
5. APCO; Series 800T.

6. NIBCO

2.08 SLANTING DISC CHECK VALVE

A. Where indicated on the Drawings, check valve shall be slanting disc type. The body shall be heavy two piece cast iron, not fabricated steel. The two (2) body halves and body seat shall be a-ring sealed and bolted together in a manner to sandwich the body seat on 55 degree angle. Each body half must have an access covered hole for internal inspection, and each body half and disc shall be fully machined to accept attachment of a Top Mounted Oil Dash Pot. The seat ring and disc ring must be of the design that permits replaceability in the field without need for special tools of machining. The pivot pins in the body and the bushings, in the disc lugs, must be stainless steel, but of different hardnnesses to prevent galling. The bushings shall be press fit to prevent wear. An indicator shall be provided to show the position of the disc. The area throughout the valve body must be equal to full pipe area. The area thru the seat section shall be 40% larger than the inlet and outlet of the valve to achieve lowest head loss.

B. Valve materials shall be certified conforming to the following A.S.T.M. specifications.

<table>
<thead>
<tr>
<th>Part</th>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bodies</td>
<td>Cast Iron</td>
<td>ASTM A126 GR.B</td>
</tr>
<tr>
<td>Disc (2&quot; thru 10&quot;)</td>
<td>Bronze</td>
<td>ASTM B584 C83700</td>
</tr>
<tr>
<td>Disc (12&quot; &amp; larger)</td>
<td>Ductile Iron</td>
<td>ASTM A536</td>
</tr>
<tr>
<td>Seat Ring &amp; Disc Ring</td>
<td>Bronze</td>
<td>ASTM A271 C92200</td>
</tr>
<tr>
<td>Pivot Pins (2&quot; thru 10&quot;)</td>
<td>Aluminum Bronze</td>
<td>ASTM B 150 Alloy 2</td>
</tr>
<tr>
<td>Pivot Pins (12&quot; &amp; larger)</td>
<td>Stainless Steel</td>
<td>ASTM A582 T303</td>
</tr>
<tr>
<td>Pivot Pin Bushings</td>
<td>Stainless Steel</td>
<td>ASTM A269 T304</td>
</tr>
<tr>
<td>Exterior Paint</td>
<td>Phenolic Primer</td>
<td>FDA Approved for</td>
</tr>
<tr>
<td></td>
<td>Red Oxide</td>
<td>Potable Water Contact</td>
</tr>
</tbody>
</table>

C. Each valve shall have a top mounted oil dashpot to control opening and closing cycle of the valve in order to prevent surge and water hammer. Dashpot must have two (2) control flow rates: (1) 90% rapid rate; (1) 10% slow rate during shut-down and start-up. Each rate shall be infinitely and independently adjustable. The dashpot must be a self contained oil system, separate and independent from the water line media. The oil reservoir for closing cycle shall be open to atmosphere with an air breather cap to prevent dust and other media from contaminating the oil. The oil reservoir for opening cycle must be hermetically
sealed to contain pressure if necessary (air over oil) and be equipped with a pressure gauge and pneumatic air valve.

D. Valves shall be provided with electrical signal switches mounted on the indicator cover to give remote signal indicating if the valve disc is closed.

E. Suppliers, or Equal
   1. APCO; Series 800T

2.09 STAINLESS STEEL BALL VALVES

A. Ball valves for use with stainless steel piping systems, including instrument isolation, air lines, and moisture drains shall be end entry type with type 316 stainless steel body and trim, Teflon seats and seals and flanged or threaded connections as indicated. Valve body shall be either two or three piece design, no internal ring for the ball shall be acceptable. Valves shall be class 150, ASTM A479 GR 316 or ASTM A351 GR CF8M, rated 1,000-pound WOG.

B. Valves shall be supplied with stainless steel manual lever or "T" handle. Valves used as moisture drain valves shall be installed at low points of the line and piped to drain.

C. Suppliers, or Equal
   1. Janesbury Corporation;
   2. Jenkins Bros.;
   3. Lunkenheimer Flow Control;
   4. Wm. Powell Company;
   5. Worcester Controls;
   6. Swagelock Series 40 (instrument isolation) or Series 60 (SS Ball Valve).

2.10 RESILIENT-SEATED GATE VALVES

A. Gate Valves three inches and larger shall be resilient seated or resilient wedge gate valves for 150 psi working pressure, conforming to AWWA Standard C-509. The gate valves shall have a high strength bronze non-rising stem. Valves shall have neoprene, Buna-N or equal, but not natural rubber, O-ring stem seals (compatible with chloramines) and be of a design that permits the replacement of the O-ring seals while the valve is in service, without undue leakage. All exposed bolts used with valves shall be AISI Type 304 stainless steel. The valves shall operate in a vertical position with a vertical operating nut shaft and shall be suitable for buried service. The valves shall open by turning the operating nut
counterclockwise. Operating nuts shall be AWWA two inch square nuts with skirts. Valve body, bonnet, and gate shall be ductile iron conforming to ASTM-A536. The gate valves for distribution systems shall be designed for 150 psi working water pressure rating. Gate valves for connection to the high pressure transmission mains and installed between the transmission mains and pressure reducing valves, shall be designed for 250 psi working pressure and 400 psi test pressure and shall be furnished with two Class 250 flanges.

B. Suppliers, or Equal
   1. American Flow Control (Series 2500);
   2. Clow Corporation;
   3. Kennedy Valve Mfg. Co., (ITT Grinnell);
   4. Mueller Company;

2.11 GATE VALVES (SMALLER THAN 3-INCH)

A. Gate valves, smaller than 3-inch, for general purpose use shall be heavy duty type for industrial service, with threaded or soldered ends to suit piping. The bodies shall have threaded tops or union bonnets, of bronze to ASTM B 62, with bronze stems, solid wedges, metal handwheels, and Teflon-impregnated or other acceptable packing. Buried valves shall have non-rising stems. Exposed valves (above ground) shall have rising stems. All valves shall have a minimum pressure rating of 125 psi steam, or 200 psi cold water, unless otherwise specified or shown.

B. Suppliers, or Equal
   1. Crane Company;
   2. Milwaukee Valve Company;
   3. Wm. Powell Company;
   4. Stockham Valves and Fittings.

2.12 TAPPING SLEEVE AND VALVE

A. Tapping sleeves shall be ASTM 285 Grade C Steel or ASTM A-36 Carbon Steel with Fusion applied epoxy coating (AWWA C213-70). Tapping Sleeves shall utilize AISI Type 304 (ASTM A320 Grade B8) stainless steel bolts and nuts. Tapping Sleeves shall be as manufactured by JCM Industries Model 412, Romac Industries Model FTS420, or approved equal.

B. Tapping valves shall be as specified for gate valves, hereinabove, and as further
specified herein. Tapping valves for use in tapping distribution mains shall be resilient seat gate valves. Inlet shall be Class 125, ANSI B16.1, ductile iron flange with centering ring to match tapping sleeve. Outlet shall be a mechanical joint. Tapping valve shall be compatible for use with drilling machine. Operating nut shall be 2" square and open to the left. Tapping valves shall be attached to tapping sleeves with heavy hex-head AISI Type 316 (ASTM A320 Grade B8) stainless steel bolts. Approved tapping valves include: American Flow Control Series 2500 or approved equal.

2.13 AIR RELEASE VALVES

A. Refer to Section 15108.

2.14 AIR/VACUUM VALVE

A. Refer to Section 15108.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

A. All valves and appurtenances shall be installed in accordance with the manufacturer’s written instructions and in the locations shown, true to alignment and rigidly supported. Any damage to the valves and appurtenances shall be repaired to the satisfaction of the Engineer before they are installed.

B. All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or handrails.

C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location, and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

D. Valve boxes with concrete bases shall be installed as shown on the Drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box.
3.02 TESTING

A. All valves shall be hydrostatically field tested at the specified pipeline test pressures specified in the piping sections. Any leakage or “sweating” of joints shall be stopped and all joints shall be tight.

END OF SECTION
Section 15101

AWWA BUTTERFLY VALVES

PART 1 - GENERAL

1-1. **SCOPE.** This section covers furnishing AWWA butterfly valves for cold water service. All other butterfly valves are specified in the Industrial Butterfly Valves section.

AWWA butterfly valves shall be furnished complete with actuators and accessories as specified herein, and as specified in the Valve and Gate Actuators section.

1-2. **GENERAL.** Equipment provided under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Valves shall be furnished with all necessary parts and accessories indicated on the drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

1-2.01. **General Equipment Stipulations.** The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. **Governing Standard.** Except as modified or supplemented herein, all butterfly valves and manual actuators shall conform to the applicable requirements of ANSI/AWWA C504.

1-2.03. **Marking.** Supplementing the requirements of Section 6.1 of the governing standard, the country of origin of all castings and an identifying serial number shall be stamped on a corrosion-resistant plate attached to the valve body.

1-2.04. **Temporary Number Plates.** Not used.

1-2.05. **Permanent Number Plates.** Not used.

1-3. **SUBMITTALS.** Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals section. Included in the submittal shall be drawings by the valve manufacturer to indicate the position of the valve actuator and valve shaft. Submittal drawings shall clearly indicate the country of origin of all cast gray iron and ductile iron valve components.
Certified copies of test results as required by Section 5 of ANSI/AWWA C504, with an affidavit of compliance as indicated in Section 6.3 of C504, shall be submitted to Engineer before the valves are shipped.

1-4. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

PART 2 - PRODUCTS

2-1. ACCEPTABLE PRODUCTS. Butterfly valves shall be limited to the manufacturers listed below. Sizes and styles for the manufacturers shall be as indicated, without exception:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Acceptable Sizes and Styles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pratt</td>
<td>HP-250 Butterfly Valve, 250#, Flanged Ends</td>
</tr>
</tbody>
</table>

2-2. MATERIALS. Except as modified or supplemented herein, materials used in the manufacture of butterfly valves shall conform to the requirements of ANSI/AWWA C504.

Acceptable shop coatings are listed in the following table.

<table>
<thead>
<tr>
<th>Coal Tar Epoxy</th>
<th>High-build coal tar epoxy; Ameron &quot;Amercoat 78HB Coal Tar Epoxy&quot;, Carboline &quot;Bitumastic 300 M&quot;, Tnemec &quot;46H-413 Hi-Build Tneme-Tar&quot;, or Sherwin- Williams &quot;Hi-Mil Sher-Tar Epoxy&quot;.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epoxy</td>
<td>Ameron “Amercoat 400 High Solids Epoxy”, Carboline “Carboguard 891”, or Tnemec “Series N140 Pota-Pox Plus”.</td>
</tr>
</tbody>
</table>
Rust-Preventive Compound       As recommended by manufacturer.

2-3. VALVE CONSTRUCTION.

2-3.01. Valve Bodies. Valves shall be short-body type unless otherwise specified. The use of a stop or lug cast integrally with or mechanically secured to the body for the purpose of limiting disc travel by means of direct contact or interference with the valve disc (in either the open or closed position) will not be acceptable.

2-3.02. Flanges. Flanges shall be finished to true plane surfaces within a tolerance limit of 0.005 inch [125 µm]. The finished face shall be normal to the longitudinal valve axis within a maximum angular variation tolerance of 0.002 inch per foot (0.017 percent) of flange diameter.

2-3.03. Mechanical Joint Ends. Mechanical joint ends shall be either mechanical joint or push-on ends conforming to ANSI/AWWA C111/A21.11 with elastomeric synthetic rubber gaskets. Gaskets of natural rubber will not be acceptable. For Potable Water service, gaskets shall be EDPM for chloramine resistance.

2-3.04. Valve Shafts. Valve shafts shall be fabricated of AISI Type 304 or 316 stainless steel. The use of shafts having a hexagonal cross section will not be acceptable. The connection between shaft and disc shall be in accordance with ANSI/AWWA C504.

The connection between the shaft and the disc shall be mechanically secured by means of solid, smooth sided, stainless steel or monel taper pins or dowel pins. Each taper pin or dowel pin shall extend through or shall wedge against the side of the shaft and shall be mechanically secured in place. The use of set screws, knurled or fluted dowel pins, expansion pins, roll pins, tension pins, spring pins, or other devices instead of the pins specified herein will not be acceptable.

2-3.05. Valve Seats. Acceptable seating surfaces mating with rubber are AISI Type 304 or 316 stainless steel, monel, or plasma-applied nickel-chrome overlay for all valves; bronze for 20 inch [500 mm] and smaller valves; and alloy cast iron for 20 inch [500 mm] and smaller manually operated valves.

Seats shall be located on the valve body. Valve seat configurations which rely on the mating pipe flange to hold the seat in position in the valve body will not be acceptable.

2-3.06. Shaft Seals. Shaft seals shall be of the chevron type.

2-3.07. Thrust Bearings. Each valve shall be provided with one or more thrust bearings in accordance with the governing standard. Thrust bearings which are directly exposed to line liquid and which consist of a metal bearing surface in rubbing contact with an opposing metal bearing surface will not be acceptable.
2-4. **VALVE ACTUATORS.** Requirements for valve actuators shall be as specified herein and as specified in the Valve and Gate Actuators section. Valve actuators shall be manual types.

All 8 inch [200 mm] and larger valves shall have geared actuators.

If valves with an AWWA class designation higher than specified are furnished, actuator torque capabilities shall be increased accordingly and be acceptable to Engineer.

2-4.01. **Actuator Sizing.** The valve manufacturer shall size the actuator in accordance with AWWA C504, and the valve manufacturer's requirements.

Unless otherwise indicated or specified, actuator torque requirements shall be based on a maximum differential pressure across the valve equal to the valve class and a maximum velocity through the valve of 16 feet per second [4.9 m/s].

Valves with operating stands shall have actuator torques increased by 25 percent. Actuator torques determined by the above requirements shall be increased by any safety factors required by AWWA C504, paragraphs 4.5.8.6.1 and 4.5.8.7 or indicated or specified herein.

2-5. **SHOP PAINTING.** All interior and exterior ferrous metal surfaces, except finished surfaces, bearing surfaces, and stainless steel components, of valves and accessories shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting. Epoxy enamel coatings shall be ANSI/NSF 61 certified.

Surfaces shall be painted as follows: Unfinished

<table>
<thead>
<tr>
<th>Surfaces</th>
<th>Coating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Surfaces</td>
<td>Epoxy enamel.</td>
</tr>
<tr>
<td>Exterior Surfaces of Valves To Be Buried</td>
<td>Coal tar epoxy.</td>
</tr>
<tr>
<td>Exterior Surfaces of Valves to Be Submerged, or Installed in Manholes or Valve Vaults</td>
<td>Epoxy enamel.</td>
</tr>
<tr>
<td>Exterior Surfaces of All Other Valves</td>
<td>Universal primer.</td>
</tr>
<tr>
<td>Polished or Machined Surfaces</td>
<td></td>
</tr>
</tbody>
</table>
Flange Faces  
Rust-preventive compound.

Other Surfaces  
Epoxy enamel.

Interior coatings shall comply with AWWA C550 and shall be free of holidays. The total dry film thickness of shop-applied coatings shall be not less than:

<table>
<thead>
<tr>
<th>Type of Coating</th>
<th>Minimum Dry Film Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal Tar Epoxy</td>
<td>15 mils [380 µm]</td>
</tr>
<tr>
<td>Epoxy Enamel</td>
<td>10 mils [250 µm]</td>
</tr>
<tr>
<td>Universal Primer</td>
<td>3 mils [75 µm]</td>
</tr>
</tbody>
</table>

2-6. ACCESSORIES. Requirements for extension stems and stem guides, position indicators, floor boxes, operating stands, torque tubes, valve boxes, and extension bonnets shall be as specified in the Valve and Gate Actuators section.

PART 3 - EXECUTION

3-1. INSTALLATION. Valves will be installed in accordance with the Valve Installation section.

3-1.01. Installation Check. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation in accordance with Startup Requirements section, and shall revisit the job site as often as necessary until any problems are corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping and appurtenances; and has been operated under full load conditions and that it has operated satisfactorily.

All costs for these services shall be included in the contract price.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing, combination air valves, as required by the Work.

1-2. GENERAL. Equipment provided under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Valves shall be furnished with all necessary parts and accessories indicated on the drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Governing Standard. Except as modified or supplemented herein, all valves furnished under this section shall conform to the applicable requirements of AWWA C512.

1-2.03. Permanent Number Plates. Not used.

1-3. SUBMITTALS. Complete assembly drawings, together with detailed specifications and data covering materials used and accessories forming a part of the valves furnished, shall be submitted in accordance with the Submittals section.

1-4. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

PART 2 - PRODUCTS

2-1. CONSTRUCTION. Three inch [75 mm] and smaller combination air valves shall be of the integral type with a valve assembly which functions as both an air and vacuum valve and an air release valve. The valves shall be Val-Matic.
Combination Air Valves, Model number 202C.2, or approved equal. A Val-Matic Floodsafe valve, Model number 1302 with optional bracket SPK-1302-80 shall be provided with each combination air valve, no exceptions.

Six inch [150 mm] combination air valves shall be of the integral type with a valve assembly which functions as both an air and vacuum valve and an air release valve. The valves shall be Val-Matic Combination Air Valves, Model number 256C, no exceptions.

2-2. MATERIALS. Except as modified or supplemented herein, materials of construction shall comply with the governing standard. The use of stressed thermoplastic components will not be acceptable.

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve Trim</td>
<td>Bronze or austenitic stainless steel.</td>
</tr>
<tr>
<td>Float</td>
<td>Austenitic stainless steel.</td>
</tr>
<tr>
<td>Shop Coatings</td>
<td></td>
</tr>
<tr>
<td>Medium Consistency</td>
<td>Carboline &quot;Bitumastic 50&quot; or Tnemec &quot;46-465 H.B. Tnemecol&quot;.</td>
</tr>
<tr>
<td>Coal Tar</td>
<td></td>
</tr>
<tr>
<td>Epoxy</td>
<td>Carboline &quot;Carboguard 891&quot; or Tnemec &quot;Series N140 Pota-Pox Plus.&quot;</td>
</tr>
<tr>
<td>Rust-Preventive</td>
<td>As recommended by manufacturer.</td>
</tr>
<tr>
<td>Compound</td>
<td></td>
</tr>
</tbody>
</table>

2-3. SHOP PAINTING. All interior and exterior ferrous metal surfaces, except stainless steel components, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field coating. Field painting is covered in the Protective Coatings section.

Surfaces shall be painted as indicated:

<table>
<thead>
<tr>
<th>Surface Description</th>
<th>Paint Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Surfaces</td>
<td>Epoxy.</td>
</tr>
<tr>
<td>Exterior Surfaces of Valves To Be Installed in Manholes or Valve Vaults</td>
<td>Coal tar epoxy.</td>
</tr>
<tr>
<td>Exterior Surfaces of All Other Valves</td>
<td>Universal primer.</td>
</tr>
<tr>
<td>Polished or Machined Surfaces</td>
<td>Rust-preventive compound.</td>
</tr>
</tbody>
</table>
Interior epoxy coatings shall comply with AWWA C550 and shall be free of holidays. The total dry film thickness of shop-applied coatings shall be not less than:

<table>
<thead>
<tr>
<th>Type of Coating</th>
<th>Minimum Dry Film Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Consistency Coal Tar</td>
<td>15 mils [380 µm]</td>
</tr>
<tr>
<td>Epoxy</td>
<td>10 mils [250 µm]</td>
</tr>
<tr>
<td>Universal Primer</td>
<td>3 mils [75 µm]</td>
</tr>
</tbody>
</table>

2-4. SHUTOFF VALVES. A shutoff valve shall be provided in the piping leading to each air release valve and combination air valve. Each 4 inch [100 mm] and larger combination air valve shall be provided with a shutoff valve between the air and vacuum valve and the air release valve.

PART 3 - EXECUTION

3-1. INSTALLATION. Air release and combination air valves will be installed in accordance with the Valve Installation section. Air release and combination air valves will be installed in Guard Shack Enclosure/ S.S.(Stainless Steel) N Pattern, Model No. CGS-NP-1. Powder coat finish in Forest Green.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing manual and powered valves and gate actuators and accessories as specified herein.

1-2. GENERAL. Equipment provided under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Actuators shall be furnished with all necessary parts and accessories indicated on the drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of actuators.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Governing Standards. Except as modified or supplemented herein, all powered actuators shall conform to applicable requirements of ANSI/AWWA C540.

Except as modified or supplemented herein, all manual and cylinder actuators for butterfly and eccentric plug valves shall conform to the applicable requirements of ANSI/AWWA C504.

Except as modified or supplemented herein, all manual actuators for ball valves shall conform to the applicable requirements of ANSI/AWWA C507.

Except as modified or supplemented herein, all manual actuators for sluice and slide gates shall conform to the applicable requirements of ANSI/AWWA C560.

1-2.03. Power Supply. Not used.

1-2.04. Marking. Each actuator shall be marked with the manufacturer's name, model number, and the country of origin. An identifying serial number shall be stamped on a corrosion-resistant plate attached to the actuator.
1-2.05. **Temporary Number Plates.** Each actuator shall be factory tagged or marked to identify the actuator and the applicable valve or gate by number or service as indicated in the valve or gate schedule.

1-3. **SUBMITTALS.** Complete drawings, details, and specifications covering the actuators and their appurtenances shall be submitted in accordance with the Submittals section. Submittal drawings shall clearly indicate the country of origin of each actuator and its components.

The drawings shall include separate wiring diagrams for each electrically operated or controlled actuator and the electrical control equipment. Each actuator drawing shall be identified with the respective valve number or name.

For electric or cylinder actuators, certified copies of reports covering proof-of-design testing of the actuators as set forth in Section 5 of ANSI/AWWA C540, together with an affidavit of compliance as indicated in Section 6.3 of ANSI/AWWA C540, shall be submitted to Engineer before the actuators are shipped.

1-4. **DELIVERY, STORAGE, AND HANDLING.** Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

**PART 2 - PRODUCTS**

2-1. **PERFORMANCE AND DESIGN REQUIREMENTS.**

2-1.01. **General.** Actuators and appurtenances shall be designed for the conditions and requirements as indicated in the respective valve and gate sections.

Liberal factors of safety shall be used throughout the design, especially in the design of parts subject to intermittent or alternating stresses. In general, working stresses shall not exceed one-third of the yield point or one-fifth of the ultimate strength of each material.

2-1.02. **Valve Actuators.** Each actuator shall be designed to open or close the valve under all operating conditions. Actuators shall be designed for the maximum pressure differential across the valve and maximum velocities through the valve where indicated in the respective valve schedules.

Valve actuators shall be provided and adjusted by the valve manufacturer. Actuator mounting arrangements and positions shall facilitate operation and maintenance and shall be determined by the valve manufacturer unless indicated otherwise on the drawings or directed by Engineer.
When valves are to be buried, submerged, or installed in vaults, the actuators and accessories shall be sealed to prevent the entrance of water. The design water depth shall be as indicated in the respective valve schedules but not less than 20 feet [6.1 m].

2-1.03. Gate Actuators. Not Used.

2-2. MATERIALS. Except as modified or supplemented herein, materials used in the manufacture of actuators shall conform to the requirements of ANSI/AWWA C504 and C540.

2-3. VALVE MANUAL ACTUATORS.

2-3.01. General. Manual actuators of the types listed in the valve specifications or schedules shall be provided by the valve manufacturer.

Unless otherwise indicated or specified, each geared manual actuator shall be equipped with a wrench nut.

The direction of rotation of the wheel, wrench nut, or lever to open the valve shall be to the left (counterclockwise). Each valve body or actuator shall have cast thereon the word "Open" and an arrow indicating the direction to open.

The housing of traveling-nut type actuators shall be fitted with a removable cover which shall permit inspection and maintenance of the operating mechanism without removing the actuator from the valve. Travel limiting devices shall be provided inside the actuator for the open and closed positions. Travel limiting stop nuts or collars installed on the reach rod of traveling-nut type operating mechanisms shall be field adjustable and shall be locked in position by means of a removable roll pin, cotter pin, or other positive locking device. The use of stop nuts or adjustable shaft collars which rely on clamping force or setscrews to prevent rotation of the nut or collar on the reach rod will not be acceptable.

Each actuator shall be designed so that shaft seal leakage cannot enter the actuator housing.

Valves for throttling service shall be equipped with an infinitely variable locking device or a totally enclosed gear actuator.

Actuators shall produce the required torque with a maximum pull of 80 lbs [356 N] on the lever, handwheel, or chain. Actuator components shall withstand, without damage, a pull of 200 lbs [890 N] on the handwheel or chainwheel or an input of 300 foot-lbs [407 J] on the operating nut.

2-3.02. Handwheels. Handwheel diameters shall be at least 8 inches [200 mm] but not more than 24 inches [600 mm] for 30 inch [750 mm] and smaller valves and not more than 30 inches [750 mm] for 36 inch [900 mm] and larger valves.
2-3.03. **Levers.** Levers shall be capable of being locked in at least five intermediate positions between fully open and fully closed. In any building or structure containing lever operated valves, at least two operating levers shall be provided for each size and type of lever operated valve.

2-3.04. **Wrench Nuts.** Unless otherwise specified in the valve schedules or on the drawings, wrench nuts shall be provided on all buried valves and on all valves that are to be operated through floor boxes. Unless otherwise directed by Owner, all wrench nuts shall comply with Section 4.4.13 of AWWA C500. At least two operating keys shall be furnished for operation of the wrench nut operated valves.

2-4. **GATE MANUAL ACTUATORS.** Not used.

2-5. **PROGRAMMABLE ELECTRIC ACTUATORS.** Not used.

2-6. **STANDARD ELECTRIC ACTUATORS.** Not used.

2-7. **HYDRAULIC CYLINDER ACTUATORS.** Not used.

2-8. **AIR CYLINDER ACTUATORS.** Not used.

2-9. **AIR-OIL CYLINDER ACTUATORS.** Not used.

2-10. **PORTABLE ELECTRIC ACTUATORS.** Not used.

2-11. **PORTABLE HYDRAULIC ACTUATORS.** Not used.

2-12. **ACTUATOR ACCESSORIES.**

2-12.01. **Extension Stems.** Extension stems and stem guides shall be furnished when indicated in the respective valve schedules, indicated on the drawings, or otherwise required for proper valve operation. Extension stems shall be of solid steel and shall be not smaller in diameter than the stem of the actuator shaft. Extension stems shall be connected to the actuator with a single Lovejoy “Type D” universal joint with grease-filled protective boot. All stem connections shall be pinned.

At least two stem guides shall be furnished with each extension stem, except for buried valves. Stem guides shall be of cast iron, bronze bushed, and adjustable in two directions. Stem guide spacing shall not exceed 100 times the stem diameter or 10 feet [3 m], whichever is smaller. The top stem guide shall be designed to carry the weight of the extension stem. The extension stem shall be provided with a collar pinned to the stem and bearing against the stem thrust guide.

Extension stems for buried valve actuators shall extend to within 6 inches [150 mm] of the ground surface, shall be centered in the valve box using spacers, and shall be equipped with a wrench nut.
Extension stems for buried valve actuators shall be provided with position indicators as specified in the valve schedules.

2-12.02. **Position Indicators.** Unless otherwise specified, each valve actuator shall be provided with a position indicator to display the position of the plug or disc relative to the body seat opening.

For quarter turn plug, ball, or cone type valves installed in interior locations, the indicating pointer shall be mounted on the outer end of the valve operating shaft extension and shall operate over an indicating scale on the operating mechanism cover. Where the shaft passes through the cover, a suitable stuffing box or other seal shall be provided to prevent the entrance of water.

Each actuator for butterfly valves, except where located in manholes, buried, or submerged, shall have a valve disc position indicator mounted on the end of the valve shaft. A disc position indicator shall also be provided on each operating stand or the actuator mounted thereon.

2-12.02.01. **Position Indicators for Buried Actuators.** Each buried valve actuator shall be equipped with a position indicator. Position indicators shall be Indico "Model 179 Valve Position Indicators" manufactured by the Mills Engineering Company, Needham Heights, Massachusetts, or "Diviner" ground level position indicator manufactured by the Henry Pratt Company, Aurora, Illinois. Each indicator assembly shall be designed for installation on the extension stem connected to the operating stem of the buried actuator mechanism and shall be mounted in the top section of the valve box beneath the valve box cover. Each indicator shall be equipped with a wrench nut. Internal gearing shall be sealed and protected from the elements.

2-13. **SHOP PAINTING.** All ferrous metal surfaces, except bearing and finished surfaces and stainless steel components of valve actuators and accessories, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting.

The following surfaces shall be painted:

- **Polished or Machined Surfaces**
  - Rust-preventive compound.
- **Other Surfaces**
  - Epoxy enamel.
- **Actuators and Accessories**
  - Universal primer.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** Actuators will be installed on the valves in accordance with the Valve Installation section.

End of Section
TECHNICAL SPECIFICATIONS

FLORIDA KEYS AQUEDUCT AUTHORITY
C-905 PHASE IIB
KEY LARGO TO OCEAN REEF
TRANSMISSION WATERMAIN REPLACEMENT

FKAA PROJECT # 1152-17-PHASE IIB

APRIL 2018
1. **GENERAL DESCRIPTION OF WORK.** The Work to be performed under these Contract Documents is generally described as follows:

   The proposed Phase IIB of the project consists of 20,830 linear feet of 16-inch diameter C-900 DR14 (Unrestrained Pipe) and 1,710 linear feet of 16-inch diameter C-900 DR14 (Restrained Pipe). The work also includes 4 Master Meter Taps. The location of the work is along C905, from Ocean Reef toward Key Largo. The project will tie into Phase IIA at a proposed valve.

2. **UNITS OF MEASUREMENT** Values expressed in various units as specified in Section 01025 Measurement and Payment shall govern.

3. **COORDINATION WITH PUBLIC UTILITIES AND AGENCIES.** It shall be the Contractor’s responsibility to coordinate the Work with other utilities and to arrange for the relocation of power poles, telephone poles, telephone cables, telephone pedestals, and all other utilities’ facilities as necessary to complete the Work. Contractor shall be responsible for proper shoring and bracing of power poles, telephone poles, telephone cables, telephone pedestals, gas lines, and all other utilities facilities whether they have been relocated or not relocated. Requirements of public utilities shall govern relocation, shoring, and bracing work.

   It shall be the Contractor’s responsibility to coordinate the Work with Monroe County.

   All costs associated with coordination with public utilities, relocation, shoring, and bracing of utilities’ facilities, whether the costs are Contractor’s costs or costs payable to other public utilities, shall be borne by the Contractor and shall be included in the Contractor’s bid price unless otherwise noted on the drawings or in the specifications.

   Existing underground utilities installations (including service connections) are indicated on the drawings only to the extent such information was made available to or discovered by Engineer in preparing the drawings. There is no guarantee as to the accuracy or completeness of such information and all responsibility for the accuracy and completeness thereof is expressly disclaimed.

   Contractor shall be responsible for the discovery of existing underground installations, in advance of excavating or trenching, by contacting all local utilities and by prospecting.

   The Owner has provided the following permits:

   a. Florida Department of Environmental Protection General Permit for Construction of a Water Main Extension.
Contractor shall be responsible for complying with all terms, clearance requirements, and special conditions of these permits, which are included at the end of this section.

The Contractor is responsible for all other permits such as dewatering and rights-of-way permits, etc.

4. **OFFSITE STORAGE.** Offsite storage arrangements will not be permitted. Materials stored offsite shall not be included in the Application for Payment.

5. **SUBSTITUTES AND "OR-EQUAL" ITEMS.** Provisions for evaluation of substitutes and "or-equal" items of materials and equipment are covered in Paragraph 6.05 of the General Conditions. Requests for review of equivalency will not be accepted by Engineer from anyone except Contractor, and such requests will not be considered until after the Effective Date of the Agreement.

6. **PREPARATION FOR SHIPMENT.** All materials shall be suitably packaged to facilitate handling and protect against damage during transit and storage. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

   Each item, package, or bundle of material shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

7. **EASEMENTS AND RIGHTS-OF-WAY.** The easements and rights-of-way for the pipelines will be provided by Owner. Contractor shall confine its construction operations within the limits indicated on the Drawings. Contractor shall use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies in order to avoid damage to property and interference with traffic.

   a. **Work within Highway and Railroad Rights-of-Way.** All Work performed and all operations of Contractor, its employees, or Subcontractors within the limits of railroad and highway rights-of-way shall be in conformity with the Monroe County requirements for CR905 and be under the control (through Owner) of the railroad or highway authority owning, or having jurisdiction over and control of, the right-of-way in each case.

8. **OPERATION OF EXISTING FACILITIES.** The existing pipeline must be kept in continuous operation throughout the construction period. No interruption will be permitted which adversely affects the degree of service provided. Provided permission is obtained from Owner in advance, portions of the existing pipeline may be taken out of service for six hours corresponding with periods of minimum service demands.

   Contractor shall provide temporary facilities and make temporary modifications as necessary to keep the existing facilities in operation during the construction period.
9. **NOTICES TO OWNERS AND AUTHORITIES.** Contractor shall, as provided in the General Conditions, notify owners of adjacent property and utilities when prosecution of the Work may affect them, at least one week prior to the work beginning unless otherwise specified.

When it is necessary to temporarily deny access to property, or when any utility service connection must be interrupted, Contractor shall give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.

Unless otherwise specified, utilities and other concerned agencies shall be notified at least two weeks prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

10. **LINES AND GRADES.** All Work shall be done to the lines, grades, and elevations indicated on the Drawings.

Basic horizontal and vertical control points will be established or designated by Engineer to be used as datums for the Work. All additional survey, layout, and measurement work shall be performed by Contractor as a part of the Work.

Contractor shall provide an experienced instrument person, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement work. In addition, Contractor shall furnish, without charge, competent persons and such tools, stakes, and other materials as Engineer may require in establishing or designating control points, in establishing construction easement boundaries, or in checking survey, layout, and measurement work performed by Contractor.

Contractor shall keep Engineer informed, a reasonable time in advance, of the times and places at which it wishes to do Work, so that horizontal and vertical control points may be established and any checking deemed necessary by Engineer may be done with minimum inconvenience to Engineer and minimum delay to Contractor.

Contractor shall remove and reconstruct work which is improperly located.

11. **MATERIALS.** Only domestic supplied materials with no lead will be accepted.

12. **CONNECTIONS TO EXISTING** Contractor shall receive permission from Owner or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the
minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

Prior to each of the shutdowns and before any connection will be permitted, the Contractor shall submit to Engineer for review and approval a detailed connection plan and layout drawings in accordance with Section 01300 – Submittals. A submittal will be required for each connection. The submittal shall provide sequencing details and necessary sketches indicating the sequence of the Work to be performed as well as a listing of the materials required for the Work with certification that all required materials are onsite. Contractor’s schedule for shutdowns and connections shall be acceptable to the Owner and the Engineer.

Prior to the commencement of each connection, the existing main to which the connection is being made and any other mains connected thereto, shall be isolated from service and dewatered.

Unless otherwise acceptable to the Engineer, each of the connections shall be scheduled independently of one another and cannot occur concurrently. Contractor shall provide adequate equipment and workforce to ensure that the connection is completed within that timeframe.

Contractor shall provide any additional temporary plugs, sleeves, couplings, closure pieces, restraining devices, bulkheads, and any other miscellaneous appurtenances as required to perform the Work in the specified sequence at no additional cost to the Owner.

Due to water system demands and scheduling of other related work items, specific requirements for scheduling connections to existing facilities of the Owner are set forth as follows.

12.1 **Sequencing of Connections to Existing Facilities.** Contractor shall reference Section 01310-Construction Scheduling for detailed sequencing requirements for connections to existing facilities.

13. **UNFAVORABLE CONSTRUCTION CONDITIONS.** During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall confine its operations to work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by Contractor to perform the Work in a proper and satisfactory manner.

14. **CUTTING AND PATCHING.** As provided in General Conditions, Contractor shall perform all cutting and patching required for the Work and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.

Contractor shall perform all cutting and patching required for and in connection with the Work, including but not limited to the following:
Removal of improperly timed Work.

Removal of samples of installed materials for testing. Alteration of existing facilities.

Installation of new Work in existing facilities.

Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work and existing facilities during cutting and patching operations. Contractor shall not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without Engineer's concurrence.

Materials shall be cut and removed to the extent indicated on the Drawings or as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. Materials which are not salvageable shall be removed from the site by Contractor.

All Work and existing facilities affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to Engineer, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished.

Restoration of pavement and other surface construction shall be performed in accordance with the Florida Department of Transportation and Monroe County requirements shown in the General Notes of the Drawings.

15. **CLEANING UP.** Contractor shall keep the premises free at all times from accumulations of waste materials and rubbish. Contractor shall provide adequate trash receptacles about the Site and shall promptly empty the containers when filled.

Roads shall be swept and cleaned daily. Dust shall be controlled by appropriate means.

Protruding nails in boards, planks, timbers, etc. shall be removed, hammered in or bent over flush with the wood as the nails are exposed.

Construction materials, such as concrete forms and scaffolding, shall be neatly stacked by Contractor when not in use. Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

Contractor is responsible for the disposal of all hazardous materials in accordance with all applicable laws and regulations.

Volatile wastes shall be properly stored in covered metal containers and removed daily.
Wastes shall not be buried or burned on the Site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the Site and disposed of in a manner complying with local ordinances and antipollution laws.

Contractor and its Subcontractors shall restore their working areas of the Project to a neat and orderly condition at the end of each day’s work. Cleaning up shall be a continuing operation, performed on a daily basis throughout the construction period and shall not be left to be performed after the Work or a portion of the Work is completed.

Adequate cleanup will be a condition for recommendation of progress payment applications.

16. RECORD DRAWINGS. The contractor is responsible for collection GPS coordinates for all pipe, fittings, valves, bends, connections to existing utilities, meters, etc. on required State Coordinate System NAD 1983 HARN StatePlane Florida Eas FIPS 0901 Feet and must be deliverable as a shape file with attributes (i.e. pipe with material, size, outside and inside diameter and length of pipe segments, valves with type, size, turns to close, and fittings with type and sizes, etc.) prior to burial. The vertical and horizontal precision should be within 1-inch and 1 feet, respectively. A list of required attributes for each water appurtenance will be provided to the contractor.

17. APPLICABLE CODES. References in the Contract Documents to local codes mean the following: International Building Code

Other standard codes which apply to the Work are designated in the Specifications.

18. PRECONSTRUCTION CONFERENCE. Prior to the commencement of Work at the Site, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by:

   Contractor and its superintendent. Principal

   Subcontractors.

   Representatives of principal Suppliers and manufacturers as appropriate. Engineer.

   Representatives of Owner.

   Government representatives as appropriate.

   Others as requested by Contractor, Owner, or Engineer.

Unless previously submitted to Engineer, Contractor shall bring to the conference a preliminary schedule for each of the following:
Progress Schedule.

Procurement Schedule.

Schedule of Values for progress payment purposes. Schedule of
Shop Drawings and other submittals.

The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:

Contractor's preliminary schedules.

Transmittal, review, and distribution of Contractor's submittals. Processing Applications for Payment.

Maintaining record documents.

Critical Work sequencing.

Field decisions and Change Orders.

Use of premises, office and storage areas, security, housekeeping, and Owner's needs.

Major equipment deliveries and priorities.

Contractor's assignments for safety and first aid.

Engineer will preside at the conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

19. **PROGRESS MEETINGS.** Contractor shall schedule and hold regular progress meetings at least monthly and at other times as requested by Engineer or required by progress of the Work. Contractor, Engineer, and all Subcontractors active on the Site shall be represented at each meeting. Contractor may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.

Engineer shall preside at the meetings. Meeting minutes shall be prepared and distributed by Engineer. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.

20. **NSF CERTIFICATION.** All material or products which come into contact with
drinking water shall be third party certified as meeting the specifications of the American National Standards Institute/National Sanitation Foundation Standard 61, Drinking Water System Components – Health Effects. The certifying party shall be accredited by the American National Standards Institute.

21. **PROJECT SECURITY.** The Contractor shall be responsible for the security of Contractor’s own work, property and materials.

20 **CONTRACTOR’S DAILY LOG.** Each Contractor shall prepare and distribute to the Engineer daily a comprehensive daily log, on a form provided by the Engineer, during the entire project period. The daily report shall specifically alert the Engineer to items which could result in delays. Include the following data:

   a. Weather
   b. Work force by trade.
   c. Major equipment type and quantity.
   d. Accidents or near-miss accidents.
   e. Description, location, and quantity of work performed.
   f. Any assistance required by Owner or Engineer.
   g. Other information as appropriate.

21. **SITE ADMINISTRATION.** Contractor shall be responsible for all areas of the Site used by it and by all Subcontractors in the performance of the Work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to Owner or others. Contractor shall have the right to exclude from the Site all persons who have no purpose related to the Work or its inspection, and may require all persons on the Site (except Owner's employees) to observe the same regulations as Contractor requires of its employees.

End of Section
PART 1 - GENERAL

1.01 PROVISIONS OF PAYMENT

A. The Contractor shall receive and accept the compensation as provided in the Bid Form and the Contract in full payment for performing all operations necessary to complete the work under the Unit Price and Aggregate Sum portions of this Contract, and also in full payment for all loss or damages arising from the nature of the work, until the final acceptance by the FKAA.

B. The Unit Prices and Aggregate Sums stated in the Bid Form include all costs and expenses for labor, equipment, materials, commissions, transportation, changes, expenses, patent fees and royalties, labor for handling materials during inspection, together with any and all costs and expenses in performing and completing the work as ordered and as shown on Contract Drawings and details and specified herein. Measurement and payment for an item at a Unit Price or Aggregate Sum shown in the Bid Form shall be in accordance with the description of that item in this section.

C. The Contractor’s attention is called to the fact that the quotations for the various items of work are intended to establish a total price for completing the work in its entirety. Should the Contractor feel that the cost for any item has not been established by the Bid Form, or this section, he shall include the cost for that work in an applicable bid item, so that his bid reflects his total Unit Prices and Aggregate Sums for completing the work in its entirety. It is the intent of this Contract that the Contractor provide a completed operating system, and any item required to accomplish this shall be included to establish a total cost.

D. The quantities for payment under this Contract shall be determined by actual measurement of the completed items, in place, ready for service and accepted by the FKAA, in accordance with the applicable method of measurement contained herein. The Contractor shall designate and provide a representative to be present at, to witness, and to assist in the making of field measurements for payment.
1.02 DESCRIPTION OF BID ITEMS

A. General Conditions-Bid Item No. 1
   a. Site Mobilization & Demobilization

   Payment for mobilization and demobilization, scheduling and temporary facilities, construction trailers and utilities (see Section 01510), permits (SFWMD dewatering, FDEP water main clearances, etc.) all other activities necessary will be made at the contract lump sum price bid for the item, which price shall be full compensation for all materials, labor, equipment, tools and all other incidentals necessary to complete this item. Includes all required mobilizations/demobilizations for all items.

   This also includes coordination between the Contractor and Power Company/Phone Company in regard to any power poles or anchors that may need to be temporarily held during construction. This includes all costs for securing the poles and anchors.

   Refer to Specifications Section 01510 for description of construction trailers required that shall be paid under this Payment Item.

   Payment item for site mobilization/demobilization shall not exceed two percent (2%) of the contract price. Should the bid price for this item exceed two percent (2%) of the Contract amount, any amount over the 2% will be paid with the Contractor’s final payment application.

   b. Bonds and Insurance

   Payment for bonds and insurance will be made at the contract lump sum price bid for the item. The contractor shall provide proof of payment for all bonds and insurance.

   c. Maintenance of Traffic(MOT)

   The quantity of traffic control to be considered for payment shall be equivalent to the percentage of the project determined by the Engineer to be complete as of the date of the pay request submitted. The percent completion of the project shall be based on the percent of the total project actually constructed and not on the percent of the Contract price completed.
Payment for traffic control shall be made on the basis of a percentage (as determined above) of the Lump Sum Price. The contract unit price shall include compensation for required labor, materials, and equipment necessary to keep roadways and property accesses in service during construction activities in accordance with the Contract Documents.

A detailed MOT plan will need to be provided by the Contractor for each Phase of construction.

This item includes maintenance of traffic plan, traffic control, flagman, detour signs, barricades, temporary signage, construction and removal of temporary access driveways to residential homes for driveway maintenance, etc. in order to provide safety and traffic access in accordance with local and state requirements.

d. As-Built Record Drawings

Payment for this item shall be on a Lump Sum Basis. One set of full size design drawings on reproducible material and an electronic file of the design drawings on compact disk and will be furnished to the Contractor by FKAA. The contractor is responsible to GPS all fittings, valves, bends, flush-out assemblies, connections to existing water mains, fire hydrants, service connections, etc. with required coordinate plane and must use compatible software to that of the FKAA’s. The Contractor shall maintain full size (24 x 36) field drawings to reflect the “as-built” items of work as the work progresses. Contractor shall provide Owner with copies of monthly updates to as-built drawings as part of pay application process. Failure to provide updates may delay payment until updates are submitted. Upon completion of the work, the contractor shall prepare a record set of “as-built” drawings on full size, reproducible material and an electronic file in AutoCAD 2007 or latest version. No final payment will be made for “as-built” drawings until both the reproducible and electronic files are received and accepted by the FKAA.

Place a full size set of contract documents in the Contractor’s filed office to be used for marking the actual installation location of the work and noting changes in the work. Assign one person to be in charge of the compiling and maintaining on a daily basis.

The signed and sealed As-built drawings prepared by professional surveyor are required to be submitted with each pay request. Partial
payment will be made for this item based upon the percentage of work completed. All survey work shall be performed by an independent third party surveyor, licensed to practice in the State of Florida. The surveyor shall be retained by the Contractor and approved by the Engineer.

This item does not include surveying work required for layout and alignment of utility and roadway improvements.

B. Water Mains in Place - Bid Item No. 2

Payment will be at the contract unit price per linear foot for the actual number of linear feet of each size and type of pipe acceptably furnished and installed. The unit price shall include all costs of excavation and backfill of trench, compaction, temporary water lines, dewatering, sheeting, pipe bedding, temporary restoration, erosion control, detectible warning tapes, preconstruction video, furnishing and installing pipe, restrained joints, polyethylene encasement, disinfection, flushing, pressure testing, bacteriological testing, pigging, site restoration including in-kind sod replacement, and appurtenances except as otherwise provided for in the Bid Form. Measurement will be along the horizontal projection of the centerline of the pipe through all fittings, valves, casings, specials, etc. Flushing and testing shall be considered to be five percent (5%) of this pay item and clean-up shall be considered to be five percent (5%) of this pay item.

C. Valves and Valve Boxes - Bid Item No. 3

Payment for this item shall be made at the contract unit price for each type and size of valve acceptably furnished and installed. The unit price shall include all costs of excavation and backfill, dewatering, sheeting, furnishing and installing valves, boxes, mechanical restraining devices, concrete pads, brass I.D. disc, polyethylene encasement, and all other work and material required for a complete and satisfactory installation as specified and shown on the Drawings.

Air Release Valves and Pedestal Housings

The unit price as specified to be paid for all 2” combination air release valves and, if above ground installation, pedestal housing enclosure as detailed in the drawings shall include furnishing all air release valves, saddles, corp stops, ball valves, connecting pipe and fittings, air release valve pedestal housing, and appurtenances. This item shall include all work including excavation, backfill, grading, and disposal of water and excess excavated materials, sheeting and shoring, installation and joining
of saddles, valves, pipe, and fittings, installation of pedestal housing covers for above ground installation, testing, clean-up, and all other operations necessary to complete the air release valves ready for operation. The actual number of 2” combination air release valves furnished and installed in the Work will be measured for payment.

D. **Ductile Iron Fittings** - Bid Item No. 4

Payment for this item shall be made at the contract unit price per fitting. The unit price shall include excavation and backfill, temporary restoration, dewatering, sheeting, furnishing and installing all mechanical restrained fittings, polyethylene encasement, flushing, testing, and disinfection at the locations indicated on the Drawings and all other items of work and materials required for a complete and satisfactory installation.

The quantity for payment shall be the total number of fittings, for the respective types, satisfactorily installed as specified and show on drawings.

E. **Connect to Existing Water Mains** - Bid Item No. 5

Payment for this item shall be made at the contract unit price for each connection made to an existing water main. The quantity for payment shall be based on each connection made to a specific size existing main. When tapping sleeves and valves are specified, the quantity shall be based on the number of each size of tapping sleeve and valve installed. The unit price shall include all excavation and backfill, dewatering, sheeting, removing existing thrust blocks and fittings, connecting to the existing water main or valve, thrust blocks as required, flushing, testing, disinfection, and all other work and materials required for a complete and satisfactory installation as specified and in accordance with the details shown on the Drawings.

F. **Master Meter Assembly** - Bid Item No. 6

Payment for this item shall be made at the contract unit price for each type and size of Master Meter Assembly. The unit price shall include labor and materials for installing the 316SS flanged master meter/PRV assembly and piping and concrete vault as depicted on the drawings. This item shall include the furnishing and installing of the two gate valves, the two PRV’s, the Neptune strainer and turbo meter, the harness coupling, the concrete pipe supports, the concrete vault, and all piping, valves/valve boxes required for connections to proposed transmission main and existing distribution water main, piping appurtenances, and all work including excavation, backfill, disposal of water and excess excavated materials,
sheeting and shoring, placing and joining of pipe, fittings, and valves furnished for this item, hydrostatic testing, disinfection, cleaning by flushing for the transmission mains and cleaning by pigging for the transmission main, clean-up, and all other operations necessary to complete the master metering assembly ready for operation.

G. Pavement Restoration - Bid Item No. 7

Payment for road pavement restoration, for the respective types, shall be made at the contract unit price, per linear foot, square foot, or square yard depending on the type. The unit price shall include all labor, materials, equipment and all operations necessary for the removal of the existing pavement, construction of a limerock base, asphaltic concrete surface course, maintenance of traffic, restriping new paving to match original, reflectors, and repainting, all in accordance with the requirements of the Monroe County.

The quantity for payment of “Pavement Restoration” shall be per linear foot based on the horizontal distance, measured along the centerline of the main from end to end and within the limits of pavement restoration, as shown on the drawings.

The quantity for payment of “Full-Lane Restoration” shall be per square yard based on the linear distance as measured for trench restoration multiplied by the width of pavement restored within the limits of pavement restoration as shown on the drawings.

H. 5 % Contingency Allowance-Bid Item No. 8

FKAA may utilize this pay item, as needed, to modifying scope of work, for unforeseen circumstances of authorized additional work, at the Owner’s sole discretion, and solely with prior authorization by the Owner in writing.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)
END OF SECTION
1. **LIST OF ABBREVIATIONS.** Abbreviations for standards and organizations used in the Contract Documents are defined as follows:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Organization</th>
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<tbody>
<tr>
<td>AA</td>
<td>Aluminum Association</td>
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<tr>
<td>AABC</td>
<td>Associated Air Balance Council</td>
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<tr>
<td>AAMA</td>
<td>Architectural Aluminum Manufacturers Association</td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
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<tr>
<td>ABMA</td>
<td>American Boiler Manufacturers Association</td>
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<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
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<tr>
<td>ACPA</td>
<td>American Concrete Pipe Association</td>
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<tr>
<td>AEIC</td>
<td>Association of Edison Illuminating Companies</td>
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<tr>
<td>AFBMA</td>
<td>Antifriction Bearing Manufacturers Association</td>
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<tr>
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<td>American Forest &amp; Paper Association</td>
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<td>AGA</td>
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<td>AHA</td>
<td>American Hardboard Association</td>
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<td>American Institute of Steel Construction</td>
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<tr>
<td>AISI</td>
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<td>AITC</td>
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<td>API</td>
<td>American Petroleum Institute</td>
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<tr>
<td>AREMA</td>
<td>American Railway Engineers and Maintenance-of-Way Association</td>
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<td>ARI</td>
<td>American Refrigeration Institute</td>
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<tr>
<td>ASAHIC</td>
<td>American Society of Architectural Hardware Consultants</td>
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<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
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<tr>
<td>ASHRAE</td>
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<td>American Society of Mechanical Engineers</td>
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<td>American Society of Sanitary Engineers ASTM</td>
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<tr>
<td>AVATI</td>
<td>See RTI</td>
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<td>Architectural Woodwork Institute</td>
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<td>AWPA</td>
<td>American Wood-Preservers' Association</td>
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<td>AWPB</td>
<td>American Wood Preservers Bureau AWS</td>
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<td>AWWA</td>
<td>American Welding Society</td>
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<td>AWWA</td>
<td>American Water Works Association</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>BHMA</td>
<td>Builders Hardware Manufacturers Association</td>
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<td>BIA</td>
<td>Brick Institute of America (formerly SCPI)</td>
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<td>CDA</td>
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<td>CISPI</td>
<td>Cast Iron Soil Pipe Institute</td>
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<td>DHI</td>
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<td>DIPRA</td>
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<td>EEI</td>
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<td>EPA</td>
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<td>FCC</td>
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<td>IBC</td>
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<td>MHI</td>
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<td>Abbreviation</td>
<td>Full Form</td>
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<td>MIL</td>
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<td>NACE</td>
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<td>PCI</td>
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<td>SAE</td>
<td>Society of Automotive Engineers</td>
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<td>SCPRF</td>
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<td>Southern Forest Products Association</td>
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<td>SI</td>
<td>Système International des Unités (International System of Units)</td>
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<td>SIGMA</td>
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<td></td>
<td>Steel Joist Institute</td>
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<td>Abbreviation</td>
<td>Full Name</td>
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<tr>
<td>SMA</td>
<td>Screen Manufacturers Association</td>
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<td>SSSI</td>
<td>Scaffolding and Shoring Institute</td>
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<td>SSPC</td>
<td>SSPC: The Society for Protective Coatings</td>
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<td>UL</td>
<td>Underwriters' Laboratories</td>
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<td>USBR</td>
<td>U.S. Bureau of Reclamation</td>
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<tr>
<td>WEF</td>
<td>Water Environment Federation</td>
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</table>

End of Section
1. **PROGRESS SCHEDULE.** A Progress Schedule shall be submitted to Engineer. The Progress Schedule shall indicate the sequence of the Work; the time of starting and completion of each part and the time for making connections to existing piping, structures, or facilities. An initial Progress Schedule shall be submitted after the preconstruction conference and before Work is started. The schedule shall be revised as necessary to reflect changes in the progress of the Work.

Owner shall cooperate with Contractor in arrangements for continuity of service and operation of valves and other control facilities.

Owner may require Contractor, at Contractor's expense, to add to its facilities, equipment, or construction forces, as well as increase the working hours, if operations fall behind schedule at any time during the construction period.

1.1. **Progress Reports.** A progress report shall be furnished to Engineer with each Application for Payment. If the Work falls behind schedule, Contractor shall submit additional progress reports at such intervals as Engineer may request.

Each progress report shall include sufficient narrative to describe current and anticipated delaying factors, their effect on the progress schedule, and proposed corrective actions. Any work reported complete, but which is not readily apparent to Engineer, must be substantiated with satisfactory evidence.

Each progress report shall also include three prints of the accepted graphic schedule marked to indicate actual progress.

1.2. **Shutdown and Connection Plans.** As specified in Section 01015 – Project Requirements, detailed shutdown and connection plans are required to be submitted and approved and permission must be granted from the OWNER prior to making connections to existing facilities or utilities. Prior to initial submission of the plan, a meeting shall be conducted between the CONTRACTOR and ENGINEER to discuss logistics of the shutdown. Sufficient time shall be allowed for initial review; conductance of a coordination meeting between CONTRACTOR, OWNER, and ENGINEER; correction and resubmission; and final review of all shutdown and connection plans. All temporary provisions and shutdown times shall be acceptable to OWNER. All shutdowns and connections are subject to approval by OWNER.
1.3. **Project Sequencing Requirements.** The following requirements shall be reflected in preparing the schedule of construction operations. The maximum time the existing transmission main can be taken out of service during a single shutdown shall be limited to 6 hours. The Contractor may propose alternate project sequencing, as long as the proposed sequence reduces the impact of construction on the Owner’s ongoing operations of the pipeline. Alternate construction sequencing shall be acceptable to the Owner and Engineer.

1. **Tie-in at Stations 236+75 and 461+50:**

   Contractor shall install new PVC-piping between 236+75 and 461+50. After the new piping has been pressure tested, disinfected, sampled, and cleared by FDEP, Contractor shall perform the tie-ins at both stations. The combined time for the two connections is 6-hours. Contractor shall sequence his work as follows:

   a. Contractor shall notify Owner one week in advance that the existing transmission main is ready to be shut down. If acceptable to Owner, Owner will shut down main. Contractor shall dewater existing main in accordance with all applicable regulations, remove a portion of the existing ductile iron transmission mains at each end and install the connections of the new transmission main. Contractor shall disinfect new pieces either by spraying or swabbing with a one percent solution of chlorine just prior to installation in accordance with AWWA C651, Section 9.1. Contractor shall notify Owner that pipeline is ready to be returned to service. Piping shall be observed for 24 hours without backfilling for visible signs of leaks.

   b. The connection to Anglers Cove Can be made after this as this system is backed through a connection to the Ocean Reef system. to backfilling for visible signs of leaks.

   End of Section
1. **GENERAL.**

1.1. **Units of Measurement.** The values shall be expressed in inch-pound units.

2. **SCHEDULE OF PAYMENTS.** Within 30 days after award of contract, Contractor shall furnish to Engineer a schedule of estimated monthly payments. The schedule shall be revised and resubmitted each time an Application for Payment varies more than 10 percent from the estimated payment schedule.

3. **SURVEY DATA.** All field books, notes, and other data developed by Contractor in performing surveys required as part of the Work shall be available to Engineer for examination throughout the construction period. All such data shall be submitted to Engineer with the other documentation required for final acceptance of the Work.

4. **LAYOUT DATA.** Contractor shall keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Copies of such data shall be furnished to the Resident Project Representative for use in checking Contractor's layout as provided in the project requirements section. All such data considered of value to Owner will be transmitted to Owner by Engineer with other records upon completion of the Work.

End of Section
1. **CONSTRUCTION PHOTOGRAPHS AND VIDEOS BY CONTRACTOR.** Contractor shall be responsible for the production of construction photographs and videos as provided herein. No payment will be made to Contractor until acceptable preconstruction photographs and videos are received.

1.1. **Construction Photographs.** Photographs shall be taken along the route of the pipeline before the commencement of Work, and promptly submitted to Engineer. The photographs shall be at intervals of 100 feet [30 m]. The same views shall be rephotographed upon completion of construction activities on any section of the pipeline, and submitted with Contractor's Application for Payment for Work on that section.

All photographs shall be color digital, produced by a competent professional photographer. Contractor shall submit the photographs electronically and two copies of 4 by 5 inch [100 by 125 mm] prints. Digital images shall be compiled on CD and provided with a descriptive index of the images. Prints shall be mounted on linen with flap for binding or enclosed in clear plastic binders, and marked with the name and number of the Contract, name of Contractor, description and location of view, and date photographed.

Engineer will transmit the digital files and one copy of the prints to Owner.

1.2. **Construction Videos.** Contractor shall video tape in detail the entire route of the pipeline and submit two (2) copies of the DVD to Engineer for approval before commencement of Work. The video shall be produced by a competent video photographer and shall be color, commercial quality, DVD format. The Engineer shall be present at the time the videotape is produced. The same views shall be re-videoed upon completion of construction activities.

The video shall identify the physical conditions of the site. The video shall identify, at a minimum, all asphalt, concrete, gravel, or grassed surfaces; locations of curbs and gutters, sidewalks, wheelchair ramps, driveways, landscaped areas, retaining walls, fences, signs, and mail boxes; and locations of existing utility manholes, valve boxes, meter boxes, control panels, and power poles.
1. **TESTING SERVICES.** Testing services shall be provided in accordance with Paragraph 13.03 of the General Conditions. All tests to determine compliance with the Contract Documents shall be performed by an independent commercial testing firm acceptable to Engineer. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped and fully qualified to perform the tests in accordance with the specified standards.

Testing services provided by Owner are for the sole benefit of Owner; however, test results shall be available to Contractor. Testing necessary to satisfy Contractor's internal quality control procedures shall be the sole responsibility of Contractor.

1.1. **Testing Services Provided by Contractor.** Unless otherwise specified, Contractor shall provide all testing services in connection with the following:

Concrete materials and design mixtures. Asphaltic concrete materials and design mixtures. Embedment, fill, and backfill materials.

Concrete. Asphaltic concrete.

Moisture-density and relative density tests on embedment, fill, and backfill materials.

All other tests and engineering data required for Engineer's review of materials and equipment proposed to be used in the Work.

Contractor shall obtain Engineer's acceptance of the testing firm before having services performed, and shall pay all costs for these testing services. Testing, including sampling, will be performed by the testing firm's laboratory personnel, in the general manner indicated in the Specifications. Engineer shall determine the exact time, location, and number of tests, including samples.

Arrangements for delivery of samples and test specimens to the testing firm's laboratory will be made by Owner. The testing firm's laboratory shall perform all
laboratory tests within a reasonable time consistent with the specified standards and shall furnish a written report of each test.

Contractor shall furnish all sample materials and cooperate in the testing activities, including sampling. Contractor shall interrupt the Work when necessary to allow testing, including sampling, to be performed. Contractor shall have no Claim for an increase in Contract Price or Contract Times due to such interruption. When testing activities, including sampling, are performed in the field by Engineer or laboratory personnel, Contractor shall furnish personnel and facilities to assist in the activities.

1.2. **Transmittal of Test Reports.** Written reports of tests and engineering data furnished by Contractor for Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.

The laboratory retained by Owner will furnish four copies of a written report of each test. Two copies of each test report will be transmitted to the Resident Project Representative, one copy to Engineer, and one copy to Contractor, within 3 days after each test is completed.

3. **OFFSITE INSPECTION.** When the Contract Documents require inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, such services will be performed by Engineer or an independent testing firm or inspection organization acceptable to Engineer.

Owner shall arrange for and pay an independent organization to perform the inspection services required.

Contractor shall give appropriate written notice to Engineer not less than 10 days before offsite inspection services are required, and shall provide for the producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.

The inspection organization will submit a written report to Engineer, with a copy to Contractor, at least once each week.
1. **WATER.** The Contractor shall utilize an approved reduced pressure zone backflow preventer, and meter all water taken from Florida Keys Aqueduct Authority for flushing, pigging, testing, and disinfection of mains. Meters must be obtained from Florida Keys Aqueduct Authority. All water metered during construction, will be billed for construction.

2. **POWER.** Contractor shall provide all power for heating, lighting, operation of Contractor's plant or equipment, or for any other use by Contractor. Temporary heat and lighting shall be maintained until the Work is accepted.

3. **SANITARY FACILITIES.** Contractor shall furnish temporary sanitary facilities at the Site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the Site.

4. **MAINTENANCE OF TRAFFIC.** Contractor shall conduct its work to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel, and shall give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when Contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point.

In making open-cut street crossings, Contractor shall not block more than one-half of the street at a time. Whenever possible, Contractor shall widen the shoulder on the opposite side to facilitate traffic flow. Temporary surfacing shall be provided as necessary on shoulders.

Contractor shall be responsible for coordinating and obtaining all Monroe County Lane Closure Permits. Contractor shall give Owner two weeks’ notice before submitting Monroe County Lane Closure Permits.

4.1. **Temporary Bridges.** Contractor shall construct substantial bridges at all points where it is necessary to maintain traffic across pipeline construction. Bridges in public streets, roads, and highways shall be acceptable to the authority having jurisdiction.
thereover. Bridges erected in private roads and driveways shall be adequate for the service to which they will be subjected. Bridges shall be provided with substantial guardrails and with suitably protected approaches. Foot bridges shall be at least 4 feet [1.2 m] wide, provided with handrails and uprights of dressed lumber. Bridges shall be maintained in place as long as the conditions of the Work require their use for safety of the public. When necessary for the proper prosecution of the Work in the immediate vicinity of a bridge, the bridge may be relocated or temporarily removed for such period as Engineer may permit.

4.2. Detours. Where required by the authority having jurisdiction thereover that traffic be maintained over any construction work in a public street, road, or highway, and the traffic cannot be maintained on the alignment of the original roadbed or pavement, Contractor shall, at its own expense, construct and maintain a detour around the construction work. Each detour shall include a bridge across the pipe trench and all necessary barricades, guardrails, approaches, lights, signals, signs, and other devices and precautions necessary for protection of the Work and safety of the public.

5. BARRICADES AND LIGHTS. All streets, roads, highways, and other public thoroughfares which are closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest intersecting public highway or street on each side of the blocked section.

All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions, such as material piles and equipment, shall be provided with similar warning signs and lights.

All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and conduct of the Work on or alongside public streets and highways shall cause the minimum obstruction and inconvenience to the traveling public.

All barricades, signs, lights, and other protective devices shall be installed and maintained in conformity with applicable statutory requirements and, where within railroad and highway rights-of-way, as required by the authority having jurisdiction thereover.

If necessary to maintain separation of pedestrian traffic from automobiles or if requested by Owner or Monroe County, Contractor shall provide concrete barriers as required.

6. FENCES. All existing fences affected by the Work shall be maintained by Contractor until completion of the Work. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the owner of the fence, and the period the fence may be left relocated or dismantled has been agreed upon. Where fences must be maintained across the construction easement, adequate gates shall be installed. Gates shall be kept closed and locked at all times when not in use.

On completion of the Work across any tract of land, Contractor shall restore all fences to their original, new condition or to a better condition than their original, new condition and to their original locations to the satisfaction of the property owner.
7. **PROTECTION OF PUBLIC AND PRIVATE PROPERTY.** Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by its construction operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards, parkways, and medians, shall be restored to their original condition, whether within or outside the easement. All replacements shall be made with new materials.

No trees shall be removed outside the permanent easement, except where authorized by Engineer. Whenever practicable, Contractor shall tunnel beneath trees in yards and parking lots when on or near the line of trench. Hand excavation shall be employed as necessary to prevent injury to trees. Trees left standing shall be adequately protected against damage from construction operations.

Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, which may be caused by transporting equipment, materials, or workers to or from the Work or any part or site thereof, whether by Contractor or its Subcontractors. Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property concerning its repair or replacement or payment of costs incurred in connection with the damage.

All fire hydrants and water control valves shall be kept free from obstruction and available for use at all times.

8. **ACCESS ROADS.** Contractor shall establish and maintain temporary access roads to various parts of the Site as required to complete the Project. Such roads shall be available for the use of all others performing work or furnishing services in connection with the Project.

9. **PARKING.** Contractor shall provide and maintain suitable parking areas for the use of all workers and others performing work or furnishing services in connection with the Project, as required to avoid any need for parking personal vehicles where they may interfere with public traffic, Owner's operations, or construction activities.

10. **NOISE CONTROL.** Contractor shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours. All construction machinery and vehicles shall be equipped with practical sound-muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the Work.

During construction activities on or adjacent to occupied buildings, and when appropriate, Contractor shall erect screens or barriers effective in reducing noise in the building and shall conduct its operations to avoid unnecessary noise which might
interfere with the activities of building occupants.

11. **DUST CONTROL.** Contractor shall take reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. When practicable, dusty materials in piles or in transit shall be covered to prevent blowing dust.

The Contractor must have onsite at all times an operable water truck for controlling dusty conditions. The Owner or Engineer may require the Contractor to use the truck to reduce dust at any time.

Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels, or similar equipment shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

12. **TEMPORARY DRAINAGE PROVISIONS.** Contractor shall provide for the drainage of storm water and such water as may be applied or discharged on the Site in performance of the Work. Drainage facilities shall be adequate to prevent damage to the Work, the Site, and adjacent property.

Existing drainage channels and conduits shall be cleaned, enlarged, or supplemented as necessary to carry all increased runoff attributable to Contractor's operations. Dikes shall be constructed as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect Owner's facilities and the Work, and to direct water to drainage channels or conduits. Ponding shall be provided as necessary to prevent downstream flooding.

13. **EROSION CONTROL.** Contractor shall prevent erosion of soil on the Site and adjacent property resulting from its construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operation that will disturb the natural protection.

Work shall be scheduled to expose areas subject to erosion for the shortest possible time, and natural vegetation shall be preserved to the greatest extent practicable. Temporary storage and construction buildings shall be located, and construction traffic routed, to minimize erosion. Temporary fast-growing vegetation or other suitable ground cover shall be provided as necessary to control runoff.

14. **POLLUTION CONTROL.** Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. No sanitary wastes shall be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris, or other substance shall be permitted to enter sanitary sewers, and reasonable measures shall be taken to prevent such materials from entering any drain or watercourse.

End of Section
Section 01605

GENERAL EQUIPMENT REQUIREMENTS

1. **SCOPE.** All equipment furnished and installed under this Contract shall conform to the general requirements set forth in this section, except as otherwise specified in other sections.

2. **COORDINATION.** Contractor shall coordinate all details of the equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alterations in the Work required to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

3. **MANUFACTURER'S EXPERIENCE.** Unless specifically named in the Specifications, a manufacturer shall have furnished equipment of the type and size specified which has been in successful operation for not less than the past 5 years.

4. **WORKMANSHIP AND MATERIALS.** Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.

   All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.

   Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4 inch [6.3 mm] thick. When dissimilar metal components are used, consideration shall be given to prevention of galvanic corrosion.

End of Section

PROJECT # 1152-17-PHASE IIB  01605-1  GENERAL EQUIPMENT REQUIREMENT
1. **SCOPE.** This section covers packaging and shipping of materials and equipment.

2. **PREPARATION FOR SHIPMENT.** All equipment shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept dry at all times.

   Painted and coated surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted and coated surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

   Grease and lubricating oil shall be applied to all bearings and similar items.

3. **SHIPPING.** Before shipping each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

End of Section
Section 01614

HANDLING AND STORAGE

1. **SCOPE.** This section covers delivery, storage, and handling of materials and equipment.

2. **DELIVERY.** Contractor shall bear the responsibility for delivery of equipment, spare parts, special tools, and materials to the site and shall comply with the requirements specified herein and shall provide required information concerning the shipment and delivery of the materials specified in this Contract. These requirements also apply to any subsuppliers making direct shipments to the jobsite.

Contractor shall, either directly or through contractual arrangements with others, accept responsibility for the safe handling and protection of the equipment and materials furnished under this Contract before and after receipt at the port of entry. Acceptance of the equipment shall be made after it is installed, tested, placed in operation and found to comply with all the specified requirements.

All items shall be checked against packing lists immediately on delivery to the site for damage and for shortages. Damage and shortages shall be remedied with the minimum of delay.

Delivery of portions of the equipment in several individual shipments shall be subject to review of Engineer before shipment. When permitted, all such partial shipments shall be plainly marked to identify, to permit easy accumulation, and to facilitate eventual installation.

3. **STORAGE.** Upon delivery, all equipment and materials shall immediately be stored and protected until installed in the Work.

Stacked items shall be suitably protected from damage by spacers or load distributing supports that are safely arranged. No metalwork (miscellaneous steel shapes and reinforcing steel) shall be stored directly on the ground. Pipe, fittings, and valves may be stored out of doors, but must be placed on wooden blocking. PVC pipe, geomembranes, plastic liner, and other plastic materials shall be stored off the ground on pallets and protected from direct sunlight.

Equipment and materials shall not show any pitting, rust, decay, or other deleterious effects of storage when installed in the Work.
4. **HANDLING.** Stored items shall be laid out to facilitate their retrieval for use in the Work. Care shall be taken when removing the equipment for use to ensure the precise piece of equipment is removed and that it is handled in a manner that does not damage the equipment.

End of Section
1. **SCOPE.** This section consists of an equipment schedule for items for which a basic level of manufacturer's field services or operation and maintenance manuals are required, but not covered in other sections. When other sections indicate that manufacturer’s field services and operation and maintenance manuals are required, the requirements shall be as specified in the other sections.

Specific requirements for manufacturer's field services are covered in the Quality Control section.

Specific requirements for operation and maintenance manuals are covered in the Submittals section.

2. **SCHEDULE.** Manufacturer's field services, including equipment installation checks and training, and operation and maintenance manuals shall be provided for the items of equipment indicated in the following schedule:

<table>
<thead>
<tr>
<th>Spec Section</th>
<th>Type of Equipment</th>
<th>Mfr's. Field Services</th>
<th>O&amp;M Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>15101</td>
<td>Butterfly Valves</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

End of Section
PART 1 - GENERAL

1-1. SCOPE.

This section covers clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching; tunneled (trenchless construction) crossings; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary; protection of adjacent property; backfilling; pipe embedment; surfacing and grading; and other appurtenant work.

1-2. GENERAL.

With reference to the terms and conditions of the construction standards for excavations set forth in OSHA "Safety and Health Regulations for Construction", Chapter XVII of Title 29, CFR, Part 1926, and Contractor shall employ a competent person and, when necessary based on the regulations, a registered professional engineer, to act upon all pertinent matters of the work of this section.

1-3. SUBMITTALS.

Drawings, specifications, and data covering the proposed materials shall be submitted in accordance with the Submittals section.

1-3.01. Filter Fabric Data.

Complete descriptive and engineering data for the fabric shall be submitted in accordance with the Submittals section. Data submitted shall include:

- A 12 inch square [300 mm] sample of fabric.
- Manufacturer's descriptive product data.
- Installation instructions.

1-4. INSURANCE.

Professional Liability insurance shall be provided as specified in the Supplementary Conditions.
PART 2 - PRODUCTS

2-1. MATERIALS.

2-1.01. Filter Fabric.

Type A filter fabric shall be used to prevent migration of soil into the embedment material, and is intended to be used in open cut trenches to surround the granular embedment in low lying areas.

2-1.02. Polyethylene Film.

Polyethylene film beneath concrete slabs or slab base course material shall be Product Standard PS17, 6 mil [150 mm] minimum thickness.

2-1.03. Tunnel Liner Plates. Not used.

2-1.04. Smooth Steel Pipe. Not used.

2-1.05. Wood Skids. Not used.

2-1.06. Casing Insulators. Not used.

2-1.07. Stabilized Sand Backfill. Not used.

2-1.08. End Closure. Not used.

2-1.09. Inundated Sand Fill. Not used.

2-1.10. Graded Gravel Fill.

Graded gravel for compacted trench backfill shall conform to the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>inch [25 mm]</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch [19 mm]</td>
<td>85 – 100</td>
</tr>
<tr>
<td>3/8 inch [9.5 mm]</td>
<td>50 – 80</td>
</tr>
<tr>
<td>No. 4 [4.75 mm]</td>
<td>35 – 60</td>
</tr>
<tr>
<td>No. 40 [425 µm]</td>
<td>15 – 30</td>
</tr>
<tr>
<td>No. 200 [75 µm]</td>
<td>5 – 10</td>
</tr>
</tbody>
</table>

The gravel mixture shall contain no clay lumps or organic matter. The fraction
passing the No. 4 [4.75 mm] sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2-1.11. **Controlled Low Strength Material (CLSM) Fill.**

CLSM shall consist of a mixture of Portland cement, fly ash, sand, and water and shall be placed at locations indicated on the drawings or as directed by Engineer. The CLSM shall be in accordance with FDOT Section 121.

The type of cement in CLSM shall be ASTM C150 Type I. The class of fly ash in CLSM shall be ASTM C618 Class C ASTM C618 Class F, except loss on ignition shall not exceed 4 percent. Fine aggregate in CLSM shall be clean natural sand, ASTM C33, except that clay particles shall not exceed one percent. Water in CLSM shall be potable.

Contractor shall design and test the CLSM. Contractor shall submit the mix design and test results to Engineer for review and acceptance. Initial set time shall be 8 hours plus or minus one hour as determined by ASTM C403. CLSM shall have an efflux time of 10 to 26 seconds through a special flow cone with a 1/2 inch [12.7 mm] discharge tube.

The batch proportions accepted by Engineer shall apply only for materials from the same source and having the same characteristics as the materials used in the mix design. Materials from any other source shall be used only with the acceptance of Engineer.

If a change in sources of materials is proposed, a new mix design shall be developed by Contractor before the new material is used. When unsatisfactory results or other conditions make it necessary, Contractor shall develop a new mix design to get the desired results.

During the progress of the work, no change shall be made in the batch proportions of the ingredients without the acceptance of Engineer.

2-1.12. **Granular Fill.**

Granular fill material shall be crushed rock or gravel. Granular fill shall be free from dust, clay, organics, and trash; hard, durable, non-friable; and shall be graded 3/4 inch to No. 4 [19 to 4.75 mm] as defined in ASTM C33 for No. 67 coarse aggregate. Granular fill shall meet the quality requirements for ASTM C33 coarse aggregate.

2-2. **MATERIALS TESTING.**

2-2.01. **Preliminary Review of Materials.**
As stipulated in the Quality Control section, all tests required for preliminary review of materials shall be made by an acceptable independent testing laboratory at the expense of Contractor. Two initial gradation tests shall be made for each type of embedment, fill, backfill, or other material, and one additional gradation test shall be made for each additional 500 tons [450 Mg] of each material delivered to the site. In addition, one set of initial Atterberg Limits test shall be made for each fill materials containing more than 20 percent by weight passing the No. 200 sieve [75 µm].

One additional Atterberg Limits test shall be made for each additional 500 tons [450 Mg] of each material delivered to the site.

All material testing on CLSM shall be made by an independent testing laboratory at the expense of Contractor.

2-2.02. Field Testing Expense.

All moisture-density (Proctor) tests and relative density tests on the materials, and all in-place field density tests, shall be made by an independent testing laboratory at the expense of Contractor. Contractor shall provide access to the materials and work area and shall assist the laboratory as needed in obtaining representative samples.

2-2.03. Required Tests.

For planning purposes, the following guidelines shall be used for frequency of field tests. Additional tests shall be performed as necessary for job conditions and number of failed tests. Test results shall be submitted as indicated in the Submittals section.

   a. Two moisture density (Proctor) tests in accordance with ASTM D698 (or, when required, ASTM D1557), or two relative density tests in accordance with ASTM D4253 and D4254 for each type of general fill, designated fill, backfill, or other material proposed.

   b. In-place field density and moisture tests at intervals of 500 feet [300 m] maximum along the trench.

   c. One in-place field density and moisture test for every 200 cubic yards [153 m³] of backfill.

   d. One in-place density and moisture test whenever there is a suspicion of a change in the quality of moisture control or effectiveness of compaction.

   e. At least one test for every full shift of compaction operations on mass earthwork.

   f. Additional gradation, Proctor, and relative density tests whenever the source or quality of material changes.
g. Testing of CLSM shall be as follows:
Compressive Strength. For every 200 cubic yards [153 cubic meters] of CLSM placed, fill four 6 by 12 inch [150 by 300 mm] plastic cylinder molds to overflowing and then tap sides lightly. Cure cylinders in the molds covered until time of testing, at least 14 days. Strip the cylinders carefully using a knife to cut away the plastic mold. Cap the cylinders with high strength gypsum plaster or other capping process that will not break these low strength materials. Test cylinders in accordance with ASTM C39. Two cylinders shall be tested at 7 days and the other two cylinders shall be tested at 56 days.
Flow of Fill. Once each day that CLSM is placed, test the fill material in accordance with ASTM C939 for the efflux time. Wet screening may be required to remove coarse particles.
Unit Weight and Yield. Once each day that CLSM is placed, determine unit weight and yield in accordance with ASTM C138.
Air Content. Once each day that CLSM is placed, determine air content in accordance with ASTM C231.
Penetration Resistance. Once each day that CLSM is placed, determine early bearing strength in accordance with ASTM C403 penetration procedure.

PART 3 - EXECUTION

3-1. CLEARING.

All clearing shall be performed as necessary for access, stringing of pipeline materials, and construction of the pipeline and appurtenant structures.

3-2. EXCAVATION.

Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

Except where exterior surfaces are specified to be damp-proofed, monolithic concrete manholes and other concrete structures or parts thereof, which do not have footings that extend beyond the outside face of exterior walls, may be placed directly against excavation faces without the use of outer forms, provided that such faces are stable and also provided that a layer of polyethylene film is placed between the earth and the concrete.
Excavations for manholes and similar structures constructed of masonry units shall have such horizontal dimensions that not less than 6 inches [150 mm] clearance is provided for outside plastering.

3-2.01. Classification of Excavated Materials.

No classification of excavated materials will be made for payment purposes. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition, or condition thereof.

3-2.02. Preservation of Trees.

No trees shall be removed outside excavated or filled areas, unless their removal is authorized by Owner. Trees left standing shall be adequately protected from permanent damage by construction operations.

3-2.03. Blasting.

Blasting or other use of explosives for excavation will not be permitted.

3-2.04. Dewatering.

Dewatering equipment shall be provided to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

As an alternative, Contractor may use shallow injection wells for the disposal of groundwater. If this alternative is selected, Contractor is responsible for all permitting and permitting fees, installation and abandonment/plugging of wells.

All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level to the minimum depth of 24 inches [600 mm], beneath such excavations. The specified dewatering depth shall be maintained below the prevailing bottom of excavation at all times.

Surface water shall be diverted or otherwise prevented from entering excavations or trenches to the greatest extent possible without causing damage to adjacent property.

Contractor shall be responsible for the condition of any pipe or conduit which he
may use for drainage purposes, and all such pipe or conduit shall be left clean and free of sediment.

Contractor shall obtain from the appropriate agencies and authorities, the dewatering and stormwater discharge permits required to remove and dispose of groundwater, surface water, and any other water used in Contractor's operations. Within 10 calendar days after Notice-to-Proceed, submit a dewatering plan to the Owner and the Engineer, which must comply with all the applicable rules and regulations of the South Florida Water Management District. Contractor shall prepare an application to the District and pay any fee, and shall provide pertinent information that may be required by the South Florida Water Management District. The permits shall be obtained prior to start of construction.

3-2.05. **Sheeting and Shoring.**

Except where banks are cut back on a stable slope, excavations for structures and trenches shall be supported with steel sheet piling and shoring as necessary to prevent caving or sliding.

Sheet piling or other excavation support systems shall be installed as necessary to limit the extent of excavations for deeper structures and to protect adjacent structures and facilities from damage due to excavation and subsequent construction. Contractor shall assume complete responsibility for, and shall install adequate protection systems for prevention of damage to existing facilities.

Sheeting, shoring and excavation support systems shall be designed by a professional engineer registered in the state where the project is located.

Trench sheeting may be removed if the pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting. Trench sheeting shall not be pulled after backfilling. Where trench sheeting is left in place, it shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed. Trench sheeting shall be removed unless otherwise permitted by Engineer. Trench sheeting will not be removed, if in the opinion of Engineer, removal of the sheeting will cause damage to the facility it is protecting. If left in place, the sheeting shall cut off 12 inches below finished grade. The design of the support system shall be such as to permit complete removal while maintaining safety and stability at all times.

3-2.06. **Stabilization.**

Sub-grades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workers.
Sub-grades for concrete structures or trench bottoms which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with crushed rock or gravel as specified for granular fills. The stabilizing material shall be placed in a manner that no voids remain in the granular fill. All excess granular fill with unfilled void space shall be removed.

The finished elevation of stabilized sub-grades shall not be above sub-grade elevations indicated on the drawings.

3-3. TRENCH EXCAVATION.

No more trench shall be opened in advance of pipe laying than is necessary to expedite the work. One block or 400 feet [120 m], whichever is the shorter, shall be the maximum length of open trench on any line under construction.

Except where tunneling is indicated on the drawings, is specified, or is permitted by Engineer, all trench excavation shall be open cut from the surface.

3-3.01. Alignment, Grade, and Minimum Cover.

The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe.

Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe of 36 inches over pipes below paved and graded streets and, of 30 inches over pipes in other locations. Greater pipe cover depths may be necessary on vertical curves or to provide adequate clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation, except where future surface elevations are indicated on the drawings.

3-3.02. Maximum Trench Widths. Not used.

3-3.03. Minimum Trench Widths.

Except when maximum trench width is required for certain conduits, trenches shall be excavated to the minimum trench widths indicated in the following table. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment.

<table>
<thead>
<tr>
<th>Nominal Pipe Size</th>
<th>Minimum Trench Width</th>
<th>Clearance</th>
</tr>
</thead>
</table>

PROJECT # 1152-17-PHASE IIB 02202-8 TRENCHING & BACKFILLING
<table>
<thead>
<tr>
<th>Size Range</th>
<th>Sidewall Clearance Formula</th>
<th>Average Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 27 in [700 mm]</td>
<td>Pipe OD plus 12 in [600 mm]</td>
<td>6 in [300 mm]</td>
</tr>
<tr>
<td>27 in through 60 in [700 mm through 1,500 mm]</td>
<td>Pipe OD plus nominal pipe size ID/2</td>
<td></td>
</tr>
<tr>
<td>Greater than 60 in [1,500 mm]</td>
<td>Pipe OD plus 70 in [1800 mm]</td>
<td>30 in [750 mm]</td>
</tr>
</tbody>
</table>

Clearance = Minimum sidewall clearance
OD = Outside diameter (or span) of conduit
ID = Inside diameter (or span) of conduit.

Specified minimum sidewall clearances are not minimum average clearances but are minimum clear distances which will be required to the trench excavation or the trench protective system.

Cutting trench banks on slopes to reduce earth load to prevent sliding and caving shall be used only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits.
3-3.04. Mechanical Excavation.

The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated, that the rough trench excavation bottom elevation can be controlled, and that trench alignment is such that pipe, when accurately laid to specified alignment, will be centered in the trench with adequate sidewall clearance. Undercutting the trench sidewall to obtain sidewall clearance will not be permitted.

In locations where maximum trench widths are required for designated rigid conduits, mechanical equipment shall be operated so that uniform trench widths and vertical sidewalls are obtained at least from an elevation 12 inches [300 mm] above the top of the installed pipe to the bottom of the trench.

3-3.05. Cutting Concrete Surface Construction.

Cuts in concrete pavement and concrete base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with a concrete saw in a manner which will provide a clean groove at least 1-1/2 inches [40 mm] deep along each side of the trench and along the perimeter of cuts for structures.

Concrete pavement and concrete base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 6 inches [150 mm] in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the center line of the trench.

Pavement removal for connections to existing lines or structures shall not exceed the extent necessary for the installation.

Where the trench parallels the length of concrete walks, and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and subsequently replaced between existing joints or between saw cuts as specified for pavement.
3-3.06. **Excavation Below Pipe Sub-grade.**

Except where otherwise required, pipe trenches shall be excavated below the underside of the pipe to provide for the installation of granular embedment, as shown in the Drawings.

Bell holes shall provide adequate clearance for tools and methods used for installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

3-3.07. **Artificial Foundations in Trenches.**

Whenever unsuitable or unstable soil conditions are encountered, trenches shall be excavated below grade and the trench bottom shall be brought to grade with suitable material. In such cases, adjustments will be made in the Contract Price in accordance with the provisions of the General Conditions.

3-4. **Pipe Embedment.**

Embedment materials both below and above the bottom of the pipe, classes of embedment to be used, and placement and compaction of embedment materials shall conform to the requirements indicated in the Drawings and to the following supplementary requirements.

Embedment material shall be clean and free from cinders, organic material, clay lumps, paving materials, or other material which may cause pipe corrosion. No rocks or stones larger than two inches in diameter shall be allowed in any backfill material and sharp edges not allowed.

3-4.01. **Embedment Classes.**

a. **Class A Arch Encasement.**

When arch encasement is indicated on the drawings, Class A arch encasement shall be used at all locations so indicated. When arch encasement is not indicated on the drawings, Class A arch encasement is not required unless improper trenching or unexpected trench conditions require its use as determined by Engineer. Concrete and reinforcing steel for Class A arch encasement shall conform to the requirements of the Cast-in-Place Concrete section.

b. **Class B Bedding.**

Class B bedding shall be used for all steel, ductile iron, pretensioned concrete and vitrified clay pipelines, and for all other pipelines not otherwise specified.
3-4.02. **Embedment for Pipelines.**

Granular embedment for pipelines shall be pea gravel or crushed rock with rounded or sub-rounded particles; crushed rock with sharp edges which could cause significant scratching or abrasion of the pipe or damage to the polyethylene tube protection shall not be used. Granular fill or graded gravel fill shall be used as pipe “select bedding” within the pipe zone from 8-inches below the pipe to 8-inches above the pipe, as shown on the drawings.

When excessive water is encountered the Florida Keys Aqueduct Authority Field Representative may require uniformly graded 3/8-inch limerock with a maximum particle size of 3/8-inch to be used as bedding, and shall be used as bedding as described above or to a point above the water table as directed by the FKAA Field Representative whichever is greater. Bedding above that point shall meet the requirements of select bedding as described above.

3-4.03. **Placement and Compaction.**

Granular embedment material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle.

After each pipe has been graded, aligned, and placed in final position on the bedding material, and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof by shovel slicing or other suitable methods to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations.

Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

Each lift of granular embedment material shall be vibrated with a mechanical probe type vibrator or shovel sliced during placement to ensure that all spaces beneath the pipe are filled. Granular embedment shall be placed in maximum lift thickness of 6 inches [150 mm] and compacted. Each lift of embedment material shall be compacted with three passes (round-trip) of a platform type vibrating compactor.

Where indicated on the drawings, or as directed by the Owner and the Engineer, migration of soil into the embedment material shall be prevented with filter fabric Type A. The use of filter fabric is intended to be used in open cut trenches to surround the granular embedment in low lying areas at elevations approximately 4 feet NGVD, or lower. Filter fabric shall be placed on the trench surfaces so that it completely surrounds the embedment material. Joints shall be lapped 12 inches [300 mm].
3-5. TRENCH BACKFILL.

All trench backfill above pipe embedment shall conform to the following requirements.

A layer of backfill material not more than 8 inches [200 mm] deep may be placed over concrete arch encasement or concrete reaction blocking after the concrete has reached its initial set, to aid curing. No additional backfill shall be placed over arch encasement or blocking until the concrete has been in place for at least 3 days.

3-5.01. Compacted Backfill.

Compacted backfill will be required for the full depth of the trench above the embedment in the following locations:

- Where beneath pavements, surfacings, driveways, curbs, gutters, walks, or other surface construction or structures.
- Where in street, road, or highway shoulders. In established lawn areas.

The top portion of backfill beneath established lawn areas shall be finished with at least 12 inches [300 mm] of topsoil corresponding to, or better than that which is underlying adjoining lawn areas.

Trench backfill material shall be suitable job excavated material graded gravel and shall be as specified herein.

3-5.01.01. Job Excavated Material.

Job excavated material may be used for compacted backfill when the job excavated material is finely divided and free from debris, organic material, cinders, clay marl, paving materials, any corrosive material, and stones larger than 2 inches in greatest dimension. Masses of moist, stiff clay shall not be used. Job excavated materials shall be placed in uniform layers not exceeding 8 inches [200 mm] in uncompacted thickness. Each layer of material shall have the best possible moisture content for satisfactory compaction. The material in each layer shall be wetted or dried as needed and thoroughly mixed to ensure uniform moisture content and adequate compaction. Increased layer thickness may be permitted for noncohesive material if Contractor demonstrates to the satisfaction of Engineer that the specified compacted density will be obtained. The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.

For pipelines not located under existing or proposed pavement, the job excavated
material shall be compacted to 95 percent of maximum density at a moisture content within 2 percent of the optimum moisture content, as determined by ASTM D698 modified proctor.

For pipelines located under existing pavement, for which pavement replacement will be required per Monroe County standards, or in areas of proposed paving, backfill shall be placed and compacted as specified above, except that the top 12-inches, measured downward from the level of the bottom of the required base course restoration, or proposed base course, shall be Miami Limerock, in accordance with Section 911 D.O.T. Specifications compacted to not less than 98 percent density at a moisture content within 2 percent of the optimum moisture content, as determined by ASTM D698 modified proctor.

3-5.01.02. **Inundated Sand.** Not used.

3-5.01.03. **Graded Gravel.** Not used.

3-5.02. **Ordinary Backfill.**

Compaction of trench backfill above pipe embedment in locations other than those specified will not be required except to the extent necessary to prevent future settlement. Contractor shall be responsible for backfill settlement as specified.

Ordinary earth backfill material to be placed above embeddings shall be free from debris, organic material, cinders, clay marl, paving materials, any corrosive material, and stones larger than 2 inches.

Backfill material above embeddings shall be placed by methods which will not impose excessive concentrated or unbalanced loads, shock, or impact on installed pipe, and which will not result in displacement of the pipe.

Compact masses of stiff clay or other consolidated material more than 1 cubic foot [0.03 m³] in volume shall not be permitted to fall more than 5 feet [1.5 m] into the trench, unless cushioned by at least 2 feet [600 mm] of loose backfill above pipe embedment.

3-5.03. **Water-Settled Earth Backfill.**

Settlement or consolidation of trench backfill using water jetting or ponding shall not be performed.

3-5.04. **Structure Backfill.**

Backfill around manholes and small concrete vaults shall meet the requirements specified for compacted trench backfill.
3-5.05. **Controlled Low Strength Material (CLSM).**

Batching, mixing, and placing of CLSM may be started when weather conditions are favorable and when the temperature is at least 34°F [1°C] and rising. At time of placement, CLSM shall have a temperature of at least 40°F [4°C]. Mixing and placing shall stop when the temperature is 38°F [3°C] and falling. Each filling stage shall be as continuous an operation as is practicable.

CLSM shall be discharged from the mixer by an acceptable procedure into the area to be filled. CLSM shall be placed to limits indicated on the drawings. Mixing CLSM with in-situ soil shall be avoided.

When CLSM is placed as backfill against structures, the fill shall be placed in lifts of 2 to 3 feet [0.6 to 1 meter] and the next lift shall not be placed until the previous lift has taken initial set and at least 16 hours have elapsed from the end of placement. Lift thickness shall be reduced as necessary to prevent floatation of the structure.

When CLSM is placed over culverts or pipelines, they shall be anchored to prevent flotation during the placement of CLSM. Unless otherwise required, CLSM shall be placed to one foot below subgrade elevation if the subgrade elevation is not more than 5 feet [1.5 meters] over the top of the culvert or pipe. If the subgrade is more than 5 feet [1.5 meters] over the top of the culvert or pipe fill, CLSM shall be placed to an elevation 2 feet [0.6 meters] over the top of the culvert or pipe, and the remainder shall be backfilled with soil designated by Engineer.

3-6. **TUNNEL EXCAVATION.** Not used.

3-7. **DRAINAGE MAINTENANCE.**

Trenches across roadways, driveways, walks, or other traffic ways adjacent to drainage ditches or watercourses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the traffic way, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other watercourses crossed by the line of trench shall be removed immediately after backfilling is completed, and the original section, grades, and contours of ditches or watercourses shall be restored. Surface drainage shall not be obstructed longer than necessary.
3-8. PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSES.

Where trenches are constructed in ditches or other watercourses, backfill shall be protected from surface erosion. Where the grade of the ditch exceeds 1 percent, or as otherwise required, ditch checks shall be installed. Unless otherwise indicated on the drawings, ditch checks shall be concrete. Ditch checks shall extend at least 2 feet [600 mm] below the original ditch or watercourse bottom for the full bottom width and at least 18 inches [450 mm] into the side slopes, and shall be at least 12 inches [300 mm] thick.

3-9. FINAL GRADING AND PLACEMENT OF TOPSOIL.

After other outside work has been finished, and backfilling and embankments completed and settled, all areas which are to be graded shall be brought to grade at the indicated elevations, slopes, and contours. All cuts, fills, embankments, and other areas which have been disturbed or damaged by construction operations shall be surfaced with topsoil to a depth of at least 4 inches [100 mm]. Topsoil shall be of a quality at least equal to the existing topsoil in adjacent areas, free from trash, stones, and debris, and well suited to support plant growth.

Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to manual methods. All surfaces shall be graded to secure effective drainage. Unless otherwise indicated, a slope of at least 1 percent shall be provided.

Final grades and surfaces shall be smooth, even, and free from clods and stones, weeds, brush, and other debris.

3-10. DISPOSAL OF EXCESS EXCAVATED MATERIALS.

Disposal of excess material shall be as follows. Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site.

Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be installed in trench backfill, debris encountered in excavation work, and other similar wastematerials shall be disposed of away from the site.

3-11. SODDING.

All unpaved areas cut by the line of trench or damaged during the work shall be sodded, after completion of construction, to the complete satisfaction of the property owner and Owner. All sod used shall be the same type as removed or damaged, shall be best quality, and, when placed, shall be live fresh growing grass with at least 1-1/2 inches [40 mm] of soil adhering to the roots.
All sod shall be procured from areas where soil is fertile and contains a high percentage of loamy topsoil and from areas that have been grazed or mowed sufficiently to form a dense turf.

Sod shall be transplanted within 24 hours from the time it is harvested, unless stacked at its destination in a suitable manner. All sod in stacks shall be kept moist and protected from exposure to the sun and from freezing. In no event shall more than 1 week elapse between cutting and planting.

Before placing sod, all shaping and dressing of the areas shall have been completed. After shaping and dressing, commercial fertilizer of a type acceptable to Owner shall be applied uniformly in the manner and amounts recommended by the manufacturer, and harrowed lightly. Sodding shall follow immediately.

3-12. SETTLEMENT.

Contractor shall be responsible for all settlement of trench backfill which may occur within the correction period stipulated in the General Conditions. Any settlement noted in backfill or within the limits of the excavation within the one year warranty period upon final acceptance, will be considered to be attributed to improper compaction methods and shall be corrected at no cost to the Florida Keys Aqueduct Authority.

Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from Engineer or Owner.

Pavement or structures damaged by settlement shall be restored to their original condition by the Contractor at no cost to the Florida Keys Aqueduct Authority.

3-13. PAVEMENT RESTORATION.

All paved areas cut by the line of trench or damaged during the work shall be restored per Monroe County and FDOT standards, after completion of construction, to the complete satisfaction of Monroe County and Owner, as shown in the Drawings.

End of Section
PART 1 GENERAL

1.01 SUMMARY
A. Section Includes: Requirements for AISI Type 316 and 316L stainless steel pipe, fittings, and accessories.

1.02 REFERENCES
A. General: References to standards, specifications, manuals, or codes of any technical society, organization or association, or to the Laws or Regulations of any government authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

B. ANSI Standards
1. ANSI B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys
2. ANSI B16.9 Factory-Made Wrought Steel Buttwelding Fittings

C. ANSI/ASME Standards
1. ANSI/ASME Stainless Steel Pipe B36.19M

D. ANSI/AWS Standards
1. ANSI/AWS D10.4 Recommended Practice for Welding Austenitic Chromium-Nickel Stainless Steel Pipe and Tubing

E. ASTM Standards
1. ASTM A182 Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
2. ASTM A193 Specification for Alloy-Steel and Stainless Steel Nuts for Bolts for High-Pressure and High-Temperature Service
3. ASTM A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
4. ASTM A312 Specification for Seamless and Welded Austenitic Stainless Steel Pipe
5. ASTM A778 Specifications for Welded, Unannealed Austenitic Stainless Steel Tubular Products
6. ASTM F593 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
7. ASTM F594 Specification for Stainless Steel Nuts

F. AWWA Standards
   1. AWWA C220 Stainless Steel Pipe
   2. AWWA C207 Steel Pipe Flanges for Waterworks Service

1.03 DEFINITIONS
   A. Buried Pipe and Fittings: Pipe and fittings installed in trenches and covered with soil. Pipe and fittings beneath structures and encased in concrete.
   B. Exposed Pipe and Fittings: Pipe and fittings that are not buried. Exposed pipe and fittings include: pipe and fittings outdoors aboveground; pipe and fittings in buildings; pipe and fittings on the interior of tanks; pipe and fittings on the interior of vaults; and pipe and fittings on the interior of pits.
   C. Pipe, fittings, and valve sizes and references to pipe diameter on the Drawings and in the Specifications are intended to be nominal size or diameter, and shall be interpreted as nominal size or diameter.

1.04 SUBMITTALS
   A. Submit product data for AISI Type 316 or 316L stainless steel pipe and fittings, including the following:
      1. Product manufacturer’s specifications;
      2. Materials of construction;
      3. Fabrication Details;
      4. Details of restraints and attachments;
      5. Additional information required to confirm compliance with the Contract Documents;
      6. Welding certifications;
      7. List of exceptions and associated explanation, if any, to these specifications.

1.05 QUALITY ASSURANCE
   A. Marking
      1. Mark pipe and fittings to verify materials and compliance with applicable standards.
   B. Welder Qualifications
      1. Stainless steel piping systems welding shall be by welders qualified and certified under provisions of AWS to weld austenitic chromium-nickel stainless steel pipe and tubing.
      2. Welders shall be certified by an independent local, acceptable testing agency not more than 12 months prior to commencing work.
1.06 DELIVERY, STORAGE, AND HANDLING

A. General
   1. Deliver pipe, fittings, and accessories in a clean and undamaged condition. Store pipe, fittings, and accessories off the ground.
   2. Keep interior of pipe, fittings, and accessories free from dirt and foreign matter.
   3. Stacking of pipe shall meet the requirements of the pipe manufacturer. Do not stack fabrications or fittings.

PART 2 PRODUCTS

2.01 AISI 316L STAINLESS STEEL Piping and Fittings, General

A. Wall thickness for pipe and fittings with weld joints, flange joints, or clamp type coupling joints shall be as follows unless otherwise shown or specified:
   1. All 4-inch and 10-inch piping: Schedule 40.

B. Wall thickness for pipe and fittings with threaded joints shall be as follows unless otherwise shown or specified:
   1. All Sizes: Schedule 40.

C. All stainless steel pipe and fittings shall be rated for a minimum working pressure of 250 psi, and shall have additional cyclic surge allowance capacity for a maximum anticipated pressure capability and test pressures of 300 psi.

2.02 AISI TYPE 316 and 316L STAINLESS STEEL PIPE AND FITTINGS

A. Manufacturers and Fabricators
   1. Stainless Steel Pipe
      a. Avesta-Sheffield Pipe Company;
      b. Carpenter Technology;
      c. Or equal.
   2. Stainless Steel Fittings
      a. Camco Fitting Company;
      b. Flowline;
      c. Or equal.
   3. Stainless Steel Pipe Fabricator/Supplier
      a. Douglas Brothers;
      b. Or equal.

B. Stainless Steel Pipe
3. Pipe Dimension Standard: ........................................ ANSI/ASME B36.19M.

C. Weld Fittings for AISI 316L Stainless Steel Pipe
2. Fitting Material Standard
3. Fitting Standard
4. Fitting Dimension Standard
   a. Weld Joint Fittings
      1) Wall Thickness: ........................................... ANSI/ASME B36.19M.

2.03 STAINLESS STEEL PIPING JOINTS
A. Joints for 4-inch through 10-inch Stainless Steel Pipe and Fittings
1. Exposed 4-inch through 10-inch Stainless Steel Pipe, Fitting, and Valve Joints
   a. Pipe to Pipe Joints: ...................................... Flanged or welded.
   b. Fitting to Fitting Joints: ................................ Flanged or welded.
   c. Pipe to Fitting Joints: ................................... Flanged or welded.
   d. Pipe to Valve Joints: ...................................... Flanged.
   e. Fitting to Valve Joints: ................................. Flanged.

2.04 FLANGES AND FLANGE JOINT ACCESSORIES FOR AISI 316 and 316L
STAINLESS STEEL PIPE AND FITTINGS
A. Flanges for Stainless Steel Pipe and Fittings
1. Flange Material for AISI 316L pipe shall be AISI 316L stainless steel, UNS S31603.
4. Flange Type
   a. Flange for Schedule 40S ................................. Welding neck or slip-on.
5. Flange Face Type: flat face.

B. Flange Joint Accessories
   1. Flange Joint Gaskets
      a. Flange Joint Gasket Type: Ring.
      c. Flange Joint Gasket Material
         1) Potable Water Service: EPDM.
   2. Flange Joint Bolts, Studs, and Nuts
      a. Bolts for Flange Joints
         1) Type: hexagon head machine bolts.
         2) Material: AISI Type 316 stainless steel.
         3) Standard: ASTM A193 or ASTM F593.
         4) Threads: UNC threads.
      b. Studs for Flange Joints
         1) Material: AISI 316 stainless steel.
         2) Standard: ASTM A193 or ASTM F593.
         3) Threads: UNC threads.
         4) Length: extend through nuts a minimum of 1/4-inch.
      c. Nuts for Flange Joints
         1) Type: semi-finished regular hexagon nuts.
         2) Material: AISI 316 stainless steel.
         4) Threads: UNC threads.

2.05 SHOP FABRICATIONS
   A. General
      1. Shop fabricate 4-inch and larger stainless steel pipe and fittings in sections as large as practical while assuring fit-up of piping system without stressing flanges, pumps, valves, or devices.
      2. Pipe and fitting joints in shop fabrications shall be weld joints. Ends of shop fabrications shall have flanges or plain ends. Plain ends shall be prepared for field installed couplings or field welding.
      3. Where clamp type couplings are used to connect fittings to pipe or fittings to fittings, to be installed, shop fabricate fittings with straight pipe sections of sufficient length for clamp type coupling joints.
B. Shop Welding

1. Shop welding procedures for stainless steel pipe shall meet requirements of ANSI/AWS D10.4.

2. Prepare pipe edges by machine shaping or cutting. Bevel ends of pipe and fittings with wall thicknesses of 3/16-inch and larger. Bevel ends of stainless steel pipe to meet requirements of ANSI/AWS D10.4. Separate abutting pipe ends before welding, and completely fuse inside walls of pipe without overlapping. Welding shall be continuous around the joint and shall be completed without interruption. Welds shall be single vee butt type, of sound weld metal thoroughly fused into the ends of pipe and into bottom of vee. Welds shall be free from cold spots, pin-holes, oxide inclusions, burrs, snags, rough projections or other defects.

C. Protection and Finish of Fabrications

1. Passivate welded joint stainless steel pipe, fittings, and pipe assemblies in the factory using procedures specified in this Section, unless otherwise approved by the Engineer.

2. Wire brush outside weld area. Remove weld splatter. Brushes shall be stainless steel and used only on stainless steel.

3. Remove carbon deposits, grease, and oil by pickling and neutralization.

4. Completely immerse stainless steel assemblies and parts after welding and brushing. Completely immerse stainless steel assemblies and parts in pickling solution of 6% nitric acid and 3% hydrofluoric acid at 1400°F for 15 to 20 minutes. Parts shall be free of iron particles or other foreign material following pickling.

5. Following pickling, completely immerse stainless steel assemblies and parts in trisodium phosphate rinse. Parts shall be neutralized following immersion in trisodium phosphate.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: Install stainless steel pipe, fittings, and accessories as specified in this Section. Pipe shall be installed without stressing or deflecting or forcing flanges or fittings, or fit-up to connecting pump flanges to make pressure tight leak free bolted connections.

3.02 CUTTING PIPE

A. General: Field cuts may be made for shorter than standard pipe lengths.

B. Stainless Steel Pipe

1. Field cut stainless steel pipe with either hand or mechanical saws or mechanical pipe cutters. Use proper tool, machine, or tool and machine for stainless steel pipe.

2. Do not cut pipe by burning.
3. Do not flatten pipe ends.
4. Pipe ends shall be saw cut square and perpendicular to pipe axis.
5. Examine cut ends for damage caused by cutting.
6. Finish cut ends of pipe.
   a. Plain End Pipe for Sleeve Type and Clamp Type Couplings: Remove sharp and rough edges which might injure gasket.
   b. Weld Joint Pipe (If field weld joints are approved by the Engineer)
      1) Square and smooth pipe ends.
      2) Bevel ends of stainless steel pipe as recommended in ANSI/AWS D10.4.

3.03 CLAMP TYPE COUPLING JOINTS
A. Cleaning Ends of Stainless Steel Pipe: Remove dirt, debris, and other deleterious substances from plain ends of pipe and wipe plain ends of pipe dry.
B. Cleaning Clamp Type Couplings
   1. Wash and wipe coupling clean of dirt, oil, grease, and other foreign matter.
   2. Wipe coupling dry.
   3. Wipe gasket clean of dirt, dust, and other foreign matter.
C. Joining Stainless Steel Pipe with Clamp Type Couplings
   1. Place both coupling gasket O-rings and coupling over the end of one of the pipes being joined.
   2. Align ends of pipe being joined.
   3. Slide one coupling gasket O-ring off of pipe end where gasket was previously placed. Then slide coupling gasket O-ring onto end of other pipe being joined.
   4. Adjust coupling gaskets O-rings so that O-rings are equal distance from both pipe ends and are spaced so that O-rings are centered in coupling grooves.
   5. Slide coupling over coupling gasket with coupling grooves aligned with coupling gasket O-rings and coupling joint centered on gasket filler connecting gasket O-rings.
   7. Tighten bolts and nuts so that joint will not leak.
   8. Do not over-torque bolts and nuts.
   9. Bring pipe and coupling to correct line and grade. Do not exceed deflection limits recommended by coupling manufacturer.

3.04 FLANGE JOINTS
A. Cleaning Joint Surfaces
1. Clean joint surfaces of the pipe, fittings, and valves being joined.
2. Wipe surfaces clean of dirt, oil, grease, and other foreign matter.
3. Wipe surfaces dry.
4. Wipe each gasket clean of dirt, dust, and other foreign matter.

B. Making Flange Joints

1. Align flange of pipe, fitting, or valve being installed with flange of receiving pipe, fitting, or valve.
2. Support pipe, fittings, and valves being joined so that flanges are properly aligned.
3. Lubricate bolts and nuts prior to installation of bolts and nuts.
5. Hold gasket so that one gasket hole is aligned with one of the two flange holes nearest top of flange. Place bolt through flange and gasket hole. Carefully allow gasket to rotate into position between flanges. Place second bolt in remaining flange hole nearest top of flange and through hole in gasket. Make sure all gasket holes are properly aligned with remainder of flange holes.
6. Place remainder of bolts in flange holes.
7. Install nuts on bolts. Run-up all nuts finger tight.
8. Tighten nuts to 30 percent of specified torque in a crisscrossed pattern as follows:
   a. Tighten one nut to 30 percent of specified torque;
   b. Tighten nut 180 degrees from first nut to 30 percent of specified torque;
   c. Tighten nut 90 degrees clockwise from first nut to 30 percent of specified torque;
   d. Tighten nut 270 degrees clockwise from first nut to 30 percent of specified torque;
   e. Tighten nuts adjacent to first four nuts, in a clockwise direction, to 30 percent of specified torque in the same crisscrossed sequence; and
   f. Continue advancing crisscrossed pattern, in a clockwise direction, until all nuts are tightened to 30 percent of specified torque.
9. Tighten nuts to 60 percent of specified torque in a crisscrossed pattern identical to the crisscrossed pattern used to tighten nuts to 30 percent of specified torque.
10. Tighten nuts to 90 percent of specified torque in a crisscrossed pattern identical to the crisscrossed pattern used to tighten nuts to 30 percent of specified torque.
11. Tighten nuts, in one final pass performed in a clockwise bolt-to-bolt sequence, to the following torque:
<table>
<thead>
<tr>
<th>Size</th>
<th>Bolt Torque Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-inch through 3-inch</td>
<td>35 to 70 ft.-lbs</td>
</tr>
<tr>
<td>4-inch through 6-inch</td>
<td>40 to 80 ft.-lbs</td>
</tr>
<tr>
<td>8-inch</td>
<td>50 to 100 ft.-lbs</td>
</tr>
<tr>
<td>10-inch</td>
<td>75 to 150 ft.-lbs</td>
</tr>
<tr>
<td>12-inch</td>
<td>100 to 200 ft.-lbs</td>
</tr>
<tr>
<td>14-inch and 16-inch</td>
<td>125 to 250 ft.-lbs</td>
</tr>
<tr>
<td>18-inch and 20-inch</td>
<td>150 to 300 ft.-lbs</td>
</tr>
<tr>
<td>24-inch through 30-inch</td>
<td>200 to 400 ft.-lbs</td>
</tr>
<tr>
<td>36-inch and 42-inch</td>
<td>300 to 500 ft.-lbs</td>
</tr>
<tr>
<td>48-inch through 60-inch</td>
<td>500 to 600 ft.-lbs</td>
</tr>
</tbody>
</table>

3.05 THREADED JOINTS FOR STAINLESS STEEL PIPE, FITTINGS, AND VALVES

A. Do not field thread stainless steel pipe.

B. Clean stainless steel threads by brushing with a stainless steel wire brush used only on stainless steel. Remove dirt, burrs, and other substances which would interfere with joining and sealing. Do not damage threads.

C. Make joints leak-tight by use of Teflon tape. Do not apply Teflon tape to the first two threads on the pipe.

D. Do not over-tighten threaded joints. Do not damage pipe exterior with pipe wrench or other tools.

3.06 FIELD WELD JOINTS FOR STAINLESS STEEL PIPE AND FITTINGS

A. General

1. Do not field weld stainless steel pipe or fittings, unless field welding is approved in writing by the Engineer.

   a. Welding in field shall be performed only when requested on shop drawings and accepted by Owner and Engineer in writing as specified in this Section.

   b. Field welding of stainless steel pipe or fittings will only be considered by the Engineer if:

      1) Contractor submits documentation of welder’s certification to perform welding and documentation of welder’s experience in welding stainless steel pipe; and

      2) Contractor can demonstrate that pipe can be welded to meet requirements of referenced standards.
2. If field welding is not approved by the Engineer, provide clamp type coupling joints or flange joints, as specified in this Section and the appropriate piping material Section, at no additional cost to the Owner.

B. Field Weld Joints for Stainless Steel Pipe and Fittings, if Field Weld Joints are approved by the Engineer


2. Separate abutting pipe ends before welding, and completely fuse inside walls of pipe without overlapping. Welding shall be continuous around the joint and shall be completed without interruption. Welds shall be single vee butt type, of sound weld metal thoroughly fused into the ends of pipe and into bottom of vee. Welds shall be free from cold spots, pin-holes, oxide inclusions, burrs, snags, rough projections or other defects.

3. Protect and finish stainless steel weld joints as follows:
   a. Wire brush outside weld area. Remove weld splatter. Brushes shall be stainless steel and used only on stainless steel.
   b. Remove surface oxidation by brushing, or grinding and brushing.

4. Secure buried pipe and fittings with haunching and backfill specified in Section 02202 Trenching and Backfilling.

3.07 CLEANING EXTERIOR OF STAINLESS STEEL PIPING

A. Do not paint exterior surfaces of stainless steel pipe or fittings.

B. Wipe surfaces of stainless steel pipe and fittings clean of dirt, oil, grease, and other foreign matter. Solvent clean surfaces as required to remove oil, grease, and other foreign matter.

C. Remove paint spatter by solvent cleaning or wire brushing. Remove surface oxidation by brushing, or grinding and brushing. Brushes shall be stainless steel and used only on stainless steel.

D. Following solvent cleaning, brushing, and grinding, wash surfaces with detergent solution followed by a clean water rinse. Wipe surfaces dry.

3.08 PRESSURE AND LEAKAGE TESTS.

Pipe and fittings shall be subjected to a pressure test and a leakage test in accordance with the Pipeline Pressure and Leakage Testing section.

The Contractor shall provide all necessary pumping equipment; piping connections between the piping and the nearest available source of test water; pressure gauges; and other equipment, materials, and facilities necessary for the tests.
All pipe, fittings, valves, pipe joints, and other materials which are found to be defective shall be removed and replaced with new and acceptable materials, and the affected portion of the piping shall be retested by and at the expense of Contractor.

All joints shall be watertight and free from visible leaks. Any visible leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

3.09. CLEANING AND DISINFECTION.

After installation, all potable water piping shall be cleaned and disinfected as specified in the Cleaning and Disinfection of Water Distribution System section.

3.10  VISUAL EXAMINATION UNDER SYSTEM PRESSURE.

A. For new exposed piping that cannot be isolated from existing process piping perform visual examination of new exposed piping as follows:

1. Visually examine exposed pipes, fittings, valves, and joints while piping is subjected to system pressure for leaks.

B. Contractor shall repair all visible leaks.

END OF SECTION
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installation of ductile iron pipe. Ductile iron pipe shall be furnished complete with all fittings, jointing materials, pipe hangers and supports, anchors, blocking, encasement, and appurtenances. Piping shall be furnished by the Contractor.

Piping furnished hereunder shall be complete with all joint gaskets, bolts, and nuts required for installation of any valves and equipment furnished by others for installation under this contract.

Pipe hangers and supports, pressure and leakage testing, cleaning, and disinfection are covered in other sections. Cast iron soil pipe is covered in the Miscellaneous Piping section. Pipe trenching, embedment, and backfill are covered in the Trenching and Backfilling section.

1-1.01. Main Pipe Supplier. All ductile iron pipe, fittings, and specials shall be fabricated, lined, coated, and furnished under the direction and management of one pipe supplier, (the Main Pipe Supplier). The Contractor shall designate the Main Pipe Supplier and notify them in writing of their responsibilities, which shall include, at a minimum; ensure and certify that all pipe, fittings, specials, and other materials specified herein, are being manufactured in full accordance with the contract documents; prepare and submit all submittal information and shop drawings; and make any corrections that may be required to submittal information and shop drawings.

1-1.02. Main Pipe Supplier’s Experience and Field Services. The Main Pipe Supplier’s minimum required experience qualifications shall include manufacture of a pipeline at least 1 mile [1.6 km] in length, of a diameter equal to or larger than the pipe to be provided, with joints, lining, and coating suitable for the same or a higher pressure rating, which has performed satisfactorily for the past 5 years.

All ductile iron pipe shall be installed in accordance with the Main Pipe Supplier recommendations.

1-2. SUBMITTALS. Drawings, details, specifications, and installation schedules covering all ductile iron pipe and accessories shall be submitted in accordance with the Submittals section. The drawings and data shall include, but shall not be limited to, the following:

Certification by manufacturer for each item furnished in accordance with the ANSI/AWWA Standards.

Restrained joints details.

Certification of pipe manufacturer’s field services, including a copy of the initial services, and all subsequent inspection reports.

Certification of gaskets, certifying that gasket material is suitable for services intended.
Certification of joint lubricant.
Certification of proof-of-design tests for joints, including restrained joints.
Certification of pipe manufacturer of fabricator and certification of proof-of-design tests for welded-on outlets.

Laying schedule complete with an explanation of all abbreviations used in the schedule. For long, straight pipe runs, the laying schedule shall list the pipeline station and centerline elevation at least every 100 feet.

Two samples of the polyethylene encasement, each sample clearly identified as required by the Governing Standards and test results from an independent third party laboratory of the requirements specified in ANSI/AWWA C105/A21.5.

The method that the Contractor proposes to use for measuring deflection of pipe joints.

Submittal data shall clearly indicate the country of origin of pipe, fittings, flanges, restraining devices, and accessories.

Contractor shall submit a written statement from the gasket material manufacturer certifying that the gasket materials are compatible with the joints specified herein and are recommended for the specified field test pressures and service conditions.

1-2.01. Emergency Repair Manual. [Not used.]

1-3. DELIVERY, STORAGE, AND HANDLING.

Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage the pipe and fittings. Hooks inserted in ends of pipe shall have broad, well-padded contact surfaces. Unpadded hooks, wire brushes or other abrasive tools shall not be permitted to come into contact with polyethylene lining if such lining is specified.

Contractor-furnished pipe and fittings in which the lining has been damaged shall be replaced by and at the expense of Contractor. With the concurrence of Engineer, small and readily accessible damaged areas may be repaired.

If the lining of Owner-furnished pipe or fittings is damaged by Contractor during unloading or handling, the damaged pipe or fittings shall be replaced by and at the expense of Contractor. Where the damaged areas are small and readily accessible, Contractor may be permitted to repair the lining.

Contractor shall repair any damage to pipe coatings before the pipe is installed.
PART 2 - PRODUCTS

2-1. **PIPE CLASS.**

<table>
<thead>
<tr>
<th>Pipe Size (inches)</th>
<th>AWWA C151/A21.51 Pressure Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 thru 14</td>
<td>300</td>
</tr>
<tr>
<td>12 and smaller</td>
<td>350</td>
</tr>
</tbody>
</table>

The specified class includes service allowance and casting allowance.

Pipe wall thickness for grooved and threaded end pipe shall be increased if necessary to comply with the following minimum thickness:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Minimum Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>mm</td>
</tr>
<tr>
<td>4-16</td>
<td>100-400</td>
</tr>
<tr>
<td>18</td>
<td>450</td>
</tr>
<tr>
<td>20</td>
<td>500</td>
</tr>
<tr>
<td>24</td>
<td>600</td>
</tr>
<tr>
<td>30-54</td>
<td>750-1400</td>
</tr>
<tr>
<td>60 &amp; 64</td>
<td>1500-1600</td>
</tr>
</tbody>
</table>

(1) Complies with ANSI/AWWA C115/A21.15 for minimum pipe wall thickness for threaded flanges.

(2) Complies with ANSI/AWWA C606 for grooved and shouldered joint ductile iron pipe.

2-2. **MATERIALS.**

Pipe

Ductile iron, ANSI/AWWA C151/A21.51, Table 1 or Table 3.

Gaskets – All Joint Types

Synthetic rubber; natural rubber will not be acceptable. EPDM Gaskets for potable water service shall be certified as suitable at the pipe pressure and for chlorinated and chloraminated potable water; a certificate of gasket suitability shall be submitted. Gaskets shall be furnished by the pipe manufacturer.

Gas and oil-resistant gaskets shall be made of Nitrile (NBR [Acrylonitrile
Butadiene) rubber. The name of the material shall be permanently marked or molded on the gasket. Gaskets shall be certified as suitable where soils may be contaminated with gas and oil products. A certificate of gasket suitability shall be submitted.

**Joint Lubricant**
Vegetable-based lubricant recommended by the pipe manufacturer. Petroleum or animal-based lubricants will not be acceptable. Lubricants that will be in contact with treated or potable water shall be certified as being in compliance with ANSI/NSF 61.

**Fittings**
ANSI/AWWA C110/A21.10 (except shorter laying lengths will be acceptable for U.S. Pipe), or ANSI/AWWA C153/A21.53, minimum working pressure rating as follows, unless indicated otherwise on the drawings.

<table>
<thead>
<tr>
<th>Fitting Size in. [mm]</th>
<th>Material</th>
<th>Type</th>
<th>Min. Working Pressure Rating, psi [kPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 to 24 [100 to 600]</td>
<td>DI</td>
<td>Mechanical and Push-on joints</td>
<td>350 [2,400]</td>
</tr>
<tr>
<td>4 to 24 [100 to 600]</td>
<td>DI</td>
<td>Flanged joints</td>
<td>250 [1,700]</td>
</tr>
<tr>
<td>30 to 48 [750 to 1,200]</td>
<td>DI</td>
<td>All joints</td>
<td>250 [1,700]</td>
</tr>
<tr>
<td>54 to 64 [1,350 to 1,600]</td>
<td>DI</td>
<td>All joints</td>
<td>150 [1,000]</td>
</tr>
</tbody>
</table>

All fittings shall be ductile iron and suitable for a factory test pressure of rated working pressure plus 100 psi or 1.5 times rated working pressure, whichever is less, without leakage or damage.

**Push-on Joints**
ANSI/AWWA C111/A21.11.

Restrained Push-on Joints, gaskets with stainless steel gripping segments, (4 inch through 12 inch) [100 mm through 300 mm]
American “Fast Grip” or "Field Lok 350Gasket" manufactured by U.S. Pipe and furnished to licensed Tyton® joint manufacturer.
<table>
<thead>
<tr>
<th>Flanged Joints</th>
<th>ANSI/AWWA C115/A21.15.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flanges</td>
<td>Ductile iron, flat faced, with ANSI/ASME B16.1, Class 250 diameter and drilling.</td>
</tr>
<tr>
<td>Class 250</td>
<td>Ductile iron, Class 125, ANSI/AWWA C115/A21.15.</td>
</tr>
<tr>
<td>(where identified)</td>
<td>All flanges shall be suitable for test pressure of 1.5 times rated pressure without leakage or damage.</td>
</tr>
<tr>
<td>All Others</td>
<td>ASTM A307, chamfered or rounded ends projecting 1/4 to 1/2 inch [6.3 to 12.7 mm] beyond outer face of nut.</td>
</tr>
<tr>
<td>Flanges</td>
<td>ASTM A307, hexagonal, ANSI/ASME B18.2.2, heavy semifinished pattern.</td>
</tr>
<tr>
<td>Bolts</td>
<td>ASTM D1330, Grade I rubber, full face type, 1/8 inch [3 mm] thick. Gaskets shall be furnished by the pipe manufacturer.</td>
</tr>
<tr>
<td>Gaskets</td>
<td>Gaskets for potable water service shall be certified as suitable for chlorinated potable water; a certificate of gasket suitability shall be submitted.</td>
</tr>
<tr>
<td>Insulated Flanges</td>
<td>As specified herein, except bolt holes shall be enlarged as needed to accept bolt insulating sleeves.</td>
</tr>
<tr>
<td>Flanges</td>
<td>As manufactured by Central Plastics or Pipeline Seal and Insulator, Inc.</td>
</tr>
<tr>
<td>Insulation Kits</td>
<td>Type E, NEMA G-10 glass reinforced epoxy, 1/8 inch [3 mm] thick, with Buna-N sealing element for water and air service. For wastewater service use Viton sealing element. Gaskets shall be furnished by the pipe manufacturer.</td>
</tr>
<tr>
<td>Insulating Gaskets</td>
<td>Gaskets for potable water service shall be certified as suitable for chlorinated potable water; a certificate of gasket suitability shall be submitted.</td>
</tr>
<tr>
<td>Bolt Insulating Sleeves</td>
<td>Mylar, 1/32 inch [0.79 mm] thick.</td>
</tr>
<tr>
<td>Insulating Washers</td>
<td>Phenolic laminate, 1/8 inch [3 mm] thick, two for each flange bolt.</td>
</tr>
</tbody>
</table>
Backing Washers
Steel, 1/8 inch [3 mm] thick, two for each flange bolt.

Mechanical Joints
ANSI/AWWA C111/A21.11.

Restrained Mechanical Joints (factory prepared spigot), (4 inch through 48 inch) [100 mm through 1,200 mm]
American "MJ coupled Joints", or Griffin "Mech-Lok".

Restrained Mechanical Joints, (field cut spigot), (4 inch through 24 inch) [100 mm through 600 mm]
EBAA Iron "Megalug" Series 1100, without exception.

Wall Pipes or Castings
Mechanical joint with water stop and tapped holes; single casting or fabricated ductile iron pipe; holes sized in accordance with the details on the drawings and provided with removable plugs.

Mechanical Joints with Tie Rods
As indicated on the drawings.

Tie Rods
ASTM A307.

Steel Pipe
ASTM A53, Schedule 40 or 80 as indicated on the drawings.

Washers
ANSI/ASME B18.22.1, plain steel.
ANSI/ASME B1.20.1, NPT; with boss or tapping saddle wherever wall thickness minus the foundry tolerance at the tapped connection is less than that required for 4-thread engagement as set forth in Table A.1, Appendix A, of ANSI/AWWA C151/A21.51.

Threaded Connections

Mechanical Couplings

Couplings
Dresser "Style 38"; Smith-Blair "r 411 Steel Coupling"; or Romac “Style 400” or "Style 501"; without pipe stop.

Oil-resistant synthetic rubber. Gaskets shall be furnished by the pipe manufacturer. Gaskets for potable water service shall be certified as suitable for chlorinated potable water; a certificate of gasket suitability shall be submitted.

Gaskets

Grooved-End Joints
AWWA C606.
<table>
<thead>
<tr>
<th><strong>Pipe Ends (rigid joints)</strong></th>
<th>Grooved, with dimensions conforming to AWWA C606, Table 3.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pipe Ends (flexible joints)</strong></td>
<td>Shouldered, with dimensions conforming to AWWA C606, Table 4.</td>
</tr>
<tr>
<td><strong>Couplings (non-shouldered pipe)</strong></td>
<td>Tyco/Grinnell &quot;Figure 772,&quot; or Victaulic &quot;Style 31.&quot;</td>
</tr>
<tr>
<td><strong>Couplings (shouldered pipe)</strong></td>
<td>Victaulic &quot;Style 41&quot; or &quot;Style 44&quot;.</td>
</tr>
<tr>
<td><strong>Flanged Coupling Adapters</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Restrained (4 inch through 12 inch) [100 mm through 300 mm]</strong></td>
<td>Smith-Blair &quot;Type 912&quot; or Romac &quot;Style FCA501&quot;, with anchor studs.</td>
</tr>
<tr>
<td><strong>Dismantling Joints</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Restrained (3 inch and larger [350 mm and larger] - Dismantling Joint)</strong></td>
<td>Romac &quot;DJ400&quot;; Dresser &quot;Style 131 Dismantling Joint&quot; or Viking Johnson. For use in potable water systems, coating to be in accordance with NSF-61. Bolts, nuts, and tie rods shall be stainless steel ASTM A316.</td>
</tr>
<tr>
<td><strong>Unrestrained (14 inch and larger [350 mm and larger]</strong></td>
<td>Smith-Blair &quot;Type 913&quot; or Romac &quot;Style FC400&quot;, 14 inches [350 mm] and larger.</td>
</tr>
<tr>
<td><strong>Unless otherwise indicated on the drawings, flanged coupling adapters shall be restrained.</strong></td>
<td>Ductile iron, with steel straps and rubber sealing gasket, 350 psi [1,700 kPa] pressure rating.</td>
</tr>
<tr>
<td><strong>Tapping Saddles</strong></td>
<td>PSI &quot;Thunderline Link-Seal&quot;, insulating type with modular rubber sealing elements, nonmetallic pressure plates, and stainless steel bolts and nuts.</td>
</tr>
<tr>
<td><strong>Watertight/Dusttight Pipe Sleeves</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Shop Coating and Lining</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cement Mortar Lining with Seal Coat</strong></td>
<td>ANSI/AWWA C104/A21.4.</td>
</tr>
<tr>
<td><strong>Ceramic Epoxy Lining</strong></td>
<td>Induron &quot;Protecto 401 Ceramic Epoxy&quot;. Two-coat system applied over blastcleaned surface; ground and finish coats separately fired; finished lining thickness at least 8 mils [200 μm], Mohs’ Hardness 5 to 6 density [2,500 to 3,000 kg/m3] as determined by ASTM D792; Fast Fabricators, Inc. &quot;MEH 32&quot; or &quot;SG-14&quot;.</td>
</tr>
</tbody>
</table>

**Glass Lining**
<table>
<thead>
<tr>
<th>Universal Primer</th>
<th>Manufacturer’s standard. If in contact with treated or potable water, certify as being in compliance with ANSI/NSF 61.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalitic Coating</td>
<td>Manufacturer’s standard.</td>
</tr>
<tr>
<td>Coal Tar Epoxy</td>
<td>Manufacturer’s standard.</td>
</tr>
<tr>
<td>Liquid Epoxy</td>
<td>ANSI/AWWA C210, non-coal tar modified, or when in contact with treated or potable water, certify as being in compliance with ANSI/NSF 61.</td>
</tr>
<tr>
<td>Medium Consistency Coal Tar</td>
<td>Carboline &quot;Bitumastic 50&quot; or Tnemec &quot;46-465 H.B. Tnemecol.&quot;</td>
</tr>
<tr>
<td>Polyethylene Encasement</td>
<td>Seamless, ANSI/AWWA C105/A21.5; LLDPE - 12 mil [200 μm].</td>
</tr>
</tbody>
</table>

All materials for potable water piping must be “lead free”, with no lead content no more than 0.25% in the wetted surface material.

2-3. **SHOP COATING AND LINING.** The interior of all pipe and fittings, unless noted otherwise, shall be cement mortar lined and seal coated.

Lining for pipe and fittings for potable water facilities services shall be as specified below:

<table>
<thead>
<tr>
<th>Potable Water Transmission Main piping.</th>
<th>Cement Mortar (Standard Thickness).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potable Water Distribution piping.</td>
<td>Cement Mortar (Standard Thickness)</td>
</tr>
</tbody>
</table>

The exterior surfaces of all pipe and fittings which will be exposed in interior or exterior locations shall be shop primed. Flange faces shall be coated with a suitable rust preventive compound. Exterior surfaces of all underground ductile iron pipe and fittings shall be shop coated with asphaltic coating.

2-4. **FIELD COATING OF EXPOSED PIPING.** The exterior surfaces of all exposed pipe and fittings, unless noted otherwise, shall be properly prepared per the coating system manufacturer’s requirements prior to field-applying coatings. All exposed ductile iron piping shall be field-coated with two coats of Epoxy Enamel, with a 10 mils DFT, followed by a finished coat of Aliphatic Polyurethane, with a 2 mils DFT, resulting in an overall system DFT of 12 mils. Coating color shall be Light Blue, for potable water service.
2-5. **FIELD TAPEING OF ALL BURIED METAL PIPE AND FITTINGS.** To prevent corrosion, the exterior surfaces of all buried metal pipe and fittings shall be field-taped with #1 wax tape, minimum 40-mils thickness, in accordance with AWWA C217.

**PART 3 - EXECUTION**

3-1. **INSPECTION.** Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation; pipe ends shall be examined with particular care. All defective pipe and fittings shall be removed from the site.

3-2. **PREPARATION.** The interior of all pipe and fittings shall be thoroughly cleaned of all foreign matter prior to installation. Before jointing, all joint contact surfaces shall be wire brushed if necessary, wiped clean, and kept clean until jointing is completed.

Precautions shall be taken to prevent foreign material from entering the pipe during installation. Debris, tools, clothing, or other objects shall not be placed in or allowed to enter the pipe.

3-3. **CUTTING PIPE.** Cutting shall be done in a neat manner, without damage to the pipe or the lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the ends of the pipe shall be dressed with a file or a power grinder to remove all roughness and sharp edges. The cut ends of push-on joint pipe shall be suitably beveled. All field cutting of existing gray cast iron pipe shall be done with mechanical pipe cutters, except where the use of mechanical cutters would be difficult or impracticable.

Contractor shall use factory prepared pipe ends unless a field cut is required for connections.

Ends of ductile iron pipe shall be cut with a portable guillotine saw, abrasive wheel, saw, milling cutter, or oxyacetylene torch. The use of hydraulic squeeze type cutters will not be acceptable. Field-cut holes for saddles shall be cut with mechanical cutters; oxyacetylene cutting will not be acceptable.

3-5. **LAYING PIPE.** Buried pipe shall be protected from lateral displacement by placing the specified pipe embedment material installed as specified in the Trenching and Backfilling section. Under no circumstances shall pipe be laid in water, and no pipe shall be laid under unsuitable weather or trench conditions.

Whenever pipe laying is stopped, the open end of the pipe shall be sealed with a watertight plug, which will prevent trench water from entering the pipe.

Pipe shall be laid with the bell ends facing the direction of laying, except where reverse laying is specifically acceptable by Engineer.

3-6. **FIELD JOINTS.** Joints in buried and tunnel locations shall be mechanical or push-on type unless otherwise indicated on the drawings or where required to connect to existing piping or to valves. Bells on wall castings and wall sleeves shall be mechanical joint type, with tapped holes for tie rods or stud bolts. All other joints shall be flanged unless otherwise indicated on the drawings.
Certification of joint design shall be provided in accordance with ANSI/AWWA C111/A21.11, Section 4.5, Performance Requirements, as modified herein. The joint test pressure shall be not less than 2 times the working pressure or 1-1/2 times the test pressure of the pipeline, whichever is higher. The same certification and testing shall also be provided for restrained joints. For restrained joints, the piping shall not be blocked to prevent separation and the joint shall not leak or show evidence of failure. It is not necessary that such tests be made on pipe manufactured specifically for this project. Certified reports covering tests made on other pipe of the same size and design as specified herein and manufactured from materials of equivalent type and quality may be accepted as adequate proof of design.

Restrained joints shall be extended after they are assembled to minimize further takeup.

Field closure pieces shall be located away from the bends beyond the length over which joints are to be restrained.

3-7. MECHANICAL JOINTS. Mechanical joints shall be carefully assembled in accordance with the manufacturer’s recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Bolts shall be uniformly tightened to the torque values listed in Appendix A of ANSI/AWWA C111/A21.11. Overtightening of bolts to compensate for poor installation practice will not be acceptable. The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top (or side for vertical piping) centerline. The top (or side) centerline shall be marked on each flange and mechanical joint piece at the foundry.

3-8. PUSH-ON JOINTS. The pipe manufacturer’s instructions and recommendations for proper jointing procedures shall be followed. All joint surfaces shall be lubricated with a soap solution provided by the pipe manufacturer immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean. Each spigot end shall be suitably beveled to facilitate assembly.

Pipe ends for restrained joint pipe shall be prepared in accordance with the pipe manufacturer’s recommendations.

3-9. FLANGED JOINTS. Pipe shall extend completely through screwed-on flanges. The pipe end and flange face shall be finish machined in a single operation. Flange faces shall be flat and perpendicular to the pipe centerline.

When bolting flanged joints, care shall be taken to avoid restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually and at a uniform rate, to ensure uniform compression of the gasket.

Special care shall be taken when connecting piping to any pumping equipment to ensure that piping stresses are not transmitted to the pump flanges. All connecting piping shall be permanently supported to obtain accurate matching of bolt holes and uniform contact over the entire surface of flanges before any bolts are installed in the flanges. Pump connection piping
shall be free to move parallel to its longitudinal centerline while the bolts are being tightened. Each pump shall be leveled, aligned, and wedged into position which will fit the connecting piping, but shall not be grouted until the initial fitting and alignment of the pipe, so that the pump may be shifted on its foundation if necessary to properly install the connecting piping. Each pump shall, however, be grouted before final bolting of the connecting piping. After final alignment and bolting, the pump connections shall be tested for applied piping stresses by loosening the flange bolts which, if the piping is properly installed, should result in no movement of the piping relative to the pump or opening of the pump connection joints. If any movement is observed, the piping shall be loosened and re-aligned as needed and then the flanges bolted back together. The flange bolts shall then be loosened and the process repeated until no movement is observed.

3-10. FLANGED COUPLING ADAPTERS. Flanged coupling adapters shall be installed in strict accordance with the coupling manufacturer’s recommendations. After the pipe is in place and bolted tight, the proper locations of holes for the anchor studs shall be determined and the pipe shall be field drilled. Holes for anchor studs shall be drilled completely through the pipe wall. Hole diameter shall be not more than 1/8 inch [3 mm] larger than the diameter of the stud projection. Unless indicated on the drawings, all flange coupling adapters shall be restrained. The inner surfaces of couplings shall be prepared for coating in accordance with instructions of the coating manufacturer and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210. The remaining surfaces, except flange mating surfaces, shall be cleaned and shop primed with universal primer.

3-11. DISMANTLING JOINTS. Dismantling joints shall be provided for restrained coupling 14 inch and larger and where indicated on the drawings and as specified herein. Dismantling joints shall comply with AWWA C219 and shall be restrained flange by flange couplings manufactured as a single unit. Dismantling joints shall be installed in accordance with the manufacturer’s recommendations.

3-12. MECHANICAL COUPLINGS. Mechanical couplings shall be carefully installed in accordance with the manufacturer’s recommendations. A space of at least 1/4 inch [6 mm], but not more than 1 inch [25 mm], shall be left between the pipe ends. Pipe and coupling surfaces in contact with gaskets shall be clean and free from dirt and other foreign matter during assembly. All assembly bolts shall be uniformly tightened so that the coupling is free from leaks, and all parts of the coupling are square and symmetrical with the pipe. Following installation of the coupling, damaged areas of shop coatings on the pipe and coupling shall be repaired to the satisfaction of Engineer.
The interior surfaces of the middle rings shall be prepared for coating in accordance with instructions of the coating manufacturer and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210. The remaining components shall be cleaned and shop primed with universal primer.

3-13. GROOVED-END JOINTS. [Not used.]

3-14. POLYETHYLENE ENCASEMENT. All buried ductile iron pipe, including all straight pipe, bends, tees, adapters, closure pieces, and other fittings or specials, and all valves, shall be provided with at least one wrap of 12 mil polyethylene encasement. Locations where ductile iron pipe shall be double wrapped with polyethylene encasement are indicated on the drawings and/or as specified in the provisions for Corrosion Protection section.

Polyethylene tube protection shall be installed in accordance with ANSI/AWWA C105/A21.5, Method A. Preparation of the pipe shall include, but shall not be limited to, removal of lumps of clay, mud, cinders, etc., prior to installation.

Where ductile iron pipe is also embedded or encased in concrete, the polyethylene tube shall be installed over the pipe for 5 feet [1.5 m] either side of each end of the concrete encasement.

The terms "polyethylene tube protection" and "polyethylene encasement" are interchangeable and shall have the same meaning in these Contract Documents.

3-14.01. Inspection and Testing. Tests for preliminary acceptance of polyethylene encasement materials as required in the submittal paragraph shall be made at the expense of the Contractor.

The Owner may obtain samples from the material supplied in the field and have test conducted by an independent third-party laboratory, at the Owner's expense, of the requirements specified in ANSI/AWWA C105/A21.5.

3-15. OUTLETS. Where a 12 inch [300 mm] or smaller branch outlet is indicated and the diameter of the parent pipe is at least twice the diameter of the branch, a tee, a factory welded-on boss, or a tapping saddle will be acceptable.

Where a 4 inch [100 mm] or larger branch outlet is indicated on the drawings and the diameter of the branch pipe for a given diameter of parent pipe is less than equal to the maximum diameter listed herein, a factory welded-on outlet fabricated from centrifugally cast ductile iron pipe will be acceptable.
### Parent Pipe Diameter Versus Maximum Branch Pipe Diameter for Welded-On Outlets

<table>
<thead>
<tr>
<th>Parent Pipe Dia</th>
<th>Max Branch Pipe Dia</th>
<th>Parent Pipe Dia</th>
<th>Max Branch Pipe Dia</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
</tr>
<tr>
<td>8 [200]</td>
<td>4 [100]</td>
<td>30 [750]</td>
<td>20 [500]</td>
</tr>
<tr>
<td>10 [250]</td>
<td>6 [150]</td>
<td>36 [900]</td>
<td>24 [600]</td>
</tr>
<tr>
<td>12 [300]</td>
<td>8 [200]</td>
<td>42 [1050]</td>
<td>30 [750]</td>
</tr>
<tr>
<td>16 [400]</td>
<td>10 [250]</td>
<td>54 [1350]</td>
<td>36 [900]</td>
</tr>
<tr>
<td>18 [450]</td>
<td>12 [300]</td>
<td>60 [1500]</td>
<td>36 [900]</td>
</tr>
<tr>
<td>20 [500]</td>
<td>14 [350]</td>
<td>64 [1600]</td>
<td>36 [900]</td>
</tr>
<tr>
<td>24 [600]</td>
<td>16 [400]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All 30 inch [750 mm] and smaller branch pipe diameter welded-on outlets shall be rated for a working pressure of 350 psi [1,700 kPa], 36 inch [900 mm] branch diameter welded-on outlets shall be rated for a working pressure of 200 psi [5,000 kPa], and all outlets shall have a minimum factor of safety of 2.0. The pipe manufacturer shall provide test data and certification of proof of design. It is not necessary that these tests be performed on pipe manufactured specifically for this project. Certified reports covering tests made on other pipe of the same size and design as specified herein and manufactured from materials of equivalent type and quality may be accepted as adequate proof of design. Welded-on outlets may be provided as a radial (tee) outlet, a tangential outlet, or a lateral outlet fabricated at a specific angle to the parent pipe (in 15 degrees increments between 45 degrees and 90 degrees from the axis of the parent pipe), as indicated on the drawings. The fillet weld dimensions for welded-on outlets shall be as specified herein. Parent pipe and branch pipe shall meet hydrostatic test requirements in accordance with ANSI/AWWA C151/A21.51, Sec. 5.2, prior to fabrication.

### Welded-on Outlet Fillet Weld Dimensions for Specified Outlet Configurations

#### Radial and Lateral Outlets

<table>
<thead>
<tr>
<th>Parent Pipe Dia</th>
<th>Branch Pipe Dia</th>
<th>Weld Fillet Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
</tr>
<tr>
<td>24 [600] and smaller</td>
<td>24 [600]</td>
<td>1 x 1</td>
</tr>
<tr>
<td>30-48 [750-1200]</td>
<td>24 [600] and smaller</td>
<td>1-1/4 x 1-1/4</td>
</tr>
<tr>
<td>54-64 [900]</td>
<td>24 [600]</td>
<td>2-1/4 x 2-1/2</td>
</tr>
</tbody>
</table>

#### Tangential Outlets

<table>
<thead>
<tr>
<th>Parent Pipe Dia</th>
<th>Branch Pipe Dia</th>
<th>Weld Fillet Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches [mm]</td>
<td>inches [mm]</td>
<td>inches [mm]</td>
</tr>
<tr>
<td>24 [600]</td>
<td>20-30 [500-750]</td>
<td>1-1/4 x 1-1/4</td>
</tr>
<tr>
<td>24 [600]</td>
<td>36-54 [900-1350]</td>
<td>1-1/2 x 1-1/2</td>
</tr>
<tr>
<td>24 [600]</td>
<td>60-64 [1500]</td>
<td>2-1/2 x 2-1/2</td>
</tr>
</tbody>
</table>

PROJECT # 1152-17-PHASE IIB 02625-13 DUCTILE IRON PIPE
Welded-on Outlet Fillet Weld Dimensions for Specified Outlet Configurations

<table>
<thead>
<tr>
<th>Radial and Lateral Outlets</th>
<th>Tangential Outlets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parent Pipe Dia</strong></td>
<td><strong>Branch Pipe Dia</strong></td>
</tr>
<tr>
<td>inches [mm]</td>
<td>inches [mm]</td>
</tr>
<tr>
<td>[1350-1600] and smaller</td>
<td>[57 x 64]</td>
</tr>
<tr>
<td>42-64</td>
<td>30 [750]</td>
</tr>
<tr>
<td>[1050-1600]</td>
<td>[64 x 64]</td>
</tr>
<tr>
<td>[1350-1600]</td>
<td>[70 x 70]</td>
</tr>
</tbody>
</table>

All joints on welded-on branch outlets shall be made in accordance with the latest revision of ANSI/AWWA C111/A21.11 and/or ANSI/AWWA C115/A21.15, as applicable. All outlets shall be fabricated from centrifugally cast ductile iron pipe designed in accordance with ANSI/AWWA C150/A21.50 and manufactured and tested in accordance with ANSI/AWWA C151/A21.51. Ni-Rod FC 55® electrodes manufactured by International Nickel Corporation (or an electrode with equivalent properties) shall be used in the manufacture of the fillet welds. Carbon steel electrodes will not be acceptable. Special Thickness Class 53 pipe shall be used for all branch pipe and parent pipe in 4 to 54 inch [100 to 1350 mm] sizes. Pressure Class 350 pipe shall be used for 60 inch and 64 inch [1,500 and 1,600 mm] parent pipe. After welding, each fabricated outlet shall be subjected to a 15 psi [100 kPa] air test. A soap and water solution shall be applied during the testing procedure to inspect the weld for leakage. Any welds that show air seepage shall be refabricated and retested.

Welded-on outlets shall be fabricated by the pipe manufacturer at its production facilities. Manufacturers of welded-on outlets shall have at least 5 years of satisfactory experience in the manufacture and performance of these products. The manufacturer shall have a documented welding quality assurance system and shall maintain resident quality assurance records based on ANSI/AWS D11.2, the Guide for Welding Iron Castings. The manufacturer shall also maintain appropriate welding procedure specifications (WPS) and procedure qualification (PQR), and welder performance qualification test (WPQR) records.

The type of pipe end for the branch outlet shall be as specified or indicated on the drawings. The maximum size and laying length of the welded-on branch outlet shall be as recommended by the pipe manufacturer and shall be acceptable to Engineer for the field conditions and the connecting pipe or valve. Pipe embedment material and trench backfill shall be placed and compacted under and around each side of the outlet to hold the pipe in proper position and alignment during the subsequent pipe jointing, embedment, and backfilling.

At locations acceptable to Engineer, drilling and tapping of the pipe wall for 2 inch [50 mm] and smaller pipe connections will also be acceptable, provided that the wall thickness, minus the casting allowance, at the point of connection equals or exceeds the wall thickness required for 4-thread engagement in accordance with Table A.1, Appendix A of ANSI/AWWA C151/A21.51.
3-16. **WALL PIPES OR CASTINGS.** Wall pipes or castings shall be provided where ductile iron pipes pass through concrete walls, unless otherwise indicated on the drawings.

Where a flange and mechanical joint piece is to connect to a mechanical joint wall pipe or casting, the bolt holes in the bell of the wall pipe or casting shall straddle the top (or the side for vertical piping) centerline of the pipe or casting and shall align with the bolt holes in the flange and mechanical joint piece. The top centerline shall be marked on the wall pipe or casting at the foundry.

3-17. **REDUCERS.** Reducers shall be eccentric or concentric as indicated on the drawings. Reducers of eccentric pattern shall be installed with the straight side on top, so that no air traps are formed.

3-18. **CONNECTIONS WITH EXISTING PIPING.** As shown in the Drawings.

3-19. **INSULATED FLANGED JOINTS.** Insulated flanged joints shall be installed where indicated on the drawings. In addition to one full-faced insulated gasket, each flange insulating assembly shall consist of one full-length sleeve, two insulating washers, and two backing washers for each flange bolt. The insulating gasket ID shall be 1/8 inch [3 mm] less than the ID of the flange in which it is installed. The insulated flanged joint accessories shall be installed in accordance with the instructions and recommendations of the manufacturer.

3-20. **CONCRETE ENCASEMENT.** Concrete encasement shall be installed where indicated on the drawings. A pipe joint shall be provided within 12 inches [300 mm] of each end of the concrete encasement. Concrete and reinforcing steel shall be as specified in the Cast-in-Place Concrete section. All pipe to be encased shall be suitably supported and blocked in proper position, and shall be anchored to prevent flotation.

3-21. **REACTION ANCHORAGE AND BLOCKING.** As shown in the Drawings.

3-22. **PRESSURE AND LEAKAGE TESTS.** Pipe and fittings shall be subjected to a pressure test and a leakage test in accordance with the Pipeline Pressure and Leakage Testing section. The Contractor shall provide all necessary pumping equipment; piping connections between the piping and the nearest available source of test water; pressure gauges; and other equipment, materials, and facilities necessary for the tests.

All pipe, fittings, valves, pipe joints, and other materials which are found to be defective shall be removed and replaced with new and acceptable materials, and the affected portion of the piping shall be retested by and at the expense of Contractor.

All joints shall be watertight and free from visible leaks. Any visible leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

3-23. **CLEANING AND DISINFECTION.** After installation, all potable water piping shall be cleaned and disinfected as specified in the Cleaning and Disinfection of Water Distribution System section.
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installation of 4 through 30 inch buried polyvinyl chloride (PVC) pressure pipe. PVC pressure pipe shall be furnished complete with all fittings, jointing materials, anchors, blocking, encasement, and other necessary appurtenances.

Pressure and leakage tests, cleaning, and disinfection, are covered in other sections. Pipe trenching, bedding, and backfill are covered in the Trenching and Backfilling section.

Pipe shall be furnished where indicated in the pipeline schedule or where indicated on the drawings.

1-2. GOVERNING STANDARDS. Except as modified or supplemented herein, all PVC pressure pipe shall conform to the applicable requirements of ANSI/AWWA C900 and C905.

The supplementary information required in the governing standards is as follows:

Affidavit of Compliance Required.

Plant Inspection Not required.

Special Markings Not required.

Special Preparation for Shipment Not required.

Certification Required.

1-3. SUBMITTALS. Drawings and data shall be submitted in accordance with the Submittals section. Drawings and data shall include, but shall not be limited to, the following:

Gasket material.

Pipe length.

Affidavit of Compliance (ANSI/AWWA C900, Sec. 6.3).

Affidavit of Compliance (ANSI/AWWA C905, Sec. 6.3).

Certification (ANSI/AWWA C900, Sec. 4.2.3).

Certification (ANSI/AWWA C905, Sec. 4.2.3).

1-4. DELIVERY, STORAGE AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

Pipe, fittings, and accessories shall be handled in accordance with Chapter 6 of AWWA Manual M23, to ensure installation in sound, undamaged condition. Pipe shall not be stored uncovered in direct sunlight.
## PART 2 - PRODUCTS

### 2-1. DIMENSIONS
The dimension ratios (DRs: outside diameter to wall thickness) of PVC pressure pipe shall be as indicated in the Drawings.

### 2-2. MATERIALS

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pipe</strong></td>
<td>ANSI/AWWA C900 or C905; ductile iron pipe OD, dimension ratio as specified herein.</td>
</tr>
<tr>
<td><strong>Fittings</strong></td>
<td>Ductile iron; ANSI/AWWA C110/A21.10, 350 psi pressure rating, except shorter laying lengths will be acceptable. Compact DI fittings, per AWWA C153 also acceptable.</td>
</tr>
<tr>
<td><strong>Joints</strong></td>
<td></td>
</tr>
<tr>
<td>PVC to PVC</td>
<td>ANSI/AWWA C900 or C905, stab type, with elastomeric synthetic rubber gaskets. Gaskets of natural rubber will not be acceptable. For Potable Water service, gaskets shall be EDPM for chloramine resistance.</td>
</tr>
<tr>
<td>PVC to Ductile Iron</td>
<td>ANSI/AWWA C111/A21.11, except gaskets shall be synthetic rubber. Natural rubber will not be acceptable. For Potable Water service, gaskets shall be EDPM for chloramine resistance.</td>
</tr>
<tr>
<td><strong>Tapping Saddles</strong></td>
<td>Ductile iron, with galvanized steel straps and synthetic rubber sealing gasket, 350 psi pressure rating.</td>
</tr>
<tr>
<td><strong>Restrained Joints</strong></td>
<td>ASTM F1674, EBAA Iron 2000 series (4 inch through 20 inch), Star Grip 4000, or concrete thrust blocking.</td>
</tr>
<tr>
<td><strong>Tapping Sleeves</strong></td>
<td>Ductile iron, 350 psi pressure rating.</td>
</tr>
<tr>
<td><strong>Polyethylene Encasement</strong></td>
<td>Tube or sheet, ANSI/AWWA C105/A21.5.</td>
</tr>
<tr>
<td><strong>Joint Tape</strong></td>
<td>Self-sticking, PVC or polyethylene, 10 mils thick; Chase &quot;Chasekote 750&quot;, Kendall &quot;Polyken 900&quot;, or 3M &quot;Scotchrap 50&quot;.</td>
</tr>
</tbody>
</table>
Coal Tar Epoxy

High-build coal tar epoxy; Ameron "Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300 M", Tnemec "46H-413 Hi-Build Tneme-Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy".

Conductive Tracer

Detection tape, 3 inches wide; aluminum foil core, 0.5 mil thick, encased in a protective inert plastic jacket; 5,000 psi min tensile strength; 2.5 lbs per inch per 1,000 feet min mass; color coded in accordance with APWA Uniform Color Code; Allen Systems "Detectatape", Lineguard "Type III", or Reef Industries "Terra Tape D".

All materials for potable water piping must be “lead free”, with no lead content no more than 0.25% in the wetted surface material. Manufacturing quality control shall be maintained by frequent, regularly scheduled sampling and testing. Testing shall comply with the governing standards.

2-3. SHOP COATING AND LINING. The exterior surfaces of cast iron fittings shall be coated with a bituminous coating. The interior surfaces of cast iron fittings shall be lined with cement mortar.

PART 3 - EXECUTION

3-1. INSPECTION. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation; spigot ends and bells shall be examined with particular care. All defective pipe and fittings shall be removed from the site of the work.

3-2. LAYING PIPE. Pipe shall be protected from lateral displacement by pipe embedment material installed as specified in the Trenching and Backfilling section. Pipe shall not be laid in water or other unsuitable conditions.

Pipe shall be laid with bell ends facing the direction of laying, except when reverse laying is specifically permitted by Engineer.

Foreign matter shall be prevented from entering the pipe during installation.

Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug. All water shall be removed from the trench prior to removing the plug.

A conductive tracer shall be buried above PVC pressure pipe, not more than 18 inches below the ground surface.
3-2.01. **Cleaning.** The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted.

3-2.02. **Alignment.** Piping shall be laid to the lines and grades indicated on the drawings. Pipelines or runs intended to be straight shall be laid straight.

Deflections from a straight line or grade shall not exceed the maximum deflections specified by the manufacturer.

Unless otherwise specified or indicated on the drawings, and subject to acceptance by Engineer, either shorter pipe sections or fittings shall be installed as required to maintain the indicated alignment or grade.

3-3. **CUTTING PIPE.** Cutting shall comply with the pipe manufacturer's recommendations and with Chapter 7 of AWWA Manual M23. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed to remove all roughness and sharp corners and shall be beveled in accordance with the manufacturer's instructions.

3-4. **JOINTS.** Joints shall be stab-type unless otherwise indicated on the drawings.

3-4.01. **Stab Type Joints.** Jointing shall conform to the instructions and recommendations of the pipe manufacturer. All surfaces for gasketed joints shall be lubricated immediately before the joint is completed. Gaskets and lubricants shall be supplied by the pipe manufacturer, shall be suitable for use in potable water, shall be compatible with the pipe materials, shall be stored in closed containers, and shall be kept clean. For PVC in Potable Water service applications, all gaskets shall be EPDM for chloramine resistance. Each spigot shall be suitably beveled to facilitate assembly.

3-4.02. **Mechanical Joints.** Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Over-tightening of bolts to compensate for poor installation practice will not be permitted.

3-5. **POLYETHYLENE ENCASEMENT.** All below-grade ductile iron fittings, tapping saddles, tapping sleeves, valves, or other ductile iron accessories shall be provided with 12-mil polyethylene tube or sheet protection installed in accordance with ANSI/AWWA C105/A21.5, Method A or C.

3-6. **CONNECTIONS WITH EXISTING PIPING.** Connections with existing pipes shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by Owner.

Facilities shall be provided for proper dewatering and for disposal of water removed from the dewatered lines and excavations without damage to adjacent property.
Special care shall be taken to prevent contamination of potable water lines when dewatering, cutting into, and making connections with existing pipe. No trench water, mud, or other contaminating substances shall be permitted to enter the lines. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then swabbed with, or dipped in, a 200 mg/L chlorine solution.

3-7. SERVICE CONNECTIONS. Tapping saddles or tapping sleeves shall be used for all service connections 2 inches and smaller. Direct tapping of PVC pipe will not be permitted. Fittings shall be used for service connections larger than 2 inches.

3-8. CONCRETE ENCASEMENT. Concrete encasement shall be installed as indicated on the drawings. Concrete and reinforcing steel shall be as specified in the Cast-in-Place Concrete section. All pipe to be encased shall be suitably supported and blocked in proper position and shall be anchored against flotation.

3-9. RESTRAINED JOINTS. All bell-and-spigot or all-bell tees, Y-branches, bends deflecting 11-1/4 degrees or more, valves, and plugs which are installed in piping subjected to internal hydrostatic heads in excess of 30 feet shall be provided with suitable restraint.

Concrete blocking shall extend from the fitting to solid, undisturbed earth and shall be installed so that all joints are accessible for repair. The dimensions of concrete reaction blocking shall be as indicated on the drawings or as directed by Engineer.

Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground shall be provided as indicated by the drawings or as directed by Engineer.

All steel clamps, rods, bolts, and other metal accessories used in tapping saddles or reaction anchorages subject to submergence or in contact with earth or other fill material, and not encased in concrete, shall be protected from corrosion by two coats of medium consistency coal tar applied to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat is applied.

3-10. PRESSURE AND LEAKAGE TESTS. After installation, PVC pressure piping shall be hydrostatically tested for defective workmanship and materials as specified in the Pipeline Pressure and Leakage Testing section.

3-11. LEAKAGE. All PVC piping shall be watertight and free from leaks. Leakage testing per the Pipeline Pressure and Leakage Testing specification.

3-12. CLEANING AND DISINFECTION. After installation, all PVC pressure piping shall be cleaned as specified in the Cleaning and Disinfection of Water Distribution System section. PVC potable water piping shall be disinfected as specified in the Cleaning and Disinfection of Water Distribution System section.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers cleaning and disinfection of all potable water lines installed under this contract.

1-2. GENERAL.

1-2.01. Coordination. Contractor shall coordinate flushing and disinfection work with adjacent work as necessary to preclude work interferences or duplication of effort and to expedite the overall progress of the work.

Contractor shall provide all necessary piping, piping connections, temporary valves, backflow preventers, flowmeters, sampling taps, pumps, disinfectant, neutralization agents, chlorine residual test apparatus, and all other items of equipment or facilities necessary to complete the disinfection work.

Water for flushing and disinfection work will be provided as stipulated in the Temporary Facilities section.

In all cases where it is necessary to interrupt service, permission of Owner shall be obtained at least two weeks before the service will be interrupted.

Unless otherwise specified, final cleaning work shall not be performed until after hydrostatic testing of the lines and any resulting repair work completed.

Contractor shall notify Owner and Engineer prior to the work to allow their representatives to be present during cleaning and/or disinfection of the water lines.

1-2.02. Related Work. Other sections directly related to Work covered in this section are 02621 – Stainless Steel Pipe, 02625 Ductile Iron Pipe, and 02630 – Polyvinyl Chloride (PVC) Pressure Pipe.

1-2.03. Governing Standard. All disinfection work shall conform to the requirements of ANSI/AWWA C651, and the requirements of the Florida Department of Environmental Protection, except as modified herein. If any state or local requirements conflict with the provisions of this section, the state and local requirements shall govern.
1-3. **SUBMITTALS.**

1-3.01. **Disinfection Plan.** Prior to starting any disinfection work, Contractor shall submit to Engineer a detailed disinfection plan. The plan shall cover the method and procedure proposed, necessary coordination, qualification of personnel performing the disinfection, sequence of operations, equipment to be used, manner of filling and flushing the lines, chlorine injection points, sample points, testing schedule, potable water source, neutralization, and disposal of wasted water. Personnel performing the disinfection shall demonstrate a minimum of 5 years’ experience in the chlorination and dechlorination of similar pipelines. 1-

3.02. **Testing.** Bacteriological testing shall be performed by Owner.

The chlorine residual test shall be performed by Contractor. The test log shall be made available to Owner or Engineer upon request and shall be provided to Engineer upon completion of all chlorine residual testing.

1-4. **QUALITY ASSURANCE.**

1-4.01. **Chlorine Residual Tests.** Contractor shall provide the necessary apparatus for making the chlorine residual tests by the drop dilution method as set forth in Appendix A of ANSI/AWWA C651. Test results shall be recorded in a logbook that includes for each test: the location, date, time, test results, and test kit manufacturer.

1-4.02. **Bacteriological Tests.** Sampling and testing of water in the lines shall be performed after final flushing in accordance with Section 5 of ANSI/AWWA C651. Samples shall be taken in suitable sterilized containers on two consecutive days (24 hours apart) and forwarded to a State certified testing lab for bacterial examination for the presence of total coliform.

1-4.03. **Re-disinfection.** Should the bacteriological tests indicate the presence of coliform organisms at any sampling point, the lines shall be re-flushed, resampled and retested. If check samples show the presence of coliform organisms, then the lines shall be re-chlorinated until acceptable results are obtained for two consecutive days.

**PART 2 - PRODUCTS**

2-1. **MATERIALS.** All materials furnished by Contractor shall conform to the requirements of ANSI/AWWA C651 and shall be clean and free of debris which could infer questionable test results.

2-1.01. **Liquid Chlorine.** Liquid chlorine shall conform to AWWAB301.
2-1.02. Calcium Hypochlorite (Dry). Calcium hypochlorite shall conform to AWWA B300.

2-1.03. Sodium Hypochlorite (Solution). Sodium hypochlorite shall conform to AWWA B300.

2-1.04. Chlorine Residual Test Kit. Chlorine, residual concentration shall be measured using an appropriate range, drop count, titration kit or an orthotolidine indicator comparator with wide range color discs. The color disc range shall be selected to match chlorine concentration limits. Test kits shall be maintained in good working order and available for immediate test of residuals at point of sampling. Test kits manufactured by Hach Chemical or Hellige are acceptable.

PART 3 - EXECUTION

3-1. APPLICATION.

3-1.01. Disinfection Procedure. The new lines shall be disinfected by the tablet method, continuous feed method, or slug method. Potable water shall be used in conjunction with the chlorination agent. Construction meter and RPZ are required for water supply.

For the continuous feed or slug method, the chlorination agent shall be injected into the line at the supply end of each new line or valved section thereof.

Admission of disinfectant solution into or the flushing thereof through existing mains shall be held to the minimum possible, and then only after adequate measures have been taken to prevent any such solution of wastewater from entering branch service connections to water customers.

During disinfection, all valves and hydrants shall be operated to ensure that all appurtenances are disinfected. Valves shall be operated such that the chlorine solution in the line being chlorinated will not flow back into the supply line. Check valves shall be used if needed.

Existing mains which may become contaminated during work requiring connections to the new water line, involving either tapping or cutting into operations, shall be flushed and disinfected in accordance with Section 4 of ANSI/AWWA C651.

3-1.02. Final Flushing. Upon completion of chlorination, but before sampling and bacteriological testing, all heavily chlorinated water shall be removed from the lines by flushing with potable water until the chlorine residual in the lines is not higher than that generally prevailing in the adjacent existing system.

Small pipelines shall be flushed with water at the maximum velocity which can be developed, but not less than 2.5 feet per second [0.76 m/s], unless otherwise permitted by
Engineer. Flushing shall be accomplished through the installed valves or fittings, or through corporation cocks in accordance with the details indicated on the drawings.

Pipelines may be flushed as specified, cleaned with a hose, or by other methods acceptable to Engineer.

Booster pumps shall be used if needed to obtain the necessary volume or velocity of water. Pumping equipment installed under this contract shall not be used for flushing, nor shall the flushing water be passed through them; temporary bypass piping at each pump shall be provided as needed.

3-1.03. Cleaning. The potable water mains installed under this contract, including all associated valves and fittings, shall be flushed or cleaned to the satisfaction of Owner and Engineer.

All new piping shall be cleaned by flushing with water at the maximum velocity which can be developed until the piping is free of dirt, debris, and other foreign materials. Cleaning shall precede disinfection. Flushing shall be accomplished through the installed valves or fittings, or through corporation cocks furnished and installed for that purpose.

In addition, Contractor shall pig the newly installed pipeline before it is placed into service. Contractor shall supply all pigging launch and retrieval stations as necessary to pig the entire length of the line. All pigging launch and retrieval stations shall be removed before placing the line in service. At a minimum, a Bare Type, B3 style pig shall be used as manufactured by Pipeline Pigging Products, Inc. or approved equal.

3-1.04. Disposal of Chlorinated Wastewater. All chlorinated wastewater to be discharged shall be neutralized by chemical treatment and disposed in accordance with the requirements of the applicable governing agency. Schedule and coordinate rates of flow and locations of discharge of disinfection and flushing water with Engineer and cognizant state and local regulatory agencies to ensure compliance with all applicable rules and regulations.

End of Section
PART 1 - GENERAL

1-1. **SCOPE.** This section covers field hydrostatic pressure and leakage testing of piping. The term "piping" shall be used in this section to refer to piping systems, pipelines, or sections thereof.

1-2. **GENERAL.** Unless otherwise specified, testing of piping shall be completed prior to final cleaning and disinfection.

Contractor shall notify federal, state, and local regulatory agencies to determine if any special procedures or permits are required for disposal of water used for pressure and leakage testing and to identify acceptable locations for disposal of the water. All requirements and costs associated with notifications and obtaining any discharge permit or approvals shall be responsibility of Contractor.

Engineer or Engineer's representative shall be present during testing and shall be notified of the time and place of testing at least 3 days prior to commencement of the work. All work shall be performed to the satisfaction of Engineer.

1-2.01. **Testing Schedule and Procedure.** A testing schedule and test procedure shall be submitted to Engineer for review and acceptance not less than 21 days prior to commencement of testing. The schedule shall indicate the proposed time and sequence of testing of the piping. The testing procedure shall establish the limits of the piping to be tested, the positions of all valves during testing, the locations of temporary bulkheads, and all procedures to be followed in performing the testing.

1-2.02. **Special Testing Requirements.** Special testing requirements include the following:

Unless otherwise acceptable to Engineer, the general sequence of work for each pipeline, or valved or bulkheaded section thereof, shall be as follows:

- Initial flushing and cleaning of pipeline.
- Filling pipeline.
- Hydrostatic pressure and leakage testing.
- Disinfection.
- Final cleaning, flushing, and neutralization of heavily chlorinated water.
- Bacteriological tests.
Unless otherwise acceptable, during testing of the pipeline, all valves, except for the auxiliary hydrant valve, shall be in the open position.

Unless otherwise acceptable, temporary bulkheads shall be provided during testing so that the test pressures are not applied to existing or new valves and hydrants, or to existing water lines, or to any portion of water lines installed under this Contract that have already been put into service.

A temporary pressure gauge shall be installed at each end of the limits of the pipeline to be tested.

The tests shall be conducted before connections are made to existing water lines, or to any portion of water lines installed under this Contract that have already been put into service.

Unless otherwise acceptable, upon completion of testing and disinfection, connections made to existing water lines or to any portion that has been put into service of new water lines installed under this Contract, shall be visually inspected for leakage after placing the water line into service and before backfilling the connection.

1-2.03. Water. Water for testing shall be furnished as stipulated in the Temporary Facilities section. Following completion of testing, the water shall be disposed of in a manner acceptable to Engineer. Unless otherwise permitted, the water shall be kept out of the remainder of the piping.

PART 2 - PRODUCTS

2-1. TEST EQUIPMENT. All necessary connections between the piping to be tested and the water source, together with pumping equipment, water meter, pressure gauges, and all other equipment, materials, and facilities required to perform the specified tests, shall be provided. All required flanges, valves, bulkheads, bracing, blocking, and other sectionalizing devices shall also be provided. All temporary sectionalizing devices shall be removed upon completion of testing. Vents shall be provided in test bulkheads where necessary to expel air from the piping to be tested.

Test pressures shall be applied by means of a force pump sized to produce and maintain the required pressure without interruption during the test.

Water meters and pressure gauges shall be accurately calibrated and shall be subject to review and acceptance by Engineer. Permanent gauge connections shall be installed at each location where test gauges are connected to the piping during the required tests. Drilling and tapping of pipe walls will not be permitted. Upon completion of testing, each gauge connection shall be fitted with a removable plug or cap acceptable to Engineer.
The Contractor shall utilize an approved reduced pressure zone backflow preventer, and meter all water taken from Florida Keys Aqueduct Authority for flushing, pigging, testing, and disinfection of mains. Meters must be obtained from Florida Keys Aqueduct Authority. All water metered during construction, will be billed for construction.

PART 3 - EXECUTION

3-1. Filling and Venting. Before filling the piping with water, care shall be taken to ensure that all air release valves and other venting devices are properly installed and in the open position. Hand-operated vent valves shall not be closed until an uninterrupted stream of water is flowing from each valve. The rate of filling the piping with water must not exceed the venting capacity of the installed air vent valves and devices.

3-2. Blocking and Backfilling. Piping shall be adequately blocked, anchored, and supported before the test pressure is applied.

3-3. PRESSURE TESTING. After the piping to be tested has been filled with water, the test pressure shall be applied and maintained without interruption within plus or minus 5 psi of test pressure for 2 hours plus any additional time required for Engineer to examine all piping being tested and for Contractor to locate any defective joints and pipe materials. The test pressure for this high pressure transmission main shall be 300 psi.

3-3.01. Pipeline Test Pressure. A test pressure of 300 psi shall be maintained for all high pressure transmission main piping, fittings, and appurtenances. A test pressure of 150 psi shall be maintained for all potable water distribution system piping, fittings, and appurtenances.


3-5. PIPELINE LEAKAGE TESTING. Following completion of pressure testing and acceptance by Engineer, the pipeline piping shall be subjected to a leakage test. The duration of the leakage test shall be 2 hours plus the additional time required for Engineer to make an accurate determination of leakage.

3-5.01. Leakage Test Pressure. The hydrostatic pressure maintained during the leakage test shall be at least 75 percent, but not more than 100 percent, of the pressure specified for pressure testing of the piping and shall be maintained within plus or minus 5 psi [35 kPa] during the entire time that leakage measurements are being performed.

3-5.02. Leakage Measurement. Measurement of leakage shall not be attempted until all trapped air has been vented and a constant test pressure has been established. After the
pressure has stabilized, piping leakage shall be measured with a suitable water meter installed in the pressure piping on the discharge side of the force pump.

3-5.03. Allowable Leakage. The term "leakage", as used herein, refers to the total amount of water which must be introduced into the piping during the leakage test to maintain the test pressure.

No piping will be accepted if and while it exhibits a leakage rate in excess of that determined by the indicated formulas:

\[
Q = 0.0075 \, DLN \quad \text{(using inch-pound units)}
\]

Where

- \( Q \) = allowable leakage in gallons per hour
- \( D \) = nominal diameter of pipe in inches
- \( L \) = length of section tested in thousand feet
- \( N \) = square root of average test pressure in pounds per square inch

\[
Q = 1.4 \times 10^{-6} \, DLN \quad \text{(using SI units)}
\]

Where

- \( Q \) = allowable leakage in liters per hour
- \( D \) = nominal diameter of pipe in millimeters
- \( L \) = length of section tested in meters
- \( N \) = square root of average test pressure in kilopascals

Whenever the piping to be tested contains pipe of different diameters, the allowable leakage shall be calculated separately for each diameter and the corresponding length of piping. The resulting allowable leakage rates shall be added to obtain the total allowable leakage for the entire piping.

All joints in piping shall be watertight and free from visible leaks during the leakage test. Each leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor regardless of the amount that the total leakage may have been below the specified allowable leakage rate during the leakage test.

If the leakage test indicates a higher than allowable leakage rate, Contractor shall locate and repair leaking joints and other defective work to the extent necessary to reduce the leakage to an acceptable value.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers seeding and sodding to be performed after backfilling and final grading are complete. All areas disturbed by construction operations shall be treated as specified herein.

All lawn, ditch, and street shoulder areas within street right-of-way and temporary construction easements that are damaged during the Work shall be restored, after completion of construction, to the complete satisfaction of Owner. All areas disturbed by Contractor outside the temporary construction easements shall be restored, at Contractor's expense, to the satisfaction of the property owner, except that if the temporary construction easement through the ownership is sodded all disturbed areas outside the construction easement shall also be sodded. Occupying areas outside temporary construction easements, street right-of-way, and utility easements for any purpose shall be done only with the written approval of the property owner.

1-2. GENERAL.

1-2.01. Governing Standard. The governing standard for the seeding and sodding Work shall be the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, 2007.

1-2.02. Experience. All Work shall be performed by a licensed seeding, sodding Contractor who is experienced in the type of Work required.

1-2.03. Completion. Sodding requirements are as follows:

   Locations to be sodded.       All disturbed areas.

1-3. SUBMITTALS.

1-3.01. Soil Test. A soil test for pH made of a composite sample of topsoil after finish grading shall be submitted to Engineer. Testing shall be performed through the State Extension Service or an independent agricultural soil testing lab. Samples shall be taken and submitted in accordance with instructions from the extension service or lab. Recommendations accompanying the test shall be used for application rates of lime.

1-3.02. Invoices and Analysis Labels. A copy of supplier’s invoices for all seed, mulch, and fertilizer which shows the quantity by weight purchased for the project and representative labels bearing the manufacturer’s or vendor’s guaranteed statement of
analysis shall be submitted to Engineer for review and approval to assure compliance with specified requirements for quality and application rates.

1-4. GUARANTEE.

1-4.01. Seeding. Not used.

1-4.02. Sodding. Contractor shall guarantee the sodding Work to the extent that all transplanted sod shall be uniform in color, leaf texture, shoot density, and reasonably free of visible imperfections at acceptance.

1-5. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

Prior to use, all products shall be kept dry and in a weatherproof location so that their effectiveness will not be impaired.

PART 2 - PRODUCTS

2-1. MATERIALS. All materials shall conform to the requirements of the Governing Standard, except where otherwise specified. The source of materials shall be submitted to Engineer for review.

2-1.01. Starter Fertilizer. In accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, 2007.

2-1.02. Seed. Not used.

2-1.03. Sod. Sod shall have been planted on cultivated agricultural land and grown specifically for sod purposes and shall conform to the quality standards of Nursery Grown Sod as defined by the American Sod Producers Association. Sod shall be free of objectionable grassy and broad leaf weeds. Sod shall be considered free of such weeds if less than five such plants are found per 100 square feet [9.2 m²] of area. The sod species shall be in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, 2007.

2-1.04. Lime. Material used for soil neutralization shall be commercial ground agricultural limestone, with no less than 90 percent passing the No. 8 [2.36 mm] sieve and containing no less than 65 percent calcium carbonate equivalent.
PART 3 - EXECUTION

3-1. GENERAL. Execution of seeding and sodding Work shall conform to the Governing Standard, or shall be as specified herein, whichever is the most stringent.

3-2. SEEDING. Not used.

3-3. HYDROSEEDING. Not used.

3-4. SODDING. Sodding shall be in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, 2007.

3-4.01. Preparation. The Work specified herein shall not be started until substantially all earth work has been completed. Backfills and fills shall be allowed to settle and the topsoil spread and finish grading completed before the Work is started.

3-4.02. Application of Fertilizer and Lime. Any fertilizer and lime specified shall be applied prior to the tilling operation. The fertilizer shall be distributed uniformly over the entire area to be sodded in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, 2007. Lime shall be applied at a rate based on a soil test for pH. The rate shall be adequate to neutralize the acidity of the soil.

3-4.03. Preparation of Sod Bed. After fertilizer and lime have been applied, the areas to be sodded shall be tilled to a true depth of 6 inches [150 mm] by diskng, harrowing, or other accepted methods to thoroughly incorporate the lime and fertilizer, destroy vegetation, and pulverize the soil. After tilling, the bed shall be smoothed by dragging or floating. The surface shall be cleared of all stones, stumps or other objects larger than 1-1/2 inches [38 mm] in thickness or diameter; roots, wire, grade stakes, and other objects that might be a hindrance to maintenance operations. Paved areas over which hauling operations are conducted shall be kept clean and dirt that may be brought upon the surface shall be removed.

When results are not satisfactory because of drought, excessive moisture or other causes, the Work shall be stopped until such conditions have improved or have been corrected.

All operations shall be done in a direction parallel to the contour lines and not uphill and downhill.

3-4.04. Application of Sod. Sod shall be placed after preparation of the sodbed. Sod shall be cut in strips or rectangular sections which may vary in length but shall be of equal width and of size that will permit the sections to be lifted and rolled without breaking. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. When the soil is too dry, the sod shall be cut only after Contractor has watered the sod sufficiently to moisten the soil to the depth at which the
sod is to be cut.

Care shall be exercised at all times to retain the native soil on the roots of the sod during the process of stripping, transporting, and planting. Dumping from vehicles will not be permitted.

The sod shall be transplanted within 24 hours from the time of stripping, unless stored in a satisfactory manner. During delivery and while in stacks, the sod shall be kept moist and shall be protected from exposure to the air and sun.

Sod shall be laid smoothly, edge-to-edge, and with staggered joints. The sod shall be immediately pressed firmly into contact with the sod bed by tamping or rolling with acceptable equipment so as to eliminate all air pockets, provide a true and even surface, and assure knitting.

Staking is not required, except in ditch flow lines; however, Contractor will be responsible for replacing all sod that is displaced by erosion during the maintenance period. Only wooden (lath) stakes shall be used.

3-5. WATERING.

3-5.01. Seeded Areas. Not used.

3-5.02. Sodded Areas. Contractor shall provide all water, labor, and equipment for watering sodded areas. Sodded areas representing one day’s planting shall be watered sufficiently to wet the sod pads and at least 2 inches [50 mm] of the sod bed. Thereafter, in the absence of adequate rainfall, watering shall be performed daily and as often as necessary to keep the sod pads moist at all times. Watering of sod shall continue as needed until final acceptance.

3-6. REPLANTING.

3-6.01. Seeded Areas. Not used.

3-6.02. Sodded Areas. Prior to acceptance, sodded areas that show signs of substantial desiccation as evident by a loss of color and a distinct yellowing shall be resodded and shall continue to be resodded until an acceptable sod cover is obtained. Replanting operations shall be as specified except that fertilizer and lime shall be deleted from the operation.

3-7. MAINTENANCE. All areas shall be maintained until final acceptance of the project.

3-7.01. Seeded Areas. Not used.

3-7.02. Sodded Areas. Original grades of the sodded areas shall be maintained after commencement of planting operations and until acceptance. Any damage to the
finished surface shall be repaired. In the event erosion occurs from either watering operations or rainfall, such damage shall be repaired. Ruts, ridges, tracks, and other surface irregularities shall be corrected and areas resodded.

During the maintenance period prior to acceptance, all sodded areas shall be mowed to height of 3 inches [75 mm] as soon as, and each time that, the grass reaches an average height of 5 inches [125 mm]. Clippings shall be collected and removed from the site.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers procurement of all cast-in-place concrete, including concrete materials, limiting requirements, mixture design, and performance requirements, and delivery to the site through discharge at the end of the delivery truck chute. Work beyond the end of the delivery truck chute is covered in Sections 03100, 03200, 03250, and 03350.

Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

1-2. GENERAL. All cast-in-place concrete shall conform to the limiting requirements of this specification including Tables 1A, 1B, 2A and 2B.

1-2.01. Concrete Classifications. Concrete classifications shall be defined and used as indicated for the following classes:

Class Description

A. Structural Concrete

A1. **Concrete for Liquid Containing Structures.** Concrete for liquid containing environmental structures, liquid containing tanks, and interior suspended slabs in high humidity areas, headwalls, and all other concrete not otherwise indicated.

A2. **Small Aggregate Concrete; Congested Areas.** Not Used.

A3. **Concrete for Non-Liquid Containing Structures.** Concrete for footings, foundations, manholes, catch basins, pan-formed joists, and all other structural concrete other than for liquid containing structures.

A4. **Mortar Puddle.** Placed in a lift 2 inches or more deep at the bottom of forms for walls and columns immediately before structural concrete is placed.
A5. **Drilled Pier Concrete.** Not Used.

B. **Exterior Flatwork Concrete.** Concrete for exterior slabs on grade, plant pavement, sidewalks, curbs and gutters, and small equipment pads.

C. **Architectural Concrete.** All non-liquid containing concrete that will be visible to the public on the Operations Building, as indicated on the architectural drawings.

D. **Miscellaneous Concrete**

   D1. **Ductbanks, Pipe Blocking, Concrete Fill, and Pipe Encasement Concrete.** Concrete used in ductbanks, pipe blocking, concrete fill and pipe encasements.

   D2. **Underwater Concrete.** Not Used. Unless otherwise permitted by Engineer, concrete shall not be deposited under water.

   D3. **Massive Concrete.** Not Used. D4. **Pan Stairs Concrete.** Not Used.

   D5. **Wash Water Trough Concrete.** Not Used. D6. **Composite Topping Concrete.** Not Used.

   D7. **Lean Concrete.** Used as a fill material for over-excavations.

1-3. **SUBMITTALS.**

1-3.01. **Drawings and Data.** All submittals of drawings; manufacturers' certificates of compliance, recommendations, and test data; reports; catalog data sheets; and other data shall be in accordance with the submittals section, unless otherwise specified herein.

Reports and certifications on proposed materials and mixture proportions for each concrete mixture design shall be submitted for review within 30 days after the preconstruction conference and prior to conducting the laboratory trial batches for each mixture design.

Water-soluble chlorine ion shall be determined in the concrete mix in accordance with ASTM C1218 within the 6 week period prior to the start of placing concrete on the project. This test shall be in addition to the testing described in paragraph 2-3.02.02. Testing shall be in accordance with paragraph 2-1.12. Concrete placing shall not proceed until testing demonstrates acceptable results.

1-3.02. **Manufacturer's Certificate of Compliance.** A manufacturer's certificate of...
compliance, which includes the name of the project and copies of independent test results confirming compliance with specified requirements, shall be submitted to the Engineer for the following materials when used:

- Cement.
- Admixtures.
- Fly Ash.
- Slag Cement.

1-4. STORAGE AND HANDLING. Cement, slag cement and fly ash shall be stored in suitable moisture proof enclosures. Cement, slag cement and fly ash which have become caked or lumpy shall not be used.

Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.

PART 2 - PRODUCTS

2-1. LIMITING REQUIREMENTS. Unless otherwise specified, each concrete mixture shall be designed and controlled, within the following limits, to provide a dense, durable concrete suitable for the expected service conditions.

Concrete materials shall be selected and concrete shall be proportioned, batched, mixed, and delivered in a manner that will minimize shrinkage and cracking as specified herein, and in accordance with Chapters 3 and 8 of ACI 224R. Concrete temperatures shall be controlled before and until delivery at the end of the delivery truck chute to minimize cracking. Any rise in concrete temperature caused by environmental conditions that will be conducive to excessive shrinkage shall be controlled.

For each class of concrete, each concrete mixture shall be designed and concrete shall be controlled within the limits in the specification and in Tables 1A and 1B.

2-1.01. Cementitious Material Content Limits. The minimum quantity of Portland cement in the concrete shall be as indicated in Tables 1A and 1B.

Contractor may substitute fly ash for Portland cement within the percentage ranges indicated in Tables 1A and 1B, on the basis of 1.0 lbs of fly ash added for each lb of Portland cement reduction.

Contractor may substitute slag cement for Portland cement within the percentage ranges indicated in Tables 1A and 1B on the basis of 1.0 lbs of slag cement added for each lb of Portland cement reduction.
Mixtures using slag cement in combination with fly ash will not be acceptable.

Maximum cementitious material content, when ASTM C150 Type I Portland cement is used, shall not be more than 1.15 times the minimum Portland cement content specified. When a Type II, Type I/II, or Type V Portland cement is used, the cementitious material content shall not be increased more than necessary to achieve the required $f'_{c,r}$.

2-1.02. Maximum Water-Cementitious Material Ratio. The maximum water-cementitious ratio shall be on a cement mass basis, or, if fly ash or slag cement is used, the combined mass of cement plus fly ash or slag cement shall be used to determine the water-cementitious materials ratio. Limiting maximum water-cementitious material ratios are indicated in Tables 1A and 1B.

2-1.03. Aggregates. Aggregates shall comply with ASTM C33 except as specified herein. Fine aggregate shall be clean natural sand. Artificial or manufactured sand will not be acceptable. Coarse aggregate shall be crushed rock, washed gravel, or other inert granular material, meeting Class 4S requirements, except that clay and shale particles shall not exceed values indicated in Tables 1A and 1B.

When ASTM C33 gradations are specified, final gradation of the coarse aggregate shall conform to maximum nominal size grading requirements of ASTM C33, when one size of aggregate or a combination of two or more sizes is used.

When the 18-8 combined aggregate gradation is required, the combined aggregates shall be well graded from the coarsest to the finest. Not more than 18 percent nor less than 8 percent (18-8 requirement) of the combined aggregate shall be retained on any individual sieve with the exceptions that the No. 50 may have less than 8 percent retained, sieves finer than No. 50 shall have less than 8 percent retained, and the coarsest sieve may have less than 8 percent retained.

Aggregates used in concrete shall have a combined aggregate distribution similar to the aggregates used in the concrete trial mixtures. Reports of individual aggregates shall include sieve sizes 1-1/2 inch, 1 inch, 3/4 inch, 1/2 inch, 3/8 inch, No. 4, No. 8, No. 16, No. 30, and No. 50 in accordance with ASTM E11.

When available aggregates are elongated or slivered and cause interference with mixture mobility, or available aggregate gradations will not comply with the 18-8 requirement and when permitted by Engineer, the combined aggregate percentages may be changed to not more than 22 percent nor less than 6 percent retained on any individual sieve.

Specified sand equivalent for fine aggregate shall be not less than indicated in Tables 1A and 1B for an average of 3 samples tested in accordance with ASTM D2419.

The maximum coarse aggregate content consistent with workability and minimizing shrinkage shall be used in the mixture. To comply with the specified concrete shrinkage
test requirements, the clay and shale content of the aggregates may need to be reduced by washing the aggregate.

2-1.04. Ratio of Fine to Total Aggregates. The ratio of fine to total aggregates, based on solid volumes (not weights), shall be as follows:

<table>
<thead>
<tr>
<th>Coarse Aggregate Size</th>
<th>Minimum Ratio</th>
<th>Maximum Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>0.45</td>
<td>0.60</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>0.40</td>
<td>0.55</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>0.35</td>
<td>0.50</td>
</tr>
<tr>
<td>1 inch</td>
<td>0.30</td>
<td>0.46</td>
</tr>
<tr>
<td>1-1/2 inch</td>
<td>0.25</td>
<td>0.40</td>
</tr>
</tbody>
</table>

2-1.05. Slump. Concrete slump shall be kept as low as possible, consistent with proper handling and thorough consolidation. Slump shall be at least 2 inches and shall not exceed the maximum slump as indicated in Tables 1A and 1B.

When superplasticizer is dispensed at the ready-mix plant, the concrete mixture design shall be based on a maximum slump as indicated in Tables 1A and 1B; and when superplasticizer is dispensed at the site, slump shall not exceed the maximum slump as indicated in Tables 1A and 1B before superplasticizer is added.

2-1.06. Initial Set. The initial set, as determined by ASTM C403, shall be attained 5-1/2 hour’s ±1 hour after the water and cement are added to the aggregates for each concrete mixture. The quantity of retarding admixture shall be adjusted to compensate for variations in temperature and job conditions.

2-1.07. Total Air Content. The total volumetric air content of concrete after placement shall be as indicated in Tables 1A and 1B, and within ±1 percent. Air-entraining admixture may be omitted from concrete for interior slabs which are to be trowel finished, and from Classes D1, D2, and D7 concrete.

2-1.08 Admixtures. Only approved or specified admixtures shall be used.

Unless otherwise acceptable to the Engineer, all admixtures shall be from one manufacturer and shall be compatible. Admixtures that are compatible with other admixtures and concrete materials shall not have an adverse affect on the required properties of the concrete nor the specified limiting requirements. The admixture content, batching method, and time of introduction to the mixture shall comply with these
specifications and with the manufacturer's recommendations for minimum shrinkage. The admixture manufacturer shall provide qualified field services as necessary, at no additional cost to Owner.

Admixtures used in the concrete shall be as recommended in writing by the admixture manufacturer prior to conducting the laboratory trial concrete mixture testing and the shrinkage test. No calcium chloride nor admixture containing chloride from sources other than residual impurities in admixture ingredients will be permitted. Admixtures containing unrefined or raw lignosulfonic acids ("lignins") or their salts will not be acceptable.

Combination of admixtures which cause premature or local dehydration or post-compaction settlement of the concrete surface shall not be used. If any such undesirable characteristics are observed, the use of the mixture shall be discontinued and an alternate mixture design used.

A water-reducing admixture shall be included in all concrete, except Classes D1 and D7 concrete. A superplasticizer shall be used in all liquid-containing (Class A1) concrete and shall be used in small aggregate (Class A2) concrete that is placed in liquid-containing structures. Unless otherwise required, a mid-range plasticizing admixture or a superplasticizer may be used, at the option of Contractor, in all other concrete except Classes D1 and D7. When a mid-range plasticizing admixture is used as a superplasticizer or when a superplasticizer is used, the admixture manufacturer shall recommend to Engineer, in writing, the type of superplasticizer to be used with the required water-reducing admixture to achieve the specified initial-set times.

Superplasticizer may be dispensed into the concrete at the plant or on the job site and shall be mixed in accordance with the admixture manufacturer's recommendations. Each superplasticizer dose, when dispensed at the site, shall be easily verifiable and recorded on the delivery ticket. The superplasticizer for each load shall be accurately proportioned into a separate container prior to dispensing the admixture into the concrete. When truck-mounted dispensers are used, the system shall not be flushed or cleaned with water until after the entire load of concrete has been discharged. When permitted by Engineer, redoing of concrete with superplasticizer shall be done only once. Redoing procedures shall be as recommended by the admixture manufacturer.

A shrinkage reducing admixture may be added to concrete class A1. If used, it shall replace an equal volume of mixing water or as otherwise recommended by the admixture manufacturer. The quantity of air entrainment admixture shall be adjusted as required by the admixture manufacturer to keep mix air content within specified limits.


2-1.10. Strength. In addition to the other limiting requirements to achieve durability and minimize shrinkage, the minimum acceptable compressive strengths of concrete tested at the end of the delivery truck chute using 6 by 12 inch site-cast cylinders, as determined by ASTM C39, shall be as indicated in Tables 1A and 1B.
Adequate test cylinders taken at the point of placement shall also be made to verify that the construction contractor's concreting procedures comply with applicable industry standard procedures.

2-1.11. **Pumped Concrete.** Coarse aggregate size for pumped concrete mixtures shall be limited to a maximum of 1-1/2 inch.

The slump of concrete, with or without a superplasticizer that is discharged into the pump may exceed the specified maximum slump value by the amount of slump loss in the pumping system, up to a maximum of 1 inch. The slump loss shall be determined by tests made at each end of the pumping system.

2-1.12. **Water-Soluble Chloride.** Maximum water-soluble chloride ion concentrations in hardened concrete at an age of 28 days shall not exceed the limits expressed as a percentage of mass of cement as indicated in Tables 1A and 1B.

Test results shall be reported as the percentage of water-soluble chloride ions in the concrete and as a percentage of chloride ion relative to the mass of cement in the concrete.

Testing of the concrete components, except aggregates, for water-soluble chloride ions will be done at the discretion of Contractor. Copies of the reports on such tests shall be furnished to Engineer.

The hardened concrete and each gradation of aggregate used in the concrete shall be tested each time a chloride ion test is conducted on a concrete mixture.

2-1.13. **Laboratory Shrinkage Limits.** Based on the modified ASTM C157 test procedures as specified herein, the shrinkage limits of concrete shall be the average drying shrinkage of each set of three test specimens cast in the laboratory from a trial batch as measured at the 21 days drying age, and shall not exceed the values in Tables 1A and 1B.

The average drying shrinkage of each set of test specimens cast in the field from concrete delivered to the site, and sampled at the end of the delivery truck chute, as measured at the 21 days drying age shall not exceed the values in Tables 1A and 1B.

2-1.14. **Mineral Colored Concrete.** Not Used.

2-1.15. **Cold Weather Concrete.** Except as modified herein, cold weather concrete shall comply with ACI 306R. The temperature of concrete at the point of delivery at the end of the delivery truck chute shall be not less than that indicated in ACI 306R for corresponding outdoor temperature (in shade) at the time of placement:

When delivered, heated concrete shall be not warmer than 80°F.

2-1.16. **Hot Weather Concrete.** Except as modified herein, hot weather concrete shall
comply with ACI 305R. At air temperatures of 90°F or above, concrete shall be kept as cool as possible before and during delivery. The temperature of the concrete at the time of delivery at the end of the delivery truck chute shall not exceed the values indicated in Tables 1A and 1B.

2-2. MATERIALS

Cement
ASTM C 150, Type II or Type I/II. Low Alkali.

Fly Ash
ASTM C618, Class F or ASTM C618, Class C that passes ASTM C1012 testing for moderate sulfate resistance, except loss on ignition shall not exceed 4 percent.

Slag Cement (GGBFS)
ASTM C989, Grade 100 or Grade 120.

Aggregates, Fine and Coarse
As specified in Limiting Requirements paragraph.

Water
Potable.

Admixtures

Water Reducing/Normal Set
ASTM C494, Type A, except as otherwise specified herein.

Water Reducing/Retarding
ASTM C494, Type D, except as otherwise specified herein.

Air-Entraining
ASTM C260.

Superplasticizing/Normal Set
ASTM C494, Type F, extended slump life type, except as otherwise specified herein.

Superplasticizing/Retarding
ASTM C494, Type G, extended slump life type, except as otherwise specified herein.

Shrinkage Reducing Admixture
Grace “Eclipse Plus” or BASF (Master Builders) “Tetraguard AS20”.

Mineral Coloring
Not Used.

2-3. PROPORTIONING.

2-3.01. Mixture Design. Using concrete materials acceptable to Engineer, a tentative concrete mixture shall be designed and tested in the laboratory for each size and combined gradation of aggregates and for each consistency as indicated and intended for use on the work and as specified. Concrete proportions shall be established based on laboratory trial mixtures that meet the following requirements:
a. The combination of materials shall be as proposed for use in the work.

b. Mixtures shall conform with the limiting requirements specified herein.

c. The required average compressive strength, \( f'_{cr} \), of the trial mixture, using 6 X 12 cylinders, shall exceed the specified minimum acceptable compressive strength, \( f'_{cr} \), as required in Tables 1A and 1B.

d. Trial mixtures of the proportions and consistencies specified for the work shall be prepared. When a three point curve is required by Tables 2A and 2B, the three concrete trial mixtures shall reflect the cement content proposed for the project and for the indicated concrete class at three water-cementitious material ratio contents at or lower than indicated in Tables 1A and 1B. The compressive strength of the cylinders made from the three trial mixtures shall produce a range of compressive strengths exceeding or encompassing the \( f'_{cr} \) required for the work.

e. For each proposed concrete mixture that is required to be tested as indicated in Tables 2A and 2B, at least three 6 by 12 inch compressive strength test cylinders shall be made for each age. Each change in the water-cementitious materials ratio shall be considered a new concrete mixture. Each mixture shall be tested at the ages of 7 days and 28 days with two test cylinders broken at 28 days.

f. When a three point curve is required in Table 2A or 2B, the results of the cylinder tests for each water-cementitious materials ratio at each age shall be plotted as a curve showing the relationship between compressive strength (along y-axis) and the water-cementitious materials ratio (along x-axis). The water-cementitious materials ratio for the concrete mixture to be used in the work shall be selected from the 28 day curve to produce the required average compressive strength. The cement content and mixture proportions to be used shall be such that the selected water-cementitious materials ratio will not be exceeded at specified maximum slump. These concrete mixture proportions shall be submitted for review in accordance with the submittals section. When a shrinkage reducing admixture is proposed, trial batches shall be prepared with and without the shrinkage reducing admixture.

If acceptable in Table 2A or 2B, concrete mixtures may utilize prior field test data in lieu of laboratory trial mixtures. Field test data records shall be from the production facility being used on current project and shall have been performed in the past 12 months. Field test data records shall represent a single group of at least 10 consecutive strength tests for one mixture, using the same materials, under the same conditions, and encompassing a period of not less than 60 days.
Mixtures shall be adjusted in the field as necessary, within the limits specified, to meet the requirements of these specifications.

2-3.02. Preliminary Review. Reports covering the source and quality of concrete materials and the concrete proportions proposed for the work shall be submitted to Engineer for review before performing the required trial mixture designs and before concrete work is started. The reports required shall be as indicated in Tables 2A and 2B. Review of these reports will be for general acceptability only, and continued compliance with all contract provisions will be required.

2-3.02.01. Aggregate Reports. Reports on aggregates shall include the information listed in Tables 2A and 2B. Aggregate reports shall be project specific and shall be no more than 90 days old at time of submittal.

2-3.02.02. Mixture Design Report. Design quantities and test results on each mixture shall be submitted for review and shall be accepted before concrete work is started. The report on each tentative concrete mixture and on the proposed concrete mixture shall contain the information in Tables 2A and 2B, and shall be submitted to Engineer.

2-3.02.03. Mixture Design Testing. As stipulated in the Quality Control section, all tests and reports required for preliminary review shall both be made by an independent testing laboratory at the expense of Contractor specifically for this project. All materials shall be tested in accordance with the specified test methods and reports for these tests shall be prepared specifically for this project. If the source of any concrete materials is changed during the contract, the materials and the new mixture design shall be tested in accordance with the specified preliminary review requirements and reports shall be submitted for review.

Aggregates shall be sampled and tested in accordance with ASTM C33. In addition, the bulk specific gravity of each aggregate shall be determined in accordance with ASTM C127 and ASTM C128.

Concrete test specimens shall be made, cured, and stored in accordance with ASTM C192 and tested in accordance with ASTM C39.

Slump shall be determined in accordance with ASTM C143. Total air content shall be determined in accordance with ASTM C231 and verified in accordance with ASTM C138. Concrete temperature shall be determined in accordance with ASTM C1064 and unit weight (mass) shall be determined in accordance with ASTM C138. Water-soluble chloride ion shall be determined in accordance with ASTM C1218.

Initial set tests shall be made at ambient temperatures of 70°F and 90°F to determine compliance with the specified time for initial set. The test at 70°F shall be made using concrete containing the specified normal set/water-reducing admixture and, when required, air-entraining admixture. The test at 90°F shall be made using concrete containing the
specified retarding/water-reducing admixture and, when required, air-entraining admixture. Initial set shall be determined in accordance with ASTM C403.

A preliminary test on a trial batch shall be conducted at the project site, using the proposed superplasticizer in the accepted mixture design to determine the correct dosage. When superplasticizer is not included in the trial mixture, the trial batch tested at the site shall be used to determine compatibility of the superplasticizer with the other materials used in the concrete, including the other admixtures.

A drying shrinkage test shall be conducted on the preliminary trial batch with the maximum water-cementitious materials ratio used to qualify each proposed concrete mixture design using the concrete materials, including admixtures that are proposed for the project. Three test specimens shall be prepared for each test. Drying shrinkage specimens shall be 4 inch by 4 inch by 11 inch prisms with an effective gauge length of 10 inches, fabricated, cured, dried, and measured in accordance with ASTM C157 except with the following modifications:

Specimens shall be removed from the molds at an age of 23 hours ±1 hour after trial batching, shall be placed immediately in water at 73°F ±3°F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in lime-saturated water as specified in ASTM C157. Measurement to determine expansion expressed as a percentage of original length shall be taken at age 7 days. The length at 7 days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity controlled room maintained at 73°F ±3°F and 50 percent ±4 percent relative humidity for the remainder of the test.

Measurements to determine shrinkage expressed as a percentage of the base length shall be reported separately for 7, 14, and 21 days ±4 hours of drying from "0" days after 7 days of moist curing for a total of 28 days from the date of casting. Drying shrinkage deformation for each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. Results of the shrinkage test shall be reported to the nearest 0.001 percent. If drying shrinkage of any specimen deviates from the average for that test age by more than 0.004 percent, the results for that specimen shall be disregarded.

The average drying shrinkage of each set of 4 inch by 4 inch by 11 inch test specimens made in the laboratory from a trial batch shall not exceed the values required in Tables 1A and 1B. Drying shrinkage tests will only be required for concrete mixtures indicated in Tables 1A, 1B, 2A, and 2B.

Alkali-aggregate reactivity potential shall be determined in accordance with Appendix XI of ASTM C33. Aggregates shall be tested in accordance with ASTM C289 and C295 or ASTM C1260 to determine potential reactivity. Aggregates which do not indicate a potential for alkali reactivity or do not have reactive constituents may be used without
further testing. Aggregates which indicate a potential for alkali reactivity shall be further tested in accordance with ASTM C227 or C1105, as appropriate, using a cement containing less than 0.6 percent alkalies. At the discretion of Engineer, testing in addition to that indicated in Appendix XI of ASTM C33 may be performed on potentially reactive aggregates. Nonreactive aggregates shall be imported if, in the opinion of the Engineer, local aggregates exhibit unacceptable potential reactivity.

2-4. ARCHITECTURAL CONCRETE. Architectural concrete shall conform to the applicable requirements of Section 6 of ACI 301 and to the additional requirements specified herein.

2-4.01. General Requirements. Architectural concrete shall be free from holes, sand streaks, mortar leakage, offsets, irregularities, and other defects.

2-5. BATCHING AND MIXING. Concrete shall conform to ASTM C94 and shall be furnished by an acceptable ready-mixed concrete supplier.

2-5.01. Consistency. The consistency of concrete shall be suitable for the placement conditions. Aggregates shall float uniformly throughout the mass, and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.

2-5.02. Delivery Tickets. A delivery ticket shall be prepared for each load of ready-mixed concrete and a copy of the ticket shall be handed to Engineer by the truck operator at the time of delivery. Tickets shall indicate the name and location of Contractor, the project name, the mixture identification, the quantity of concrete delivered, the quantity of each material in the batch, the outdoor temperature in the shade, the time at which the cement was added, and the numerical sequence of the delivery.

PART 3 – EXECUTION

3-1. CONTRACTOR’S ON GOING MATERIAL CONTROL TESTING. The following tests and the test reports are required during the progress of the work and shall be made at the expense of Contractor. The frequency specified herein for each field control test is approximate and subject to change as determined by Engineer.

3-1.01. Aggregate Gradation. Each 200 tons of fine aggregate and each 400 tons of coarse aggregate shall be sampled and tested in accordance with ASTM D75 and C136. If lesser quantities of aggregates are used the sampling and testing shall occur at least once every 6 months.

3-1.02. Sand Equivalent. The sand equivalent test shall be conducted each time the sand gradation tests are conducted.

3-1.03. Fly Ash. Each 400 tons of fly ash shall be sampled and tested in accordance with ASTM C618 and C311. Contractor shall supply ENGINEER with certified copies of supplier's (source) test reports showing chemical composition and physical analysis for
each shipment delivered to Contractor and certifying that the fly ash complies with the specifications. The certificate shall be signed by both the fly ash supplier and Contractor.

3-1.04. Cement. Contractor shall supply Engineer with certified copies of supplier's (source) test reports showing chemical composition and physical analysis for each shipment delivered to Contractor, and certifying that the cement complies with ASTM C150 and these specifications. The certificate shall be signed by both the cement manufacturer and Contractor.

3-1.05 Slag Cement. Contractor shall supply Engineer with certified copies of supplier’s (source) test reports showing chemical composition and physical analysis for each shipment delivered to Contractor and certifying that the slag cement complies with ASTM C989 and these specifications. The certificate shall be signed by both the slag cement manufacturer and the Contractor.

3-2. CONTRACTOR’S FIELD CONTROL TESTING. Field control tests, including aggregate gradation (if needed), slump, air content, making compression test cylinders, and other listed tests shall be performed by testing laboratory personnel. Contractor shall provide all facilities and the services of one or more employees as necessary to assist with the field control testing.

Testing shall be in accordance with the Florida Building Code and completed by Qualified Technicians employed by an Approved Agency.

As stipulated in the quality control section, tests required during the progress of the work shall be made at the expense of Contractor.

The frequency specified herein for each field control test is approximate and subject to change as determined by Engineer.

Engineer may require field testing prior to the addition of superplasticizer at the site to determine compliance with the specifications. Field testing after the addition of superplasticizer shall be conducted as specified and as needed to determine that the concrete is in compliance with the specifications. Air tests shall be conducted whenever field tests are conducted.

3-2.01. Slump. A slump test shall be made for each 50 cubic yards of concrete. Slump shall be determined in accordance with ASTM C143.

3-2.02. Air Content. An air content test shall be made on concrete from one of the first three batches mixed each day and on concrete from each batch of concrete from which concrete compression test cylinders are made. Air content shall be determined in accordance with ASTM C231 and verified in accordance with ASTM C138.

3-2.03. Unit Weight. A unit weight test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Unit weight shall
be determined in accordance with ASTM C138.

3-2.04. **Concrete Temperature.** A concrete temperature test shall be made on concrete from the first batch of concrete mixed each day and on concrete from each batch of concrete from which concrete compression test cylinders are made. Concrete temperature shall be determined in accordance with ASTM C1064.

3-2.05. **Water-Soluble Chloride Ion.** Water-soluble chloride ion testing shall be performed once for each 500 cubic yards of concrete in accordance with ASTM C1218.

3-2.06. **Compression Tests.** One set of four concrete compression test cylinders shall be made each day when 25 to 50 cubic yards of concrete is placed. One additional set of test cylinders shall be made from each additional 50 cubic yards, or major fraction thereof, placed in any one day. Two cylinders of each set shall be tested at an age of 7 days and the remaining cylinders shall be tested at an age of 28 days.

Test cylinders shall be 6 inches in diameter by 12 inches high and shall be made, cured, stored, and delivered to the laboratory in accordance with ASTM C31 and tested in accordance with ASTM C39.

Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders was placed, the number of the delivery truck or batch, the air content, the slump, the unit weight, and the concrete temperature.

3-2.07. **Shrinkage Tests.** Concrete shrinkage tests shall be performed once for each 1,000 cubic yards of concrete with controlled shrinkage that is placed and shall be made on concrete from a batch of concrete from which concrete compression test cylinders are made. Shrinkage testing shall be conducted as specified for the preliminary trial mixes.

The average drying shrinkage of each set of test specimens cast in the field from concrete delivered to the site as measured at the 21 days' drying age shall not exceed the values indicated in Tables 1A and 1B.

3-2.08. **Test Reports.** Five copies of each test report shall be prepared and distributed by the testing laboratory to the Resident Project Representative (two copies), Engineer, and Contractor, in accordance with the quality control section.

3-3. **EVALUATION AND ACCEPTANCE OF CONCRETE.** Concrete will be evaluated for compliance with all requirements of the specifications. Concrete strength will be only one of the criteria used for evaluation and acceptance of the concrete. The results of all tests performed on the concrete and other data and information concerning the procedures for handling, placing, and curing concrete will be used to evaluate the concrete for compliance with the specified requirements.

Compression tests will be evaluated in accordance with ACI 318 and as specified herein. A
strength test shall be the average of the compressive strengths of two cylinders made from the same concrete sample tested at 28 days.

3-3.01. Compression Test Evaluation. Compressive strength test results will be evaluated for compliance with the specified strength requirements. The strength level of the concrete will be considered satisfactory when the averages of all sets of three consecutive strength tests equal or exceed the specified compressive strength, $f'c$, and no individual strength test result falls below the specified compressive strength by more than 500 psi.

3-3.02. Inspection of Concrete Supplier. Both scheduled and unscheduled visits by inspectors on days of concrete pours shall be accommodated. Inspectors shall be allowed access to mix tickets and mix proportions.
## TABLE 1A - LIMITING REQUIREMENTS

<table>
<thead>
<tr>
<th>Concrete Classification</th>
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### D Coarse Aggregate:
Clay and shale combined particles shall not exceed, max. percent

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### TABLE 1B - LIMITING REQUIREMENTS

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<td><strong>1.</strong> Minimum Cement Content, lbs/cubic yard; based on maximum slump and maximum water-cementitious material ratio.**</td>
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<td>1-1/2&quot;</td>
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<td>7. Air entrainment, percent (±1 percent)</td>
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**NOTES:**

# "D2" (Underwater concrete) - Limit aggregate to 3/4" for reinforced concrete, up to 1-1/2" for unreinforced concrete.

* "D2" (Underwater concrete) - Reduce cement content 100 lbs. per cubic yard for each aggregate size listed for 2,500 psi.

ª "D5" Wash water trough top edge water-cementitious ratio, 100 percent sand passing No. 8 sieve.

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<th>TABLE 2A - SUBMITTAL REQUIREMENTS</th>
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<td>A Fine aggregate</td>
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</tr>
<tr>
<td>Gradation</td>
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<tr>
<td>Deleterious materials</td>
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<td>Fineness modulus</td>
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<td>Alkali-aggregate reactivity</td>
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<td>Sand equivalent</td>
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<td>Abrasion loss</td>
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<td>Soundness test</td>
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<tr>
<td>C Combined aggregate gradation</td>
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<tr>
<td>D &quot;18-8&quot; requirement</td>
</tr>
<tr>
<td>2 Cement, mill report</td>
</tr>
<tr>
<td>3 Cementitious material, type, data sheet, and test report (fly ash, slag cement)</td>
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<td>4 Admixtures</td>
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TABLE 2A - SUBMITTAL REQUIREMENTS

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## TABLE 2B - SUBMITTAL REQUIREMENTS

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</tr>
<tr>
<td>5 Mixture proportions, reports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A Mixture proportions report using field test data (prior experience) acceptable</td>
<td>X</td>
<td>---</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>B Job-specific laboratory trial mix required</td>
<td>---</td>
<td>X</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>C Three point curves required</td>
<td>---</td>
<td>X</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>D Compressive strength at 7 and 28 days</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>E Mixture proportions report</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Slump</td>
<td>---</td>
<td>X</td>
<td>---</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>---</td>
</tr>
<tr>
<td>Water content</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>---</td>
</tr>
<tr>
<td>Water-cementitious materials ratio</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>---</td>
</tr>
<tr>
<td>Brand, type, composition, and quantity of cement</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>---</td>
</tr>
<tr>
<td>Brand, type, composition, and quantity of fly ash</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Specific gravity of each aggregate</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ratio of fine to total aggregates</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>X</td>
<td>X</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Air content</td>
<td>---</td>
<td>---</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>---</td>
</tr>
<tr>
<td>Temperature</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Concrete Class</td>
<td>D1</td>
<td>D2</td>
<td>D3</td>
<td>D4</td>
<td>D5</td>
<td>D6</td>
<td>D7</td>
</tr>
<tr>
<td>----------------</td>
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<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Unit weight</td>
<td>...</td>
<td>X</td>
<td>X</td>
<td>...</td>
<td>X</td>
<td>X</td>
<td>...</td>
</tr>
<tr>
<td>Time of initial set at 70°F and 90°F.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Water-soluble Chloride ion</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>...</td>
<td>X</td>
<td>X</td>
<td>...</td>
</tr>
<tr>
<td>Shrinkage</td>
<td>...</td>
<td>X</td>
<td>...</td>
<td>...</td>
<td>X</td>
<td>X</td>
<td>...</td>
</tr>
<tr>
<td>Field Compression Test Evaluation Reports taken at End of Delivery Truck Chute</td>
<td>...</td>
<td>X</td>
<td>X</td>
<td>...</td>
<td>...</td>
<td>X</td>
<td>...</td>
</tr>
</tbody>
</table>

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers procurement and installation of grout. Unless otherwise specified, only nonshrinking grout shall be furnished.

Epoxy grouting of anchor bolts, threaded rod anchors, and reinforcing bars is covered in the anchorage in concrete and masonry section. Grouting of masonry is covered in the building masonry section.

1-2. SUBMITTALS. A letter of certification indicating the types of grout to be supplied and the intended use of each type shall be submitted in accordance with the submittals section.

1-3. DELIVERY, STORAGE, AND HANDLING. Materials shall be handled, transported, and delivered in a manner which will prevent damage of any kind. Materials shall be protected from moisture.

PART 2 - PRODUCTS

2-1. MATERIALS.

- Nonshrinking Grout: Cementitious grout with demonstrated nonshrinking properties; L&M "Crystex", Master Builders "Masterflow 713" or "Set Grout", Sauereisen "F-100 Level Fill Grout", Sonneborn "Sonogrout 10K", Hilti "CG 200 PC", or Five Star Products "Five Star Grout".

- Water: Clean and free from deleterious substances.

2-2. NONSHRINKING GROUT. Nonshrinking grout shall be furnished factory premixed so that only water is added at the jobsite.

PART 3 - EXECUTION

3-1. PREPARATION. The concrete foundation to receive nonshrinking grout shall be saturated with water for at least 12 hours preceding grouting unless additional time is required by the grout manufacturer.
3-2. INSTALLATION.

3-2.01. Mixing. Grout shall be mixed in a mechanical mixer. No more water shall be used than is necessary to produce a flowable grout.

3-2.02. Placement. Unless otherwise specified or indicated on the drawings, grout under baseplates shall be 1-1/2 inches thick. Grout shall be placed in strict accordance with the directions of the manufacturer so that all spaces and cavities below the baseplates are completely filled without voids. Forms shall be provided where structural components of baseplates will not confine the grout.

3-2.03. Edge Finishing. In all locations where the edge of the grout will be exposed to view, the grout shall be finished smooth after it has reached its initial set. Except where shown to be finished on a slope, the edges of grout shall be cut off flush at the baseplate.

3-2.04. Curing. Nonshrinking grout shall be protected against rapid loss of moisture by covering with wet clothes or polyethylene sheets. After edge finishing is completed, the grout shall be wet cured for at least 3 days and then an acceptable membrane curing compound shall be applied.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the installation of new valves and actuators purchased by Contractor as part of this Work or purchased by others under the valve specifications. The equipment to be furnished by others for installation by Contractor is identified in the applicable valve schedules.

Cleaning, disinfection, pressure and leakage testing, insulation, and pipe supports are covered in other sections.

The following specification sections are applicable to valves to be installed:

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>15091</td>
<td>Miscellaneous Ball Valves</td>
</tr>
<tr>
<td>15101</td>
<td>AWWA Butterfly Valves</td>
</tr>
<tr>
<td>15104</td>
<td>Resilient-Seated Gate Valves</td>
</tr>
<tr>
<td>15108</td>
<td>Air Release/Combination Air Valves</td>
</tr>
</tbody>
</table>

1-2. GENERAL. Equipment installed under this section shall be erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

1-2.01. Coordination. When manufacturer's field services or installation check services are provided by the valve manufacturer, Contractor shall coordinate the services with the valve manufacturer. Contractor shall give Engineer written notice at least 30 days prior to the need for manufacturer's field services.

Flanged connections to valves including the bolts, nuts, and gaskets are covered in the appropriate pipe specification section.

1-3. DELIVERY, STORAGE, AND HANDLING.

1-3.01. Storage. Upon delivery, all equipment and materials shall immediately be stored and protected by Contractor in accordance with Handling and Storage section and the manufacturer’s instructions until installed in the Work. Stored equipment shall be protected by Contractor against damage and exposure from the elements. At no time shall the equipment be stored on earth or grass surfaces or come into contact with earth or grass. Contractor shall keep the equipment dry at all times.
PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3-1. INSPECTION. All valves and accessories shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and re-cleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

3-2. INSTALLATION.

3-2.01. General. Valves shall be installed with sufficient clearance for proper operation of any external mechanisms, and with sufficient clearance to dismantle the valve for in-place maintenance. Installation shall be in accordance with the valve manufacturer’s recommendations.

3-2.02. Installation Checks. When specified in the valve sections, installation checks will be provided by a manufacturer’s representative. The specified services shall be furnished at no charge to the Contractor. Any additional services in connection with the installation of the equipment which are required by reason of Contractor’s progress shall be paid for by Contractor.

Contractor shall perform no Work related to the installation or operation of materials or equipment furnished by others without direct observation and guidance of the field representative, unless Engineer and manufacturer furnishing such materials concur otherwise.

3-2.03. AWWA Butterfly Valves. Butterfly valves shall be installed with the shaft horizontal unless otherwise necessary for proper operation or as acceptable to Engineer.

Whenever an actuator must be removed to permit installation of a valve, the actuator shall be promptly reinstalled and shall be inspected and readjusted by a representative of the valve manufacturer.


3-2.05. Eccentric Plug Valves. Not Used.
3-2.06. **Resilient Seated Gate Valves.** Valves shall be handled and installed in accordance with the recommendations set forth in the Appendix to ANSI/AWWA C509 and with the recommendations of the manufacturer.

3-2.07. Double **Disc Gate Valves.** Not Used.

3-2.08. **Air Release and Combination Air Valves.** The exhaust from each valve shall be piped to a suitable point acceptable to Engineer. Air release valve exhaust piping leading to a trapped floor drain shall terminate at least 6 inches [150 mm] above the floor.

3-2.09. **Valve Boxes.** Valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves, with the top of the box brought flush with the finished grade. After each valve box is placed in proper position, earth fill shall be placed and thoroughly tamped around the box.

3-2.10. **Yard Hydrants.** Not Used. 3-

2.11. Fire **Hydrants.** Not Used.

3-3. **VALVE ACTUATORS.** Valve actuators and accessories shall be installed in accordance with the equipment manufacturer's recommendations.

3-4. **FIELD QUALITY CONTROL.**

3.4.01. **Field Testing.** After installation, all valves shall be tested in conjunction with the Pipeline Pressure and Leakage Testing section.

3-4.01.01. **Pressure Tests.** Pressure testing shall be in accordance with the Pipeline Pressure and Leakage Testing section.

3-4.01.02. **Leakage Tests.** All valves shall be free from leaks. Each leak that is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor. This requirement applies whether pressure testing is required or not.

End of Section
Section 15020
MISCELLANEOUS PIPING AND ACCESSORIES INSTALLATION

PART 1 - GENERAL

1-1. SCOPE. This section covers the installation of piping and accessories as indicated on the drawings for the following piping sections:

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15060</td>
<td>Miscellaneous Piping and Accessories</td>
</tr>
</tbody>
</table>

Contractor shall furnish all necessary jointing materials, coatings, and accessories that are specified herein.

Pipe trenching and backfilling are covered in the Trenching and Backfilling section.

1-2. GENERAL.

1-2.01. Coordination. Materials installed under this section shall be installed in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the manufacturer, unless exceptions are noted by Engineer.

1-3. SUBMITTALS.

1-3.01. Drawings and Data. Complete specifications, data, and catalog cuts or drawings shall be submitted in accordance with the Submittals section. Items requiring submittals shall include, but not be limited to, the following:

- Materials as specified herein.


1-3.03. Spool Drawings. Not Used.

1-4. QUALITY ASSURANCE.

1-4.01. Welding and Brazing Qualifications. Not Used.

1-4.02. Tolerances. These tolerances apply to in-line items and connections for other lines.

The general dimension, such as face-to-face, face or end-to-end, face- or end-to center, and center-to-center shall be 1/8 inch [3 mm].

PROJECT # 1152-17-PHASE IIB 15020-1 MISC PIPING & ACCESSORIES INSTALLATION
The inclination of flange face from true in any direction shall not exceed 3/64 inch per foot [4 mm per meter].

Rotation of flange bolt holes shall not exceed 1/16 inch [1.5 mm].

1-5. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section. All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.

PART 2 - PRODUCTS

2-1. SERVICE CONDITIONS. Pipe, tubing, and fittings covered herein shall be installed in the services indicated in the various pipe sections.

2-2. MATERIALS.

Threaded Fittings

<table>
<thead>
<tr>
<th>Anti-Seize Thread Lubricant</th>
<th>Jet-Lube &quot;Nikal&quot;, John Crane &quot;Thred Gard Nickel&quot;, Never-Seez &quot;Pure Nickel Special&quot;, or Permatex &quot;Nickel Anti-Seize&quot;.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teflon Thread Sealer</td>
<td>Paste type; Hercules &quot;Real-tuff&quot;, John Crane &quot;JC-30&quot;, or Permatex &quot;Thread Sealant with Teflon&quot;.</td>
</tr>
<tr>
<td>Teflon Thread Tape</td>
<td>Hercules &quot;Tape Dope&quot; or John Crane &quot;Thread-Tape&quot;.</td>
</tr>
</tbody>
</table>

Solvent Welded Fittings

<table>
<thead>
<tr>
<th>Solvent cement for PVC Systems</th>
<th>ASTM D2564.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solvent cement for CPVC Systems</td>
<td>ASTM F493.</td>
</tr>
<tr>
<td>Sodium Hypochlorite, Sodium Hydroxide, and Sodium Bisulfite Service</td>
<td>IPS Corporation &quot;Weld-On 724&quot;</td>
</tr>
<tr>
<td>Primer for PVC Systems</td>
<td>ASTM F656.</td>
</tr>
</tbody>
</table>
## Solder or Brazed Fittings

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solder</strong></td>
<td>Solid wire, ASTM B32, ANSI/NSF 61 certified, Alloy Grade Sb5, (95-5).</td>
</tr>
<tr>
<td><strong>Soldering Flux</strong></td>
<td>Paste type, ASTM B813.</td>
</tr>
<tr>
<td><strong>Brazing Filler Metal</strong></td>
<td>AWS A5.8, BCuP-5; Engelhard &quot;Silvaloy 15&quot;, Goldsmith &quot;GB-15&quot;, or Handy &amp; Harman &quot;Sil-Fos&quot;.</td>
</tr>
<tr>
<td><strong>Brazing Flux</strong></td>
<td>Paste type, Fed Spec O-F-499, Type B.</td>
</tr>
</tbody>
</table>

## Insulating Fittings

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Threaded</strong></td>
<td>Dielectric steel pipe nipple, ASTM A53, Schedule 40, polypropylene lined, zinc plated; Perfection Corp. &quot;Clearflow Fittings&quot;.</td>
</tr>
<tr>
<td><strong>Flanged</strong></td>
<td>Epco &quot;Dielectric Flange Unions&quot; or Central Plastics &quot;Insulating Flange Unions&quot;.</td>
</tr>
</tbody>
</table>

## Pipe Insulation

See Mechanical Insulation section.

## Watertight/Dusttight Pipe Sleeves

O-Z Electrical Manufacturing "Thruwall" and "Floor Seals", or Thunderline "Link-Seals"; with modular rubber sealing elements, nonmetallic pressure plates, and galvanized bolts.

## Pipe Sleeve Sealant

Polysulfide or urethane, as specified in the Caulking section or as indicated on the drawings.

## Protective Coatings

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tape Wrap</strong></td>
<td>ANSI/AWWA C209, except single ply tape thickness shall not be less than 30 mils [760 µm]; Protecto Wrap &quot;200&quot; or Tapecoat &quot;CT&quot;.</td>
</tr>
<tr>
<td><strong>Primer</strong></td>
<td>As recommended by the tape manufacturer.</td>
</tr>
</tbody>
</table>
Coal Tar Epoxy
High-build coal tar epoxy; Ameron
"Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300 M", Tnemec
"46H-413 Hi-Build Tneme-Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy".

PART 3 - EXECUTION

3-1. INSPECTION. All piping components shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and recleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

3-2. PREPARATION.

3-2.01. Field Measurement. Pipe shall be cut to measurements taken at the site, not from the drawings. All necessary provisions shall be made in laying out piping to allow for expansion and contraction. Piping shall not obstruct openings or passageways. Pipes shall be held free of contact with building construction to avoid transmission of noise resulting from expansion.

3-3. INSTALLATION.

3-3.01. General. All instruments and specialty items shall be installed according to the manufacturer’s instructions and with sufficient clearance and access for ease of operation and maintenance.

Flat faced wrenches and vises shall be used for copper tubing systems. Pipe wrenches and vises with toothed jaws will damage copper materials and shall not be used. Bends in soft temper tubing shall be shaped with bending tools.

3-3.02. Pipe Joints. Pipe joints shall be carefully and neatly made in accordance with the indicated requirements.

3-3.02.01. Threaded. Pipe threads shall conform to ANSI/ASME B1.20.1, NPT, and shall be fully and cleanly cut with sharp dies. Not more than three threads at each pipe connection shall remain exposed after installation. Ends of pipe shall be reamed after threading and before assembly to remove all burrs. Unless otherwise indicated, threaded joints shall be made up with teflon thread tape, thread sealer, or a suitable joint compound.
Threaded joints in plastic piping shall be made up with teflon thread tape applied to all male threads. Threaded joints in stainless steel piping shall be made up with teflon thread sealer and teflon thread tape applied to all male threads. Threaded joints in steel piping for chlorine service shall be made up with teflon thread tape or litharge and glycerine paste applied to all male threads.

3-3.02.02. Compression. Not Used. 3-

3.02.03. Flared. Not Used.

3-3.02.04. Soldered and Brazed. Not Used. 3-

3.02.05. Solvent Welded. Not Used.

3-3.02.06. Epoxy and Adhesive Bonded. Not Used. 3-


3-3.02.08. Flanged. Flange bolts shall be tightened sufficiently to slightly compress the gasket and effect a seal, but shall not be torqued less than the minimum value required by the gasket manufacturer. Flange bolts shall not be so tight as to fracture or distort the flanges. A plain washer shall be installed under the head and nut of bolts connecting plastic pipe flanges. Anti-seize thread lubricant shall be applied to the threaded portion of all stainless steel bolts during assembly.

Flange bolt holes shall be oriented as follows, unless otherwise indicated on the spool drawings:

- Vertical flange face: Bolt holes to straddle the vertical centerlines.
- Horizontal flange face: Bolt holes to straddle plant north-south centerlines.

Pipe sealants, thread compounds, or other coatings shall not be applied to flange gaskets unless recommended by the gasket manufacturer for the specified service and approved by Engineer.

Welds at orifice flanges shall have internal surfaces ground smooth to the pipe wall.

Slip-on flanges shall be welded inside and outside. There shall be a distance of approximately 1/16 to 1/8 inch [1.5 to 3 mm] between the edge of the fillet weld and the face of the flange. The seal weld shall be applied so that the flange face shall be free of weld spatter and does not require refacing.

Flat-faced flanges shall be used when mating to Class 125 flanges. Full-face gaskets shall be used with flat-faced flanges and ring gaskets shall be used with raised faced flanges.
Weld neck flanges shall be used with butt-weld fittings. The bore of weld neck flanges shall match the pipe wall thickness.

Insulating joints connecting submerged (buried) piping to exposed piping shall be installed above the maximum water surface elevation and before the first pipe support not having coated anchor bolts or adhesive-bonded concrete anchors. All submerged (buried) metallic piping shall be isolated from the concrete reinforcement. Insulating flanges shall be tested for electrical isolation after installation and bolt-up but prior to introduction of conducting fluid.


3-3.02.10. Grooved Couplings. Not Used. 3-


3-3.02.12. Rubber-Gasketed. Not Used. 3-


3-3.03. Pipe. Pipe shall be installed as specified, as indicated on the drawings, or, in the absence of detail piping arrangement, in a manner acceptable to Engineer.

Piping shall be installed without springing or forcing the pipe in a manner which would induce stresses in the pipe, valves, or connecting equipment.

Piping shall be connected to equipment by flanges or unions as specified in the various piping sections. Piping connecting to equipment shall be supported by a pipe support and not by the equipment.

Piping shall be provided with a shutoff valve and union to permit isolation and disconnection of each item without disturbing the remainder of the system.

A union shall be provided within 2 feet [600 mm] of each threaded-end valve unless there are other connections which will permit easy removal of the valve. Unions shall also be provided in piping adjacent to devices or equipment which may require removal in the future and where required by the drawings or the specifications.

In all piping insulating fittings shall be provided to prevent contact of dissimilar metals, including but not limited to, contact of copper, brass, or bronze pipe, tubing, fittings, valves, or appurtenances, or stainless steel pipe, tubing, fittings, valves, or appurtenances with iron or steel pipe, fittings, valves, or appurtenances. Insulating fittings shall also be provided to prevent contact of copper, brass, or bronze pipe, tubing, fittings, valves or appurtenances with stainless steel pipe, tubing, fittings, valves, or appurtenances.

Buried PVC piping shall be "snaked" in the trench and shall be kept as cool as possible during installation. PVC pipe shall be kept shaded and shall be covered with backfill.
immediately after installation.

Piping adjacent to flow sensors shall be installed in accordance with the requirements of the manufacturer of the flow sensor and commonly accepted design practices of the appropriate straight pipe runs both upstream and downstream.

Drains required for operation are shown on the drawings. However, vents at all high points and drains at all low points in the piping that are required for complete draining for pressure test may not be shown on these drawings. Contractor shall add such items as found to be necessary during detail piping design and/or piping installation.

3-3.04. Valves. Isolation valves provided with equipment and instruments shall be located in a manner which will allow ease of access and removal of the items to be isolated. Prior to soldering or brazing valves, Teflon and elastomer seats and seals shall be removed to prevent damage.

3-4. PIPING ASSEMBLY.

3-4.01. General. Contractor shall only use labor that has been qualified by training and experience to capably perform the specified activities required to accomplish the work in a satisfactory manner.


3-5. PROTECTIVE COATING. Not Used.

3-6. PRESSURE AND LEAKAGE TESTING. All specified tests shall be made by and at the expense of Contractor in the presence, and to the satisfaction of Engineer. Each piping system shall be tested for at least 1 hour with no loss of pressure. The Contractor shall coordinate this section with the Pipeline Pressure and Leakage Testing section. Piping shall be tested at the indicated pressures:

<table>
<thead>
<tr>
<th>Service</th>
<th>Test Pressure</th>
<th>Test Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Supply</td>
<td>1-1/2 times working Pressure but not less Than 120 psi [828 kPa]</td>
<td>Water</td>
</tr>
</tbody>
</table>
Leakage may be determined by loss-of-pressure, soap solution, chemical indicator, or other positive and accurate method acceptable to Engineer. All fixtures, devices, or accessories which are to be connected to the lines and which would be damaged if subjected to the specified test pressure shall be disconnected and the ends of the branch lines plugged or capped as needed during the testing.

All necessary testing equipment and materials, including tools, appliances and devices, shall be furnished and all tests shall be made by and at the expense of Contractor and at the time directed by Engineer.

All joints in piping shall be tight and free of leaks. All joints which are found to leak, by observation or during any specified test, shall be repaired, and the tests repeated.

3-7. CLEANING. The interior of all pipe, valves, and fittings shall be smooth, clean, and free of blisters, loose mill scale, sand, dirt, and other foreign matter when installed. Before being placed in service, the interior of all lines shall be thoroughly cleaned, to the satisfaction of Engineer.

3-8. ACCEPTANCE. Owner reserves the right to have any section of the piping system which he suspects may be faulty cut out of the system by Contractor for inspection and testing. Should the joint prove to be sound, Owner will reimburse Contractor on a time-and-material basis as specified in the Contract. Should the joint prove to be faulty, the destructive test will continue joint by joint in all directions until sound joints are found. Costs for replacement of faulty work and/or materials shall be the responsibility of Contractor.

End of Section
Section 15060
MISCELLANEOUS PIPING AND PIPE ACCESSORIES

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of miscellaneous piping and pipe accessories. Miscellaneous piping shall be furnished complete with all fittings, flanges, unions, and other accessories specified herein.

1-2. SUBMITTALS.

1-2.01. Drawings and Data. Complete specifications, data and catalog cuts or drawings shall be submitted in accordance with the submittals section. Submittals are required for all piping, fittings, gaskets, sleeves, and accessories, and shall include the following data:

- Name of Manufacturer
- Type and model
- Construction materials, thickness, and finishes
- Pressure and temperature ratings

Contractor shall obtain and submit a written statement from the gasket material manufacturer certifying that the gasket materials are compatible with the joints specified herein and are recommended for the specified field test pressures and service conditions.

1-3. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section. All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.

PART 2 - PRODUCTS

2-1. MATERIALS. Miscellaneous piping materials shall be as specified herein. 2-1.01.

Material Classification CSG-2.

<table>
<thead>
<tr>
<th>CSG-2 – Standard Weight Galvanized Steel with Threaded Fittings</th>
<th>Pipe</th>
<th>ASTM A53, Type E, standard weight, Grade A or B; or ASTM A106, of equivalent thickness, galvanized.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PROJECT # 1152-17-PHASE IIB 15060-1 MISC PIPING & PIPE ACCESSORIES
distribution system piping. | Fittings  | Malleable iron threaded, galvanized. Fittings shall conform to ANSI/ASME B16.3, Class 150, or Fed Spec WW-P-521, Type II.

2-1.02. Material Classification SS-6.

| SS-6 – Schedule 40S with Threaded Ends. | Pipe | ASTM A312, TP316.
| All piping associated with the combination air valves. | Fittings | Threaded, material to match pipe. Fittings shall conform to ANSI/ASME B16.3, Class 150.
| 3 inch [50 mm] and smaller. |

PART 3 - EXECUTION

3-1. INSTALLATION. Materials furnished under this section will be installed in accordance with the Miscellaneous Piping and Accessories Installation section.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of manually operated or remote activated two position (open-close) ball valves as specified herein.

Miscellaneous ball valves shall be provided on all combination air release valve assemblies.

Piping, pipe supports, insulation, and accessories that are not an integral part of the valves or are not specified herein are covered in other sections.

1-2. GENERAL.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If the requirements in this section are different from those in the General Equipment Stipulations, the requirements in the section shall take precedence.

1-2.02. Permanent Number Plates. Not used.

1-3. SUBMITTALS. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals section. Included in the submittal shall be drawings by the valve manufacturer to indicate the position of the valve actuator and valve shaft. Submittal drawings shall clearly indicate the country of origin of all cast gray iron and ductile iron valve components.

1-4. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

PART 2 – PRODUCTS. Ball valves shall be Apollo Model 87A-900, or approved equal.

2-1. CONSTRUCTION. Ball valves shown on the drawing, but not specified herein, shall be selected to match piping material they are installed in.

2-1.01. Length Tolerance. Unless otherwise specified, the actual length of valves shall be within plus or minus 1/16 inch [1.6 mm] of the specified or theoretical length.
2-1.02. **Shop Coatings.** All ferrous metal surfaces of valves and accessories, both interior and exterior, shall be shop coated for corrosion protection. The valve manufacturer’s standard coating will be acceptable, provided it is functionally equivalent to the specified coating.

<table>
<thead>
<tr>
<th>Coating Materials</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Varnish</td>
<td>Fed Spec TT-C-494.</td>
</tr>
<tr>
<td>Coal Tar Epoxy</td>
<td>High-build coal tar epoxy; Ameron &quot;Amercoat 78HB Coal Tar Epoxy&quot;, Carboline &quot;Bitumastic 300 M&quot;, Tnemec &quot;46H-413 Hi-Build Tneme-Tar&quot;, or Sherwin-Williams &quot;Hi-Mil Sher-Tar Epoxy&quot;.</td>
</tr>
<tr>
<td>Epoxy Enamel (for liquid service)</td>
<td>Ameron &quot;Amerlock 400 High-Solids Epoxy Coating&quot;, Carboline &quot;Carboguard 891&quot;, or Tnemec &quot;Series N140 Pota-Pox Plus&quot;.</td>
</tr>
<tr>
<td>Rust-Preventive Compound</td>
<td>As recommended by the manufacturer.</td>
</tr>
</tbody>
</table>

**Surfaces To Be Coated**

- **Unfinished Surfaces**
  - Exterior Surfaces of Valves To Be Buried, Submerged, or Installed in Manholes or Valve Vaults: Asphalt varnish or coal tar epoxy.
  - Exterior Surfaces of all other valves: Universal primer.

2-2. **VALVE ACTUATORS.** Ball valves shall be provided with manual actuators. Unless otherwise specified or indicated on the drawings, each manual actuator shall be equipped with a lever operator.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** Materials furnished under this section shall be installed in accordance with the Valve Installation section.
PART 1 - GENERAL

1-1. **SCOPE.** This section covers furnishing AWWA butterfly valves for cold water service. All other butterfly valves are specified in the Industrial Butterfly Valves section.

AWWA butterfly valves shall be furnished complete with actuators and accessories as specified herein, and as specified in the Valve and Gate Actuators section.

1-2. **GENERAL.** Equipment provided under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Valves shall be furnished with all necessary parts and accessories indicated on the drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

1-2.01. **General Equipment Stipulations.** The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. **Governing Standard.** Except as modified or supplemented herein, all butterfly valves and manual actuators shall conform to the applicable requirements of ANSI/AWWA C504.

1-2.03. **Marking.** Supplementing the requirements of Section 6.1 of the governing standard, the country of origin of all castings and an identifying serial number shall be stamped on a corrosion-resistant plate attached to the valve body.

1-2.04. **Temporary Number Plates.** Not used.

2.05. **Permanent Number Plates.** Not used.

1-3. **SUBMITTALS.** Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals section. Included in the submittal shall be drawings by the valve manufacturer to indicate the position of the valve actuator and valve shaft. Submittal drawings shall clearly indicate the country of origin of all cast gray iron and ductile iron valve components.
Certified copies of test results as required by Section 5 of ANSI/AWWA C504, with an affidavit of compliance as indicated in Section 6.3 of C504, shall be submitted to Engineer before the valves are shipped.

1-4. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

PART 2 - PRODUCTS

2-1. ACCEPTABLE PRODUCTS. Butterfly valves shall be limited to the manufacturers listed below. Sizes and styles for the manufacturers shall be as indicated, without exception:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Acceptable Sizes and Styles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pratt</td>
<td>HP-250 Butterfly Valve, 250#, Flanged Ends</td>
</tr>
</tbody>
</table>

2-2. MATERIALS. Except as modified or supplemented herein, materials used in the manufacture of butterfly valves shall conform to the requirements of ANSI/AWWA C504.

Acceptable shop coatings are listed in the following table.

<table>
<thead>
<tr>
<th>Coating Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal Tar Epoxy</td>
<td>High-build coal tar epoxy; Ameron &quot;Amercoat 78HB Coal Tar Epoxy&quot;, Carboline &quot;Bitumastic 300 M&quot;, Tnemec &quot;46H-413 Hi-Build Tneme-Tar&quot;, or Sherwin-Williams &quot;Hi-Mil Sher-Tar Epoxy&quot;.</td>
</tr>
<tr>
<td>Epoxy</td>
<td>For Treated Water Service in potable water facilities (NSF certified) Ameron “Amercoat 400 High Solids Epoxy”, Carboline “Carboguard 891”, or Tnemec “Series N140 Pota-Pox Plus”.</td>
</tr>
</tbody>
</table>
Rust-Preventive Compound As recommended by manufacturer.

2-3. VALVE CONSTRUCTION.

2-3.01. Valve Bodies. Valves shall be short-body type unless otherwise specified. The use of a stop or lug cast integrally with or mechanically secured to the body for the purpose of limiting disc travel by means of direct contact or interference with the valve disc (in either the open or closed position) will not be acceptable.

2-3.02. Flanges. Flanges shall be finished to true plane surfaces within a tolerance limit of 0.005 inch [125 µm]. The finished face shall be normal to the longitudinal valve axis within a maximum angular variation tolerance of 0.002 inch per foot (0.017 percent) of flange diameter.

2-3.03. Mechanical Joint Ends. Mechanical joint ends shall be either mechanical joint or push-on ends conforming to ANSI/AWWA C111/A21.11 with elastomeric synthetic rubber gaskets. Gaskets of natural rubber will not be acceptable. For Potable Water service, gaskets shall be EDPM for chloramine resistance.

2-3.04. Valve Shafts. Valve shafts shall be fabricated of AISI Type 304 or 316 stainless steel. The use of shafts having a hexagonal cross section will not be acceptable. The connection between shaft and disc shall be in accordance with ANSI/AWWA C504. The connection between the shaft and the disc shall be mechanically secured by means of solid, smooth sided, stainless steel or monel taper pins or dowel pins. Each taper pin or dowel pin shall extend through or shall wedge against the side of the shaft and shall be mechanically secured in place. The use of set screws, knurled or fluted dowel pins, expansion pins, roll pins, tension pins, spring pins, or other devices instead of the pins specified herein will not be acceptable.

2-3.05. Valve Seats. Acceptable seating surfaces mating with rubber are AISI Type 304 or 316 stainless steel, monel, or plasma-applied nickel-chrome overlay for all valves; bronze for 20 inch [500 mm] and smaller valves; and alloy cast iron for 20 inch [500 mm] and smaller manually operated valves. Seats shall be located on the valve body. Valve seat configurations which rely on the mating pipe flange to hold the seat in position in the valve body will not be acceptable.

2-3.06. Shaft Seals. Shaft seals shall be of the chevron type.

2-3.07. Thrust Bearings. Each valve shall be provided with one or more thrust bearings in accordance with the governing standard. Thrust bearings which are directly exposed to line liquid and which consist of a metal bearing surface in rubbing contact with an opposing metal bearing surface will not be acceptable.
2-4. **VALVE ACTUATORS.** Requirements for valve actuators shall be as specified herein and as specified in the Valve and Gate Actuators section. Valve actuators shall be manual, types.

All 8 inch [200 mm] and larger valves shall have geared actuators.

If valves with an AWWA class designation higher than specified are furnished, actuator torque capabilities shall be increased accordingly and be acceptable to Engineer.

2-4.01. **Actuator Sizing.** The valve manufacturer shall size the actuator in accordance with AWWA C504, and the valve manufacturer's requirements.

Unless otherwise indicated or specified, actuator torque requirements shall be based on a maximum differential pressure across the valve equal to the valve class and a maximum velocity through the valve of 16 feet per second [4.9 m/s].

Valves with operating stands shall have actuator torques increased by 25 percent. Actuator torques determined by the above requirements shall be increased by any safety factors required by AWWA C504, paragraphs 4.5.8.6.1 and 4.5.8.7 or indicated or specified herein.

2-5. **SHOP PAINTING.** All interior and exterior ferrous metal surfaces, except finished surfaces, bearing surfaces, and stainless steel components, of valves and accessories shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting. Epoxy enamel coatings shall be ANSI/NSF 61 certified.

Surfaces shall be painted as follows: Unfinished Surfaces

<table>
<thead>
<tr>
<th>Interior Surfaces</th>
<th>Epoxy enamel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior Surfaces of Valves To Be Buried</td>
<td>Coal tar epoxy. Epoxy enamel.</td>
</tr>
<tr>
<td>Exterior Surfaces of Valves to Be Submerged, or Installed in Manholes or Valve Vaults</td>
<td>Epoxy enamel.</td>
</tr>
<tr>
<td>Exterior Surfaces of All Other Valves</td>
<td>Universal primer.</td>
</tr>
<tr>
<td>Polished or Machined Surfaces</td>
<td></td>
</tr>
</tbody>
</table>
Flange Faces
Rust-preventive compound.

Other Surfaces
Epoxy enamel.

Interior coatings shall comply with AWWA C550 and shall be free of holidays. The total dry film thickness of shop-applied coatings shall be not less than:

<table>
<thead>
<tr>
<th>Type of Coating</th>
<th>Minimum Dry Film Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal Tar Epoxy</td>
<td>15 mils [380 µm]</td>
</tr>
<tr>
<td>Epoxy Enamel</td>
<td>10 mils [250 µm]</td>
</tr>
<tr>
<td>Universal Primer</td>
<td>3 mils [75 µm]</td>
</tr>
</tbody>
</table>

2-6. ACCESSORIES. Requirements for extension stems and stem guides, position indicators, floor boxes, operating stands, torque tubes, valve boxes, and extension bonnets shall be as specified in the Valve and Gate Actuators section.

PART 3 - EXECUTION

3-1. INSTALLATION. Valves will be installed in accordance with the Valve Installation section.

3-1.01. Installation Check. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation in accordance with Startup Requirements section, and shall revisit the job site as often as necessary until any problems are corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping and appurtenances; and has been operated under full load conditions and that it has operated satisfactorily.

All costs for these services shall be included in the contract price.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing resilient-seated AWWA gate valves for clear water service. Resilient-seated gate valves shall be furnished complete with actuators and accessories as specified herein and as specified in the Valve and Gate Actuator section.

1-2. GENERAL. Equipment provided under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Valves shall be furnished with all necessary parts and accessories indicated on the drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Governing Standard. Except as modified or supplemented herein, all resilient-seated gate valves shall conform to the applicable requirements of ANSI/AWWA C509.

1-2.03. Temporary Number Plates. Not used. 1-

2.04. Permanent Number Plates. Not used.

1-3. SUBMITTALS. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals section.

All valves shall be tested in accordance with Section 5 of the governing standard. Certified copies of the results of all tests, together with an affidavit of compliance as indicated in Section 6.3 of the governing standard, shall be submitted to Engineer before the valves are shipped.

PART 2 - PRODUCTS

2-1. ACCEPTABLE PRODUCTS. Butterfly valves shall be limited to the manufacturers
listed below. Sizes and styles for the manufacturers shall be as indicated, without exception:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Acceptable Sizes and Styles</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Pipe Metroseal</td>
<td>250, 2”-12”</td>
</tr>
<tr>
<td>American Flow</td>
<td>Series 2500, 2”-12”</td>
</tr>
<tr>
<td>Control</td>
<td></td>
</tr>
</tbody>
</table>

2-2. MATERIALS. Except as modified or supplemented herein, materials used in the manufacture of resilient-seated gate valves shall conform to the requirements of the governing standard.

2-2.01. Bronze Components. All bronze valve components in contact with liquid shall contain less than 16 percent zinc. All aluminum bronze components in contact with liquid shall be inhibited against dealuminization in accordance with Section 4.2.2.4.3 of ANSI/AWWA C504.

2-2.02. Gaskets. Gaskets shall be free of asbestos and corrosive ingredients. 2-2.03. Shop Coatings.

- Coal Tar Epoxy High-build coal tar epoxy; Ameron "Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300 M", Tnemec "46H-413 Hi-Build Tneme-Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy”.
- Epoxy Manufacturer’s standard fusion-bonded or liquid epoxy.
- Rust-Preventive Compound As recommended by manufacturer.

2-3. VALVE CONSTRUCTION.

2-3.01. Valve Ends. Valve ends shall be compatible with connecting piping. Except as modified or supplemented herein, the ends shall conform to the applicable requirements of the governing standard and have elastomeric synthetic rubber gaskets. Gaskets of natural rubber will not be acceptable. For Potable Water service, gaskets shall be EDPM for chloramine resistance.
Flanges shall be finished to true plane surfaces within a tolerance limit of 0.005 inch [125 µm]. The finished face shall be normal to the longitudinal valve axis within a maximum angular variation tolerance of 0.001 inch per inch [1 µm/mm] of flange diameter.

2-3.02. Stem Seals. Valve stems shall be the non-rising type. Stuffing box stem seals shall be provided for all gate valves with rising stems (outside screw-and- yoke type). O-ring stem seals shall be provided for all buried gate valves, and for all gate valves with non-rising stems.

2-3.03. Rotation. The direction of rotation of the handwheel or the wrench nut to open the valve shall be to the left (counterclockwise).

2-3.04. Shop Coating. All interior and exterior ferrous metal surfaces of valves and accessories shall be shop coated for corrosion protection. Except as specified below, the valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field coating.

Surfaces shall be coated as follows:

<table>
<thead>
<tr>
<th>Interior surfaces</th>
<th>Epoxy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior surfaces (potable water)</td>
<td>Epoxy (NSF certified).</td>
</tr>
<tr>
<td>Exterior surfaces of valves to buried, submerged, or installed in manholes or valve vaults</td>
<td>Epoxy or coal tar epoxy</td>
</tr>
<tr>
<td>Exterior surfaces of all other valves</td>
<td>Universal primer.</td>
</tr>
<tr>
<td>Polished or machined surfaces</td>
<td>Rust-preventive compound.</td>
</tr>
</tbody>
</table>

The protective epoxy coating on the interior surfaces of each valve shall be applied in three coats, with a minimum total dry film thickness of 13 mils [325 µm]. Alternatively, the manufacturer’s standard coating may be used and the interior surfaces of each valve shall be subjected to a nondestructive holiday test in accordance with ASTM G62, Method A, and shall be electrically void-free.

Interior coatings shall comply with AWWA C550. The total dry film thickness of shop-applied coatings shall be not less than:

<table>
<thead>
<tr>
<th>Type of Coating</th>
<th>Minimum Dry Film Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal Tar Epoxy</td>
<td>15 mils [380 µm].</td>
</tr>
<tr>
<td>Epoxy</td>
<td>10 mils [250 µm] or 13 mils [325 µm] where specified herein.</td>
</tr>
<tr>
<td>Universal Primer</td>
<td>3 mils [75 µm]</td>
</tr>
</tbody>
</table>
2-4. **VALVE ACTUATORS.** Requirements for valve actuators shall be as specified in the Valve and Gate Actuator section.

2-5. **ACCESSORIES.** When the drawings indicate the need for extension stems, stem guides, position indicators, floor boxes, valve boxes, or operating stands, refer to the Valve and Gate Actuator section.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** Valves will be installed in accordance with Valve Installation section.

3-1.01. **Installation Check.** An installation check by an authorize representative of the manufacturer is not required.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing, combination air valves, as required by the Work.

1-2. GENERAL. Equipment provided under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Valves shall be furnished with all necessary parts and accessories indicated on the drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Governing Standard. Except as modified or supplemented herein, all valves furnished under this section shall conform to the applicable requirements of AWWA C512.

1-2.03. Permanent Number Plates. Not used.

1-3. SUBMITTALS. Complete assembly drawings, together with detailed specifications and data covering materials used and accessories forming a part of the valves furnished, shall be submitted in accordance with the Submittals section.

1-4. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

PART 2 - PRODUCTS

2-1. CONSTRUCTION. Three inch [75 mm] and smaller combination air valves shall be of the integral type with a valve assembly which functions as both an air and vacuum valve and an air release valve. The valves shall be Val-Matic.
Combination Air Valves, Model number 202C.2, or approved equal. A Val-Matic Floodsafe valve, Model number 1302 with optional bracket SPK-1302-80 shall be provided with each combination air valve, no exceptions.

Six inch [150 mm] combination air valves shall be of the integral type with a valve assembly which functions as both an air and vacuum valve and an air release valve. The valves shall be Val-Matic Combination Air Valves, Model number 256C, no exceptions.

2-2. MATERIALS. Except as modified or supplemented herein, materials of construction shall comply with the governing standard. The use of stressed thermoplastic components will not be acceptable.

| Valve Trim                  | Bronze or austenitic stainless steel. |
| Float                       | Austenitic stainless steel.           |

<table>
<thead>
<tr>
<th>Shop Coatings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Consistency</td>
</tr>
<tr>
<td>Coal Tar</td>
</tr>
<tr>
<td>Epoxy</td>
</tr>
<tr>
<td>Rust-Preventive Compound</td>
</tr>
</tbody>
</table>

2-3. SHOP PAINTING. All interior and exterior ferrous metal surfaces, except stainless steel components, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field coating. Field painting is covered in the Protective Coatings section.

Surfaces shall be painted as indicated:

| Interior Surfaces                      | Epoxy.                                   |
| Exterior Surfaces of Valves To Be Installed in Manholes or Valve Vaults | Coal tar epoxy.                           |
| Exterior Surfaces of All Other Valves | Universal primer.                        |
| Polished or Machined Surfaces         | Rust-preventive compound.                |
Interior epoxy coatings shall comply with AWWA C550 and shall be free of holidays. The total dry film thickness of shop-applied coatings shall be not less than:

<table>
<thead>
<tr>
<th>Type of Coating</th>
<th>Minimum Dry Film Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Consistency Coal Tar</td>
<td>15 mils [380 µm]</td>
</tr>
<tr>
<td>Epoxy</td>
<td>10 mils [250 µm]</td>
</tr>
<tr>
<td>Universal Primer</td>
<td>3 mils [75 µm]</td>
</tr>
</tbody>
</table>

2-4. SHUTOFF VALVES. A shutoff valve shall be provided in the piping leading to each air release valve and combination air valve. Each 4 inch [100 mm] and larger combination air valve shall be provided with a shutoff valve between the air and vacuum valve and the air release valve.

PART 3 - EXECUTION

3-1. INSTALLATION. Air release and combination air valves will be installed in accordance with the Valve Installation section. Air release and combination air valves will be installed in Guard Shack Enclosure/ S.S.(Stainless Steel) N Pattern, Model No. CGS-NP-1. Powder coat finish in Forest Green.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing manual and powered valves and gate actuators and accessories as specified herein.

1-2. GENERAL. Equipment provided under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Actuators shall be furnished with all necessary parts and accessories indicated on the drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of actuators.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Governing Standards. Except as modified or supplemented herein, all powered actuators shall conform to applicable requirements of ANSI/AWWA C540.

Except as modified or supplemented herein, all manual and cylinder actuators for butterfly and eccentric plug valves shall conform to the applicable requirements of ANSI/AWWA C504.

Except as modified or supplemented herein, all manual actuators for ball valves shall conform to the applicable requirements of ANSI/AWWA C507.

Except as modified or supplemented herein, all manual actuators for sluice and slide gates shall conform to the applicable requirements of ANSI/AWWA C560.

1-2.03. Power Supply. Not used.

1-2.04. Marking. Each actuator shall be marked with the manufacturer's name, model number, and the country of origin. An identifying serial number shall be stamped on a corrosion-resistant plate attached to the actuator.
1-2.05. **Temporary Number Plates.** Each actuator shall be factory tagged or marked to identify the actuator and the applicable valve or gate by number or service as indicated in the valve or gate schedule.

1-3. **SUBMITTALS.** Complete drawings, details, and specifications covering the actuators and their appurtenances shall be submitted in accordance with the Submittals section. Submittal drawings shall clearly indicate the country of origin of each actuator and its components.

The drawings shall include separate wiring diagrams for each electrically operated or controlled actuator and the electrical control equipment. Each actuator drawing shall be identified with the respective valve number or name.

For electric or cylinder actuators, certified copies of reports covering proof-of-design testing of the actuators as set forth in Section 5 of ANSI/AWWA C540, together with an affidavit of compliance as indicated in Section 6.3 of ANSI/AWWA C540, shall be submitted to Engineer before the actuators are shipped.

1-4. **DELIVERY, STORAGE, AND HANDLING.** Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

**PART 2 - PRODUCTS**

2-1. **PERFORMANCE AND DESIGN REQUIREMENTS.**

2-1.01. **General.** Actuators and appurtenances shall be designed for the conditions and requirements as indicated in the respective valve and gate sections.

Liberal factors of safety shall be used throughout the design, especially in the design of parts subject to intermittent or alternating stresses. In general, working stresses shall not exceed one-third of the yield point or one-fifth of the ultimate strength of each material.

2-1.02. **Valve Actuators.** Each actuator shall be designed to open or close the valve under all operating conditions. Actuators shall be designed for the maximum pressure differential across the valve and maximum velocities through the valve where indicated in the respective valve schedules.

Valve actuators shall be provided and adjusted by the valve manufacturer. Actuator mounting arrangements and positions shall facilitate operation and maintenance and shall be determined by the valve manufacturer unless indicated otherwise on the drawings or directed by Engineer.
When valves are to be buried, submerged, or installed in vaults, the actuators and accessories shall be sealed to prevent the entrance of water. The design water depth shall be as indicated in the respective valve schedules but not less than 20 feet [6.1 m].

2-1.03. Gate Actuators. Not Used.

2-2. MATERIALS. Except as modified or supplemented herein, materials used in the manufacture of actuators shall conform to the requirements of ANSI/AWWA C504 and C540.

2-3. VALVE MANUAL ACTUATORS.

2-3.01. General. Manual actuators of the types listed in the valve specifications or schedules shall be provided by the valve manufacturer.

Unless otherwise indicated or specified, each geared manual actuator shall be equipped with a wrench nut.

The direction of rotation of the wheel, wrench nut, or lever to open the valve shall be to the left (counterclockwise). Each valve body or actuator shall have cast thereon the word "Open" and an arrow indicating the direction to open.

The housing of traveling-nut type actuators shall be fitted with a removable cover which shall permit inspection and maintenance of the operating mechanism without removing the actuator from the valve. Travel limiting devices shall be provided inside the actuator for the open and closed positions. Travel limiting stop nuts or collars installed on the reach rod of traveling-nut type operating mechanisms shall be field adjustable and shall be locked in position by means of a removable roll pin, cotter pin, or other positive locking device. The use of stop nuts or adjustable shaft collars which rely on clamping force or setscrews to prevent rotation of the nut or collar on the reach rod will not be acceptable.

Each actuator shall be designed so that shaft seal leakage cannot enter the actuator housing.

Valves for throttling service shall be equipped with an infinitely variable locking device or a totally enclosed gear actuator.

Actuators shall produce the required torque with a maximum pull of 80 lbs [356 N] on the lever, handwheel, or chain. Actuator components shall withstand, without damage, a pull of 200 lbs [890 N] on the handwheel or chainwheel or an input of 300 foot-lbs [407 J] on the operating nut.

2-3.02. Handwheels. Handwheel diameters shall be at least 8 inches [200 mm] but not more than 24 inches [600 mm] for 30 inch [750 mm] and smaller valves and not more than 30 inches [750 mm] for 36 inch [900 mm] and larger valves.
2-3.03. **Levers.** Levers shall be capable of being locked in at least five intermediate positions between fully open and fully closed. In any building or structure containing lever operated valves, at least two operating levers shall be provided for each size and type of lever operated valve.

2-3.04. **Wrench Nuts.** Unless otherwise specified in the valve schedules or on the drawings, wrench nuts shall be provided on all buried valves and on all valves that are to be operated through floor boxes. Unless otherwise directed by Owner, all wrench nuts shall comply with Section 4.4.13 of AWWA C500. At least two operating keys shall be furnished for operation of the wrench nut operated valves.

2-4. **GATE MANUAL ACTUATORS.** Not used.

2-5. **PROGRAMMABLE ELECTRIC ACTUATORS.** Not used.

2-6. **STANDARD ELECTRIC ACTUATORS.** Not used.

2-7. **HYDRAULIC CYLINDER ACTUATORS.** Not used.

2-8. **AIR CYLINDER ACTUATORS.** Not used.

2-9. **AIR-OIL CYLINDER ACTUATORS.** Not used.

2-10. **PORTABLE ELECTRIC ACTUATORS.** Not used.

2-11. **PORTABLE HYDRAULIC ACTUATORS.** Not used.

2-12. **ACTUATOR ACCESSORIES.**

2-12.01. **Extension Stems.** Extension stems and stem guides shall be furnished when indicated in the respective valve schedules, indicated on the drawings, or otherwise required for proper valve operation. Extension stems shall be of solid steel and shall be not smaller in diameter than the stem of the actuator shaft. Extension stems shall be connected to the actuator with a single Lovejoy “Type D” universal joint with grease-filled protective boot. All stem connections shall be pinned.

At least two stem guides shall be furnished with each extension stem, except for buried valves. Stem guides shall be of cast iron, bronze bushed, and adjustable in two directions. Stem guide spacing shall not exceed 100 times the stem diameter or 10 feet [3 m], whichever is smaller. The top stem guide shall be designed to carry the weight of the extension stem. The extension stem shall be provided with a collar pinned to the stem and bearing against the stem thrust guide.

Extension stems for buried valve actuators shall extend to within 6 inches [150 mm] of the ground surface, shall be centered in the valve box using spacers, and shall be equipped with a wrench nut.
Extension stems for buried valve actuators shall be provided with position indicators as specified in the valve schedules.

2-12.02. Position Indicators. Unless otherwise specified, each valve actuator shall be provided with a position indicator to display the position of the plug or disc relative to the body seat opening.

For quarter turn plug, ball, or cone type valves installed in interior locations, the indicating pointer shall be mounted on the outer end of the valve operating shaft extension and shall operate over an indicating scale on the operating mechanism cover. Where the shaft passes through the cover, a suitable stuffing box or other seal shall be provided to prevent the entrance of water.

Each actuator for butterfly valves, except where located in manholes, buried, or submerged, shall have a valve disc position indicator mounted on the end of the valve shaft. A disc position indicator shall also be provided on each operating stand or the actuator mounted thereon.

2-12.02.01. Position Indicators for Buried Actuators. Each buried valve actuator shall be equipped with a position indicator. Position indicators shall be Indico "Model 179 Valve Position Indicators" manufactured by the Mills Engineering Company, Needham Heights, Massachusetts, or "Diviner" ground level position indicator manufactured by the Henry Pratt Company, Aurora, Illinois. Each indicator assembly shall be designed for installation on the extension stem connected to the operating stem of the buried actuator mechanism and shall be mounted in the top section of the valve box beneath the valve box cover. Each indicator shall be equipped with a wrench nut. Internal gearing shall be sealed and protected from the elements.

2-13. SHOP PAINTING. All ferrous metal surfaces, except bearing and finished surfaces and stainless steel components of valve actuators and accessories, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting.

The following surfaces shall be painted:

- Polished or Machined Surfaces: Rust-preventive compound.
- Other Surfaces: Epoxy enamel.
- Actuators and Accessories: Universal primer.

PART 3 - EXECUTION

3-1. INSTALLATION. Actuators will be installed on the valves in accordance with the Valve Installation section.