CITY OF SALEM

EAST PUMP STATION PRV

ISSUED FOR BID

DECEMBER 2025

HANSEN ALLEN & LUCE INC
ENGINEERS

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CITY OF SALEM

EAST PUMP STATION PRV

DECEMBER 2025

PROJECT MANUAL

Project Engineer

HANSEN, ALLEN, & LUCE, INC.
Consultants/Engineers
859 West South Jordan Parkway – Ste 200
South Jordan, Utah 84095
(801) 566-5599

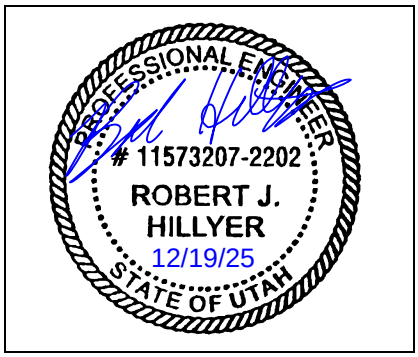
PROJECT MANUAL PREPARED UNDER THE DIRECTION OF:

CIVIL

Professional's Name: Greg S. Thomas, P.E.
Company: Hansen, Allen, & Luce, Inc.
Address: 859 West South Jordan Parkway Ste 200 South Jordan, Utah 84095
Phone Number: (801) 566-5599

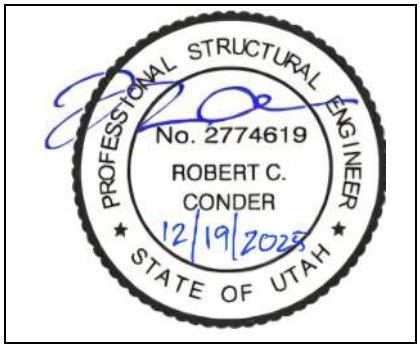
ELECTRICAL

Professional's Name: Robert J. Hillyer, P.E.
Company: Heath Engineering Company
Address: 377 West 800 North Salt Lake City, Ut 84103
Phone Number: (801) 322-0487



STRUCTURAL

Professional's Name: Robert Conder, S.E.
Company: Conder Engineering, LLC
Address: PO Box 566 Pleasant Grove, UT 84062
Phone Number: (801) 597-4860



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PART 5 – DRAWINGS (BOUND SEPARATELY)

Salem City Construction and Development Standards are included by reference. Salem City standards may be downloaded at:

https://www.salemutah.gov/standards.htm

All provisions of the standard drawings and specifications shall apply except as superseded by these plans and specifications. City may waive any requirements intended only for Developers.

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PART 1
BIDDING REQUIREMENTS

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SECTION 00 11 13
ADVERTISEMENT FOR BIDS

General Notice

Salem City (OWNER) is requesting Bids for the construction of the following Project:

East Pump Station PRV

Bids for the construction of the Project will be received at **Salem City** located at **30 W 100 South, PO Box 901, Salem, UT 84653**, until **Thursday, February 5, 2026**, at **2:00 PM** local time. At that time the Bids received will be **publicly** opened and read.

The Project includes the following Work:

Construction of a new cast-in-place pressure reducing valve (PRV) vault and associated piping and appurtenances. The vault is to be a below grade cast-in-place concrete structure. The vault will include two PRVs, valves, flowmeters, pressure relief valves, and associated piping. The project includes the installation of ductile iron pipe, PVC pipe, RCP pipe, storm drain manholes, and associated site restoration. Detailed information on the scope of work is contained in the project plans and specifications.

Bids are requested for the following Contract: **Salem East Pump Station PRV**

Obtaining the Bidding Documents

Information and Bidding Documents for the Project can be found at the following designated website:

https://www.salemutah.gov/contract-bids.htm

Bidding Documents may be downloaded from the designated website. Prospective Bidders are urged to register with the designated website as a plan holder, even if Bidding Documents are obtained from a plan room or source other than the designated website in either electronic or paper format. The designated website will be updated periodically with addenda, lists of registered plan holders, reports, and other information relevant to submitting a Bid for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through the designated website. Neither OWNER nor ENGINEER will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the designated website.

Pre-bid Conference

A non-mandatory pre-bid conference for the Project will be held on **Wednesday, January 21, 2026** at **10:30 AM** at **Salem City** located at **30 W 100 South, PO Box 901, Salem, UT 84653.**

Instructions to Bidders.

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to Section 00 21 13 - Instructions to Bidders that are included in the Bidding Documents.

This Advertisement is issued by:

OWNER: **Salem City**
By: **Bradey Wilde**
Title: **City Engineer**
Date: **January 9, 2026**

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SECTION 00 21 13
INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

ARTICLE 1—DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office*—The office from which the Bidding Documents are to be issued, and which registers plan holders.

ARTICLE 2—BIDDING DOCUMENTS

2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.

2.03 OWNER has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. OWNER recommends that Bidder register as a plan holder with the Issuing Office at such website, and obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by OWNER.

2.04 *Electronic Documents*

A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.

1. Bidding Documents will be provided in PDF (Portable Document Format) (.pdf). It is the intent of ENGINEER and OWNER that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because OWNER and ENGINEER cannot totally control the transmission and receipt of Electronic Documents nor the CONTRACTOR's means of reproduction of such documents, OWNER and ENGINEER cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.06.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of

Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and within **5** days of OWNER's request, Bidder must submit the following information:

A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.

B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.

C. Bidder's state or other CONTRACTOR license number, if applicable.

D. Subcontractor and Supplier qualification information.

E. Other required information regarding qualifications.

3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.03 No requirement in this Article 3 to submit information will prejudice the right of OWNER to seek additional pertinent information regarding Bidder's qualifications.

ARTICLE 4—PRE-BID CONFERENCE

4.01 A non-mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of OWNER and ENGINEER will be present to discuss the Project.

4.02 Information presented at the pre-Bid conference does not alter the Contract Documents. OWNER will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by OWNER for the use of the CONTRACTOR. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by CONTRACTOR.

5.02 *Existing Site Conditions*

A. *Subsurface and Physical Conditions; Hazardous Environmental Conditions*

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:

    a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.

    b. Those drawings known to OWNER of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

    c. Reports and drawings known to OWNER relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

    d. Technical Data contained in such reports and drawings.

2. OWNER will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

5.03 *Other Site-related Documents*

A. In addition to the documents regarding existing Site conditions referred to in Paragraph 5.02.A, the following other documents relating to conditions at or adjacent to the Site are known to OWNER and made available to Bidders for reference:

1. Salem City Pressurized Irrigation Project 2007 (drawings)

2. Salem Canal Road Roadway, Drainage, and Downstream Conveyance Improvements Record Drawings.

OWNER will make copies of these other Site-related documents available to any Bidder on request.

B. OWNER has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.

C. The other Site-related documents are not part of the Contract Documents.

D. Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The

requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.

E. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.

B. Bidders visiting the Site are required to arrange their own transportation to the Site.

C. All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following OWNER or ENGINEER contact for visiting the Site: Bradey Wilde, (801) 423-2770, bradeyw@salemcity.org. Bidder must conduct the required Site visit during normal working hours.

D. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

E. On request, and to the extent OWNER has control over the Site, and schedule permitting, OWNER will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. OWNER will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on OWNER's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.

F. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by OWNER or by property OWNERs or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

G. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 *OWNER's Safety Program*

A. Site visits and work at the Site may be governed by an OWNER safety program. If an OWNER safety program exists, it will be noted in the Supplementary Conditions.

5.06 *Other Work at the Site*

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which OWNER is aware (if any) that is to be performed at the Site by OWNER or others (such as utilities and other prime CONTRACTORs) and relates to the Work contemplated by these Bidding Documents. If OWNER is party to a written contract for such other work, then on request, OWNER will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Express Representations and Certifications in Bid Form, Agreement*

A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

B. If Bidder is awarded the Contract, Bidder (as CONTRACTOR) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

7.01 OWNER on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to ENGINEER in writing. Contact information and submittal procedures for such questions are as follows:

A. All questions to be submitted via email to:

1. Greg Thomas, gthomas@halengineers.com

7.03 Interpretations or clarifications considered necessary by ENGINEER in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven days prior to the date for opening of Bids may not be answered.

7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to OWNER in an amount of **5** percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents.

8.02 The Bid security of the apparent Successful Bidder will be retained until OWNER awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, OWNER may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of OWNER's damages in the case of a damages-form bond. Such forfeiture will be OWNER's exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that OWNER believes to have a reasonable chance of receiving the award may be retained by OWNER until the earlier of 7 days after the

Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that OWNER believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.

9.02 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows CONTRACTOR to request that ENGINEER authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by ENGINEER until after the Effective Date of the Contract.

10.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the CONTRACTOR will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.01 The apparent Successful Bidder, and any other Bidder so requested, must submit to OWNER a list of the Subcontractors or Suppliers proposed for the following portions of the Work within five days after Bid opening.

11.02 If requested by OWNER, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If OWNER or ENGINEER, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, OWNER may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and OWNER may consider such price adjustment in evaluating Bids and making the Contract award.

11.03 If apparent Successful Bidder declines to make any such substitution, OWNER may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which OWNER or ENGINEER makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to OWNER and ENGINEER subject to

subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

ARTICLE 12—PREPARATION OF BID

12.01 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words “No Bid” or “Not Applicable.”

12.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. OWNER reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

12.03 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.

12.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

12.05 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

12.06 A Bid by an individual must show the Bidder’s name and official address.

12.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

12.08 All names must be printed in ink below the signatures.

12.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.

12.11 The Bid must contain evidence of Bidder’s authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder’s licensure, or Bidder must

certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state CONTRACTOR license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 *Lump Sum*

A. Bidders must submit a Bid on a lump sum basis as set forth in the Bid Form.

ARTICLE 14—SUBMITTAL OF BID

14.01 The Bidding Documents include one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.

14.02 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid must be addressed to the location designated in the Advertisement.

14.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

15.01 An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

15.02 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with OWNER and promptly thereafter demonstrates to the reasonable satisfaction of OWNER that there was a material and substantial mistake in the preparation of its Bid, the Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, the Bidder will be disqualified from further bidding on the Work.

ARTICLE 16—OPENING OF BIDS

16.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

17.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but OWNER may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

18.01 OWNER reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. OWNER also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

18.02 OWNER will reject the Bid of any Bidder that OWNER finds, after reasonable inquiry and evaluation, to not be responsible.

18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to OWNER or ENGINEER, then OWNER will reject the Bid as nonresponsive.

18.04 If OWNER awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.

18.05 *Evaluation of Bids*

A. In evaluating Bids, OWNER will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

18.06 In evaluating whether a Bidder is responsible, OWNER will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

18.07 OWNER may conduct such investigations as OWNER deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 19—BONDS AND INSURANCE

19.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth OWNER's requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the executed Agreement to OWNER, it must be accompanied by required bonds and insurance documentation.

19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20—SIGNING OF AGREEMENT

20.01 When OWNER issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder

must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to OWNER. Within 10 days thereafter, OWNER will deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

- END OF SECTION -

SECTION 00 41 00
BID FORM

The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to: **Salem City**

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2—ATTACHMENTS TO THIS BID

2.01 The following documents are submitted with and made a condition of this Bid:

A. Preliminary Schedule of Vaues as per Section 01 29 00 Payment Procedures Part 1.4.A;

B. Required Bid security (Section 00 43 13);

C. Evidence of authority to do business in the state of the Project

D. CONTRACTOR's license number as evidence of Bidder's State Contractor's License

E. Required Bidder Qualification Statement with supporting data (Section 00 45 13)

ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

3.01 *Lump Sum Bids*

A. Bidder will complete the Work in accordance with the Contract Documents for the following lump sum (stipulated) price(s):

1. Lump Sum Price (Single Lump Sum)

Lump Sum Bid Price	$

ARTICLE 4—TIME OF COMPLETION

4.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of days indicated in the Agreement.

4.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 5—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

5.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of OWNER.

5.02 *Instructions to Bidders*

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Bidder's Representations*

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
6. Bidder has considered the information known to Bidder itself; information commonly known to Contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as CONTRACTOR; and (c) Bidder's (CONTRACTOR's) safety precautions and programs.
7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Bidder is aware of the general nature of work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Bidding Documents.
9. Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.
10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.
2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.
3. Bidder has not solicited or induced any individual or entity to refrain from bidding.
4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 6.02.A:
    a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.
    b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of OWNER, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive OWNER of the benefits of free and open competition.
    c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of OWNER, a purpose of which is to establish bid prices at artificial, non-competitive levels.
    d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

BIDDER hereby submits this Bid as set forth above:

Bidder:

_____

(typed or printed name of organization)

By: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's CONTRACTOR License No.: (if applicable) _____

- END OF SECTION -

SECTION 00 43 13
BID BOND

Bidder Name: Address *(principal place of business)*:	**Surety** Name: Address *(principal place of business)*:
Owner Name: City of Salem Address *(principal place of business)*: 30 West 100 South PO Box 901 Salem, UTAH 84653	**Bid** Project *(name and location)*: Salem City East Pump Station PRV Bid Due Date:
Bond Penal Sum: Date of Bond:	
Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.	
Bidder _____ *(Full formal name of Bidder)*	Surety _____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature) (Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:
Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.	

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
   3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
   3.2. All Bids are rejected by Owner, or
   3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

- END OF SECTION -

SECTION 00 45 13
CONTRACTOR'S QUALIFICATIONS AND EXPERIENCE

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

1.02 Provide information on the Business's organizational structure:

Form of Business:	☐ Sole Proprietorship ☐ Partnership ☐ Corporation		
☐ Limited Liability Company ☐ Joint Venture comprised of the following companies:			
	1.		
	2.		
	3.		
Provide a separate Qualification Statement for each Joint Venturer.			
Date Business was formed:		State in which Business was formed:	
Is this Business authorized to operate in the Project location?		☐ Yes ☐ No ☐ Pending	

1.03 Identify all businesses that own Business in whole or in part (25% or greater), or that are wholly or partly (25% or greater) owned by Business:

Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			

1.04 Provide information regarding the Business's officers, partners, and limits of authority.

Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business:

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

ARTICLE 3—NOT USED

ARTICLE 4—SAFETY

4.01 Provide information regarding Business's safety organization and safety performance.

Name of Business's Safety Officer:	

Safety Certifications		
Certification Name	Issuing Agency	Expiration

4.02 Provide Worker's Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 5—NOT USED

ARTICLE 6—SURETY INFORMATION

6.01 Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

Surety Name:			
Surety is a corporation organized and existing under the laws of the state of:			
Is surety authorized to provide surety bonds in the Project location?		☐ Yes ☐ No	
Is surety listed in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury? ☐ Yes ☐ No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 7—INSURANCE

7.01 Provide information regarding Business's insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):			
Insurance Provider		Type of Policy (Coverage Provided)	
Are providers licensed or authorized to issue policies in the Project location?			☐ Yes ☐ No
Does provider have an A.M. Best Rating of A-VII or better?			☐ Yes ☐ No
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 8—CONSTRUCTION EXPERIENCE

8.01 Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

8.02 Provide information regarding the Business's previous contracting experience.

Years of experience with projects like the proposed project:				
As a general contractor:		As a joint venturer:		
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:				
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years?				
Been barred from contracting by any local, state, or federal agency within the last 5 years?				

Been released from a bid in the past 5 years? ☐ Yes ☐ No
Defaulted on a project or failed to complete any contract awarded to it? ☐ Yes ☐ No
Refused to construct or refused to provide materials defined in the contract documents or in a change order? ☐ Yes ☐ No
Been a party to any currently pending litigation or arbitration? ☐ Yes ☐ No
Provide full details in a separate attachment if the response to any of these questions is Yes.

8.03 List all projects currently under contract in Schedule A and provide indicated information.

8.04 List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business's experience with projects similar in type and cost of construction.

8.05 In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business's key leaders as well.

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.

B. Certification of Business's safety performance if required by Paragraph 4.02.

C. Attachments providing additional information as required by Paragraph 8.02.

D. Schedule A (Current Projects) as required by Paragraph 8.03.

E. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.

F. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.

G. Additional items as pertinent.

This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

(If Business is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

Schedule A—Current Projects

Name of				
Project Owner		Project		
General Description of				
Project Cost		Date Project		
Key Project	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Project Owner		Project		
General Description of				
Project Cost		Date Project		
Key Project	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Project Owner		Project		
General Description of				
Project Cost		Date Project		
Key Project	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Schedule B—Previous Experience with Similar Projects

Name of Project Owner		Project		
General Description of Project				
Project Cost		Date Project		
Key Project	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Project Owner		Project		
General Description of Project				
Project Cost		Date Project		
Key Project	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Project Owner		Project		
General Description of Project				
Project Cost		Date Project		
Key Project	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Schedule B—Previous Experience with Similar Projects

Name of				
Project Owner		Project		
General Description of				
Project Cost		Date Project		
Key Project	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)				
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Project Owner		Project		
General Description of				
Project Cost		Date Project		
Key Project	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)				
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Project Owner		Project		
General Description of				
Project Cost		Date Project		
Key Project	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)				
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Schedule C—Key Individuals

Project Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Project Superintendent			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Safety Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Quality Control Manager			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

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PART 2
CONTRACT FORMS

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SECTION 00 51 00
NOTICE OF AWARD

Date of			
Owner:	Salem City	Owner's Project No.:	
Engineer:	Hansen, Allen & Luce Engineers	Engineer's Project	406.17
Project:	Salem East Pump Staton PRV		
Contract Name:			
Bidder:			
Bidder's			

You are notified that OWNER has accepted your Bid dated **[date]** for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

> Construction of a new cast-in-place pressure reducing valve (PRV) vault and associated piping and appurtenances. The vault is to be a below grade cast-in-place concrete structure. The vault will include two PRVs, valves, flowmeters, pressure relief valves, and associated piping. The project includes the installation of ductile iron pipe, PVC pipe, RCP pipe, storm drain manholes, and associated site restoration. Detailed information on the scope of work is contained in the project plans and specifications.

The Contract Price of the awarded Contract is $**[Contract Price]**. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

1 electronic copy (PDF) unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☒ Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner 1 electronic (PDF) counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any): **[Describe other conditions that require Successful Bidder's compliance]**

Failure to comply with these conditions within the time specified will entitle OWNER to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, OWNER will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: Salem City

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Copy: Engineer

SECTION 00 52 00
AGREEMENT

This Agreement is by and between Salem City ("OWNER") and **[name of contracting entity]** ("CONTRACTOR").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

OWNER and CONTRACTOR hereby agree as follows:

ARTICLE 1—WORK

1.01 **CONTRACTOR SHALL COMPLETE ALL WORK AS SPECIFIED OR INDICATED IN THE CONTRACT DOCUMENTS. THE WORK IS GENERALLY DESCRIBED AS FOLLOWS:**

Construction of a new cast-in-place pressure reducing valve (PRV) vault and associated piping and appurtenances. The vault is to be a below grade cast-in-place concrete structure. The vault will include two PRVs, valves, flowmeters, pressure relief valves, and associated piping. The project includes the installation of ductile iron pipe, PVC pipe, RCP pipe, storm drain manholes, and associated site restoration. Detailed information on the scope of work is contained in the project plans and specifications.

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: East Pump Station PRV

ARTICLE 3—ENGINEER

3.01 OWNER has retained Hansen, Allen & Luce, Inc. ("ENGINEER") to act as OWNER's representative, assume all duties and responsibilities of ENGINEER, and have the rights and authority assigned to ENGINEER in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by "ENGINEER" and that same entity prepared the design.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Dates*

A. The Work will be substantially complete on or before **July 1, 2026**, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before **August 1, 2026**.

4.03 *Liquidated Damages*

A. CONTRACTOR and OWNER recognize that time is of the essence as stated in Paragraph 4.01 above and that OWNER will suffer financial and other losses if the

Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* CONTRACTOR shall pay OWNER $500.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

B. If OWNER recovers liquidated damages for a delay in completion by CONTRACTOR, then such liquidated damages are OWNER's sole and exclusive remedy for such delay, and OWNER is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. For all Work, at the prices stated in CONTRACTOR's Bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. CONTRACTOR shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. OWNER shall make progress payments on the basis of CONTRACTOR's Applications for Payment on or about the 25th day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as OWNER may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. 10 percent of the value of the Work completed (with the balance being retainage).

1) If 50 percent or more of the Work has been completed, as determined by ENGINEER, and if the character and progress of the Work have been satisfactory to OWNER and ENGINEER, then as long as the character and

progress of the Work remain satisfactory to OWNER and ENGINEER, there will be no additional retainage; and

b. 5 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, OWNER shall pay an amount sufficient to increase total payments to CONTRACTOR to 100 percent of the Work completed, less such amounts set off by OWNER pursuant to Paragraph 15.01.E of the General Conditions, and less 200 percent of ENGINEER's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, OWNER shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

A. OWNER will not make final payment, or return or release retainage at Substantial Completion or any other time, unless CONTRACTOR submits written consent of the surety to such payment, return, or release.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds:
    a. Performance bond (together with power of attorney).
    b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions.
5. Specifications as listed in the table of contents of the project manual (copy of list attached).
6. Drawings (not attached but incorporated by reference) consisting of 32 sheets with each sheet bearing the following general title: East Pump Station PRV.
7. Drawings listed on the attached sheet index.
8. Addenda (numbers **[number]** to **[number]**, inclusive).
9. Exhibits to this Agreement (enumerated as follows):
    a. **[list exhibits]**
10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.

c. Change Orders.

d. Field Orders.

e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

A. In order to induce OWNER to enter into this Contract, CONTRACTOR makes the following representations:

1. CONTRACTOR has examined and carefully studied the Contract Documents, including Addenda.

2. CONTRACTOR has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. CONTRACTOR is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

4. CONTRACTOR has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. CONTRACTOR has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. CONTRACTOR has considered the information known to CONTRACTOR itself; information commonly known to CONTRACTORs doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR; and (c) CONTRACTOR's safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, CONTRACTOR agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. CONTRACTOR is aware of the general nature of work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Contract Documents.

9. CONTRACTOR has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that CONTRACTOR has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.

10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. CONTRACTOR's entry into this Contract constitutes an incontrovertible representation by CONTRACTOR that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

A. CONTRACTOR certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of OWNER, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive OWNER of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of OWNER, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

A. OWNER stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if OWNER is the party that has furnished said General Conditions, then OWNER has plainly shown all modifications to the standard wording of such published document to the CONTRACTOR in the Supplementary Conditions.

IN WITNESS WHEREOF, OWNER and CONTRACTOR have signed this Agreement.

This Agreement will be effective on **[indicate date on which Contract becomes effective]** (which is the Effective Date of the Contract).

Owner:	Contractor:
Salem City *(typed or printed name of organization)*	 *(typed or printed name of organization)*
By: _____ *(individual's signature)*	By: _____ *(individual's signature)*
Date: _____ *(date signed)*	Date: _____ *(date signed)*
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)* *(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*
Attest: _____ *(individual's signature)*	Attest: _____ *(individual's signature)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address for giving notices:	Address for giving notices:
Designated Representative:	Designated Representative:
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address:	Address:
Phone: _____	Phone: _____
Email: _____ *(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*	Email: _____ License No.: _____ *(where applicable)* State: _____

SECTION 00 55 00
NOTICE TO PROCEED

Owner:	Salem City	Owner's Project No.:	
Engineer:	Hansen, Allen & Luce Engineers	Engineer's Project No.:	406.17
Contractor:		Contractor's Project No.:	
Project:	East Pump Station PRV		
Contract Name:	East Pump Station PRV		
Effective Date of Contract:			

OWNER hereby notifies CONTRACTOR that the Contract Times under the above Contract will commence to run on **[date Contract Times are to start]** pursuant to Paragraph 4.01 of the General Conditions.

On that date, CONTRACTOR shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

The date by which Substantial Completion must be achieved is **July 1, 2026**, and the date by which readiness for final payment must be achieved is **August 1, 2026**.

Before starting any Work at the Site, CONTRACTOR must comply with the following:

[Note any access limitations, security procedures, or other restrictions]

Owner:	Salem City
By *(signature)*:	
Name *(printed)*:	
Title:	
Date Issued:	

Copy: Engineer

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SECTION 00 61 00
PERFORMANCE BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: Salem City	Description *(name and location)*: East Pump Station PRV
Mailing address *(principal place of business)*: 30 West 100 South PO Box 901 Salem, UT 84653	Contract Price:
	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:
    3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;
    3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
    3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
    5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
    5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
    5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or
    5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting

with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows: **[Describe modification or enter "None"]**

SECTION 00 61 50
PAYMENT BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: Salem City Mailing address *(principal place of business)*: 30 West 100 South PO Box 901 Salem, UT 84653	Description *(name and location)*: East Pump Station PRV Contract Price: Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:
    5.1. Claimants who do not have a direct contract with the Contractor
        5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
        5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).
    5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
    7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
    7.2. Pay or arrange for payment of any undisputed amounts.
    7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

    16.1. *Claim*—A written statement by the Claimant including at a minimum:

        16.1.1. The name of the Claimant;

        16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

        16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

        16.1.4. A brief description of the labor, materials, or equipment furnished;

16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: **[Describe modification or enter "None"]**

SECTION 00 62 50
CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:	Salem City	Owner's Project No.:	
Engineer:	Hansen, Allen & Luce Engineers	Engineer's Project No.:	406.17
Contractor:		Contractor's Project No.:	
Project:	East Pump Station PRV		
Contract Name:	East Pump Station PRV		

This ☐ Preliminary ☐ Final Certificate of Substantial Completion applies to:

☐ All Work ☐ The following specified portions of the Work:

[Describe the portion of the work for which Certificate of Substantial Completion is issued]

Date of Substantial Completion: **[Enter date, as determined by Engineer]**

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR, and ENGINEER, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of OWNER and CONTRACTOR; see Paragraph 15.03.D of the General Conditions.

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon OWNER's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to OWNER's Responsibilities: ☐ None ☐ As follows:

[List amendments to Owner's Responsibilities]

Amendments to CONTRACTOR's Responsibilities: ☐ None ☐ As follows:

[List amendments to Contractor's Responsibilities]

The following documents are attached to and made a part of this Certificate:

[List attachments such as punch list; other documents]

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

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SECTION 00 62 60
NOTICE OF ACCEPTABILITY OF WORK

Owner:	Salem City	Owner's Project No.:	
Engineer:	Hansen, Allen & Luce Engineers	Engineer's Project No.:	406.17
Contractor:		Contractor's Project No.:	
Project:	East Pump Station PRV		
Contract Name:			
Notice Date:		Effective Date of the Construction Contract:	

ENGINEER hereby gives notice to OWNER and CONTRACTOR that ENGINEER recommends final payment to CONTRACTOR, and that the Work furnished and performed by CONTRACTOR under the Construction Contract is acceptable, expressly subject to the provisions of the Construction Contract's Contract Documents ("Contract Documents") and of the Agreement between OWNER and ENGINEER for Professional Services dated February 2, 2025 ("Owner-Engineer Agreement"). This Notice of Acceptability of Work (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice has been prepared with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the ENGINEER's professional opinion.
3. This Notice has been prepared to the best of ENGINEER's knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services ENGINEER has been employed by OWNER to perform or furnish during construction of the Project (including observation of the CONTRACTOR's Work) under the Owner-Engineer Agreement, and applies only to facts that are within ENGINEER's knowledge or could reasonably have been ascertained by ENGINEER as a result of carrying out the responsibilities specifically assigned to ENGINEER under such Owner-Engineer Agreement.
5. This Notice is not a guarantee or warranty of CONTRACTOR's performance under the Construction Contract, an acceptance of Work that is not in accordance with the Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of CONTRACTOR to furnish and perform the Work thereunder in accordance with the Contract Documents, or to otherwise comply with the Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve CONTRACTOR of any surviving obligations under the Construction Contract and is subject to OWNER's reservations of rights with respect to completion and final payment.

ENGINEER

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

PART 3
CONTRACT CONDITIONS

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SECTION 00 72 00
GENERAL CONDITIONS

The General Conditions to be used for the Project are the Standard General Conditions of the Construction Contract prepared by Engineers Joint Contract Documents Council (No. EJCDC C-700, 2018 Edition) as included in this Section.

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by OWNER and CONTRACTOR, that sets forth the Contract Price and Contract Times, identifies the parties and the ENGINEER, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by CONTRACTOR, in a form acceptable to ENGINEER, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to OWNER.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by CONTRACTOR, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by ENGINEER concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by OWNER directly to CONTRACTOR, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision

by ENGINEER concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting ENGINEER's decision regarding a Change Proposal; seeking resolution of a contractual issue that ENGINEER has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by CONTRACTOR directly to OWNER, duly submitted in compliance with the procedural requirements set forth herein, contesting ENGINEER's decision regarding a Change Proposal, or seeking resolution of a contractual issue that ENGINEER has declined to address.

c. A demand or assertion by OWNER or CONTRACTOR, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after ENGINEER has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between OWNER and CONTRACTOR concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that OWNER has agreed to pay CONTRACTOR for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which CONTRACTOR shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *CONTRACTOR*—The individual or entity with which OWNER has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by CONTRACTOR.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions,

including sending and receipt; (c) printing of the transmitted Electronic Document by the recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *ENGINEER*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by ENGINEER which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires CONTRACTOR to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by OWNER to a Bidder of OWNER's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by OWNER to CONTRACTOR fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform the Work.

30. *OWNER*—The individual or entity with which CONTRACTOR has contracted regarding the Work, and which has agreed to pay CONTRACTOR for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by CONTRACTOR, describing the sequence and duration of the activities comprising CONTRACTOR's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for OWNER by ENGINEERS, CONTRACTORS, and others, including planning, study, design, construction,

testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

33. *Resident Project Representative*—The authorized representative of ENGINEER assigned to assist ENGINEER at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by CONTRACTOR, of required submittals and the time requirements for ENGINEER's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by CONTRACTOR, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing CONTRACTOR's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by OWNER upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by OWNER which are designated for the use of CONTRACTOR.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for CONTRACTOR, which the Contract Documents require CONTRACTOR to submit to ENGINEER, or that is indicated as a Submittal in the Schedule of Submittals accepted by ENGINEER. Submittals may include Shop Drawings and Samples; schedules; product data; OWNER-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by ENGINEER, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of ENGINEER, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the OWNER makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to CONTRACTOR.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials

and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to CONTRACTOR issued on or after the Effective Date of the Contract, signed by OWNER and recommended by ENGINEER, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by ENGINEER. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of ENGINEER as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to ENGINEER's recommendation of final payment (unless responsibility for the protection thereof has been assumed by OWNER at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of CONTRACTOR with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then CONTRACTOR shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. *Contract Price or Contract Times*: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When CONTRACTOR delivers the signed counterparts of the Agreement to OWNER, CONTRACTOR shall also deliver to OWNER the performance bond and payment bond (if the Contract requires CONTRACTOR to furnish such bonds).

B. *Evidence of CONTRACTOR’s Insurance*: When CONTRACTOR delivers the signed counterparts of the Agreement to OWNER, CONTRACTOR shall also deliver to OWNER, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by CONTRACTOR in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of OWNER’s Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, OWNER shall promptly deliver to CONTRACTOR, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by OWNER under Article 6.

2.02 *Copies of Documents*

A. OWNER shall furnish to CONTRACTOR four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. OWNER shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by ENGINEER and other design professionals. OWNER shall make such original printed record version of the Contract available to CONTRACTOR for review. OWNER may delegate the responsibilities under this provision to ENGINEER.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), CONTRACTOR shall submit to ENGINEER for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by OWNER, CONTRACTOR, ENGINEER, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference OWNER and CONTRACTOR each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by CONTRACTOR, ENGINEER, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to CONTRACTOR until acceptable schedules are submitted to ENGINEER.

1. The Progress Schedule will be acceptable to ENGINEER if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on ENGINEER responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve CONTRACTOR from CONTRACTOR's full responsibility therefor.

2. CONTRACTOR's Schedule of Submittals will be acceptable to ENGINEER if it provides a workable arrangement for reviewing and processing the required submittals.

3. CONTRACTOR's Schedule of Values will be acceptable to ENGINEER as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, CONTRACTOR will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the OWNER, ENGINEER, and CONTRACTOR may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then OWNER, ENGINEER, and CONTRACTOR shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. ENGINEER will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon OWNER and CONTRACTOR, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between OWNER or ENGINEER and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws, and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of OWNER, CONTRACTOR, or ENGINEER from those set forth in the part of the Contract Documents prepared by or for ENGINEER. No such provision or instruction shall be effective to assign to OWNER or ENGINEER any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for ENGINEER.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *CONTRACTOR's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, CONTRACTOR shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error, ambiguity, or discrepancy that CONTRACTOR discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by ENGINEER, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *CONTRACTOR's Review of Contract Documents*: If, before or during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then CONTRACTOR shall promptly report it to ENGINEER in writing. CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by ENGINEER, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless CONTRACTOR had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for ENGINEER

take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, CONTRACTOR and OWNER shall submit to the ENGINEER in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. ENGINEER will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

B. ENGINEER will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. ENGINEER's written clarification, interpretation, or decision will be final and binding on CONTRACTOR, unless it appeals by submitting a Change Proposal, and on OWNER, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other ENGINEERing or technical matters, then ENGINEER will promptly notify OWNER and CONTRACTOR in writing that ENGINEER is unable to provide a decision or interpretation. If OWNER and CONTRACTOR are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. CONTRACTOR and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or OWNERship rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaptation by ENGINEER; or

2. have or acquire any title or OWNERship rights in any other Contract Documents, reuse any such Contract Documents for any purpose without OWNER's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes CONTRACTOR from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. CONTRACTOR shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. OWNER shall provide ENGINEERing surveys to establish reference points for construction which in ENGINEER's judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. CONTRACTOR shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. CONTRACTOR shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with OWNER. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as OWNER and CONTRACTOR may otherwise agree in writing.

4.05 *Delays in CONTRACTOR's Progress*

A. If OWNER, ENGINEER, or anyone for whom OWNER is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then CONTRACTOR shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. CONTRACTOR shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of CONTRACTOR. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of CONTRACTOR.

C. If CONTRACTOR's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of OWNER, CONTRACTOR, and those for which they are responsible, then CONTRACTOR shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be CONTRACTOR's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
2. Abnormal weather conditions;
3. Acts or failures to act of third-party utility OWNERs or other third-party entities (other than those third-party utility OWNERs or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with OWNER, as contemplated in Article 8); and
4. Acts of war or terrorism.

D. CONTRACTOR's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. CONTRACTOR's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
2. CONTRACTOR shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of CONTRACTOR. Such a concurrent delay by CONTRACTOR shall not preclude an adjustment of Contract Times to which CONTRACTOR is otherwise entitled.
3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each CONTRACTOR request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;
2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

CONTRACTOR shall also furnish such additional supporting documentation as OWNER or ENGINEER may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference,

and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. OWNER shall furnish the Site. OWNER shall notify CONTRACTOR in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which CONTRACTOR must comply in performing the Work.

B. Upon reasonable written request, OWNER shall furnish CONTRACTOR with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and OWNER's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. CONTRACTOR shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that CONTRACTOR has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for CONTRACTOR's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the OWNERs or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the CONTRACTOR or those for which CONTRACTOR is responsible.

2. If a damage or injury claim is made by the OWNER or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the CONTRACTOR or those for which CONTRACTOR is responsible, CONTRACTOR shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all

parties through negotiations with such OWNER or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless OWNER and ENGINEER, and the officers, directors, members, partners, employees, agents, consultants and Subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of ENGINEERs, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such OWNER or occupant against OWNER, ENGINEER, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, CONTRACTOR's performance of the Work, or because of other actions or conduct of the CONTRACTOR or those for which CONTRACTOR is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the CONTRACTOR shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work CONTRACTOR shall clean the Site and the Work and make it ready for utilization by OWNER. At the completion of the Work CONTRACTOR shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by CONTRACTOR on Technical Data*: CONTRACTOR may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then

CONTRACTOR may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, CONTRACTOR may not rely upon or make any claim against OWNER or ENGINEER, or any of their officers, directors, members, partners, employees, agents, consultants, or Subcontractors, with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR, and safety precautions and programs incident thereto;
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
3. the contents of other Site-related documents made available to CONTRACTOR, such as record drawings from other projects at or adjacent to the Site, or OWNER's archival documents concerning the Site; or
4. any CONTRACTOR interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by CONTRACTOR*: If CONTRACTOR believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which CONTRACTOR is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
2. is of such a nature as to require a change in the Drawings or Specifications;
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify OWNER and ENGINEER in writing about such condition. CONTRACTOR shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting CONTRACTOR to do so.

B. *ENGINEER's Review*: After receipt of written notice as required by the preceding paragraph, ENGINEER will promptly review the subsurface or physical condition in question; determine whether it is necessary for OWNER to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from CONTRACTOR; prepare recommendations to OWNER regarding the CONTRACTOR's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise OWNER in writing of ENGINEER's findings, conclusions, and recommendations.

C. *OWNER's Statement to CONTRACTOR Regarding Site Condition*: After receipt of ENGINEER's written findings, conclusions, and recommendations, OWNER shall issue a written statement to CONTRACTOR (with a copy to ENGINEER) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting ENGINEER's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time ENGINEER determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of ENGINEER's review or OWNER's issuance of its statement to CONTRACTOR, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the ENGINEER may at its discretion instruct CONTRACTOR to resume such Work.

E. *Possible Price and Times Adjustments*

1. CONTRACTOR shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in CONTRACTOR's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

    c. CONTRACTOR's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

    a. CONTRACTOR knew of the existence of such condition at the time CONTRACTOR made a commitment to OWNER with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

    b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR's making such commitment; or

    c. CONTRACTOR failed to give the written notice required by Paragraph 5.04.A.

3. If OWNER and CONTRACTOR agree regarding CONTRACTOR's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. CONTRACTOR may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after OWNER's issuance of the OWNER's written statement to CONTRACTOR regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *CONTRACTOR's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and CONTRACTOR shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
2. complying with applicable state and local utility damage prevention Laws and Regulations;
3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;
4. coordination of the Work with the OWNERs (including OWNER) of such Underground Facilities, during construction; and
5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by CONTRACTOR*: If CONTRACTOR believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify OWNER and ENGINEER in writing regarding such Underground Facility.

C. *ENGINEER's Review*: ENGINEER will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;
2. identify and communicate with the OWNER of the Underground Facility; prepare recommendations to OWNER (and if necessary issue any preliminary instructions to CONTRACTOR) regarding the CONTRACTOR's resumption of Work in connection with the Underground Facility in question;
3. obtain any pertinent cost or schedule information from CONTRACTOR; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and
4. advise OWNER in writing of ENGINEER's findings, conclusions, and recommendations.

During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility.

D. *OWNER's Statement to CONTRACTOR Regarding Underground Facility*: After receipt of ENGINEER's written findings, conclusions, and recommendations, OWNER shall issue a written statement to CONTRACTOR (with a copy to ENGINEER) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting ENGINEER's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time ENGINEER determines that Work in connection with the Underground Facility may resume prior to completion of ENGINEER's review or OWNER's issuance of its statement to CONTRACTOR, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the ENGINEER may at its discretion instruct CONTRACTOR to resume such Work.

F. *Possible Price and Times Adjustments*

1. CONTRACTOR shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in CONTRACTOR's cost of, or time required for, performance of the Work; subject, however, to the following:

   a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

   b. CONTRACTOR's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

   c. CONTRACTOR gave the notice required in Paragraph 5.05.B.

2. If OWNER and CONTRACTOR agree regarding CONTRACTOR's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. CONTRACTOR may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after OWNER's issuance of the OWNER's written statement to CONTRACTOR regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the OWNERs of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil ENGINEERs. If such information or data is incorrect or incomplete, CONTRACTOR's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to OWNER relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to OWNER relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by CONTRACTOR on Technical Data Authorized*: CONTRACTOR may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then CONTRACTOR may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, CONTRACTOR may not rely upon or make any claim against OWNER or ENGINEER, or any of their officers, directors, members, partners, employees, agents, consultants, or Subcontractors, with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any CONTRACTOR interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. CONTRACTOR shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. CONTRACTOR shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by CONTRACTOR, Subcontractors, Suppliers, or anyone else for whom CONTRACTOR is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If CONTRACTOR encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, then CONTRACTOR shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with ENGINEER, OWNER shall take such actions as are necessary to permit OWNER to timely obtain required permits and provide CONTRACTOR the written notice required by Paragraph 5.06.F. If CONTRACTOR or anyone for whom CONTRACTOR is responsible created the Hazardous Environmental Condition in question, then OWNER may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. CONTRACTOR shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after OWNER has obtained any required permits related thereto, and delivered written notice to CONTRACTOR either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by CONTRACTOR, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of OWNER's written notice regarding the resumption of Work, CONTRACTOR may submit a Change Proposal, or OWNER may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, CONTRACTOR does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then OWNER may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. OWNER may have such deleted portion of the Work performed by OWNER's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, and ENGINEER, and the officers, directors, members, partners, employees, agents, consultants, and Subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERs, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this Paragraph 5.06.I obligates OWNER to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER, and the officers, directors, members, partners, employees, agents, consultants, and Subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERs, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by CONTRACTOR or by anyone for whom CONTRACTOR is responsible, or to a Hazardous Environmental Condition created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this Paragraph 5.06.J obligates CONTRACTOR to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. CONTRACTOR shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of CONTRACTOR's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. CONTRACTOR shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by OWNER prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. CONTRACTOR shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then CONTRACTOR shall promptly notify OWNER and ENGINEER in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If CONTRACTOR has failed to obtain a required bond, OWNER may exclude the CONTRACTOR from the Site and exercise OWNER's termination rights under Article 16.

G. Upon request to OWNER from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, OWNER shall provide a copy of the payment bond to such person or entity.

H. Upon request to CONTRACTOR from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, CONTRACTOR shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. OWNER and CONTRACTOR shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by OWNER or CONTRACTOR shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. CONTRACTOR shall deliver to OWNER, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that CONTRACTOR has obtained and is maintaining the policies and coverages required by the Contract. Upon request by OWNER or any other insured, CONTRACTOR shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, CONTRACTOR, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. OWNER shall deliver to CONTRACTOR, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that OWNER has obtained and is maintaining the policies and coverages required of OWNER by the Contract (if any). Upon request by CONTRACTOR or any other insured, OWNER shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, OWNER may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of OWNER or CONTRACTOR to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of OWNER or CONTRACTOR to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by CONTRACTOR, the OWNER, at OWNER's option, may purchase and maintain OWNER's own liability insurance. OWNER's liability policies, if any, operate separately and independently from policies required to be provided by CONTRACTOR, and CONTRACTOR cannot rely upon OWNER's liability policies for any of CONTRACTOR's obligations to the OWNER, ENGINEER, or third parties.

H. CONTRACTOR shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds OWNER and ENGINEER (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on CONTRACTOR's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If CONTRACTOR has failed to obtain and maintain required insurance, CONTRACTOR's entitlement to enter or remain at the Site will end immediately, and OWNER may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise OWNER's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. OWNER does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect CONTRACTOR or CONTRACTOR's interests. CONTRACTOR is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that CONTRACTOR deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on CONTRACTOR's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to OWNER and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and ENGINEER.

6.03 *CONTRACTOR's Insurance*

A. *Required Insurance*: CONTRACTOR shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when CONTRACTOR may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The CONTRACTOR's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds OWNER and ENGINEER, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by CONTRACTOR's acts or omissions, or the acts and omissions of those working on CONTRACTOR's behalf, in the performance of CONTRACTOR's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of OWNER Where Work Will Occur*: OWNER is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, OWNER will obtain property insurance for such substantially completed Work, and

maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of OWNER's procurement of such property insurance.

D. *Partial Occupancy or Use by OWNER*: If OWNER will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then OWNER (directly, if it is the purchaser of the builder's risk policy, or through CONTRACTOR) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If CONTRACTOR elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at CONTRACTOR's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against ENGINEER or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or Subcontractors.

1. OWNER and CONTRACTOR waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and Subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against ENGINEER, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and Subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by OWNER or CONTRACTOR as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by OWNER covering any loss, damage, or consequential loss to OWNER's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of OWNER; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against CONTRACTOR, Subcontractors, or ENGINEER, or the officers, directors, members, partners, employees, agents,

consultants, or Subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. OWNER waives all rights against CONTRACTOR, Subcontractors, and ENGINEER, and the officers, directors, members, partners, employees, agents, consultants and Subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to OWNER's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. CONTRACTOR shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against OWNER, CONTRACTOR, all individuals or entities identified in the Supplementary Conditions as insureds, the ENGINEER and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and Subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, CONTRACTOR shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *CONTRACTOR's Means and Methods of Construction*

A. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or CONTRACTOR determines, that professional ENGINEERing or other design services are needed to carry out CONTRACTOR's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then CONTRACTOR shall cause such services to be

provided by a properly licensed design professional, at CONTRACTOR's expense. Such services are not OWNER-delegated professional design services under this Contract, and neither OWNER nor ENGINEER has any responsibility with respect to (1) CONTRACTOR's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by CONTRACTOR, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. CONTRACTOR shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, CONTRACTOR shall assign a competent resident superintendent who will not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. CONTRACTOR shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. CONTRACTOR shall maintain good discipline and order at the Site.

B. CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of CONTRACTOR's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. CONTRACTOR will not perform Work on a Saturday, Sunday, or any legal holiday. CONTRACTOR may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with OWNER's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, CONTRACTOR shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of OWNER. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *CONTRACTOR's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon CONTRACTOR furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, CONTRACTOR may request that ENGINEER authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If ENGINEER in its sole discretion determines that an item of equipment or material proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, ENGINEER will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

   a. in the exercise of reasonable judgment ENGINEER determines that the proposed item:

      1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

      2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

      3) has a proven record of performance and availability of responsive service; and

      4) is not objectionable to OWNER.

   b. CONTRACTOR certifies that, if the proposed item is approved and incorporated into the Work:

      1) there will be no increase in cost to the OWNER or increase in Contract Times; and

      2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *CONTRACTOR's Expense*: CONTRACTOR shall provide all data in support of any proposed "or equal" item at CONTRACTOR's expense.

C. *ENGINEER's Evaluation and Determination*: ENGINEER will be allowed a reasonable time to evaluate each "or-equal" request. ENGINEER may require CONTRACTOR to furnish additional data about the proposed "or-equal" item. ENGINEER will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until ENGINEER's review is complete and ENGINEER determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. ENGINEER will advise CONTRACTOR in writing of any negative determination.

D. *Effect of ENGINEER's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The ENGINEER's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If ENGINEER determines that an item of equipment or material proposed by CONTRACTOR does not qualify as an "or-equal" item, CONTRACTOR may request that ENGINEER consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *CONTRACTOR's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, CONTRACTOR may request that ENGINEER authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. ENGINEER will not accept requests for review of proposed substitute items of equipment or material from anyone other than CONTRACTOR.

2. The requirements for review by ENGINEER will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as ENGINEER may decide is appropriate under the circumstances.

3. CONTRACTOR shall make written application to ENGINEER for review of a proposed substitute item of equipment or material that CONTRACTOR seeks to furnish or use. The application:

   a. will certify that the proposed substitute item will:

      1) perform adequately the functions and achieve the results called for by the general design;

      2) be similar in substance to the item specified; and

      3) be suited to the same use as the item specified.

   b. will state:

      1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

      2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for other work on the Project) to adapt the design to the proposed substitute item; and

      3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

   c. will identify:

      1) all variations of the proposed substitute item from the item specified; and

2) available ENGINEERing, sales, maintenance, repair, and replacement services.

d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other CONTRACTORs affected by any resulting change.

B. *ENGINEER's Evaluation and Determination*: ENGINEER will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from OWNER. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute item. ENGINEER will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until ENGINEER's review is complete and ENGINEER determines that the proposed item is an acceptable substitute. ENGINEER's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. ENGINEER will advise CONTRACTOR in writing of any negative determination.

C. *Special Guarantee*: OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of ENGINEER's Cost*: ENGINEER will record ENGINEER's costs in evaluating a substitute proposed or submitted by CONTRACTOR. Whether or not ENGINEER approves a substitute so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the reasonable charges of ENGINEER for evaluating each such proposed substitute. CONTRACTOR shall also reimburse OWNER for the reasonable charges of ENGINEER for making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER) resulting from the acceptance of each proposed substitute.

E. *CONTRACTOR's Expense*: CONTRACTOR shall provide all data in support of any proposed substitute at CONTRACTOR's expense.

F. *Effect of ENGINEER's Determination*: If ENGINEER approves the substitution request, CONTRACTOR shall execute the proposed Change Order and proceed with the substitution. The ENGINEER's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. CONTRACTOR may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. CONTRACTOR may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to OWNER. The CONTRACTOR's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve CONTRACTOR's obligation to OWNER to perform and complete the Work in accordance with the Contract Documents.

B. CONTRACTOR shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of CONTRACTOR's Bid or final negotiation of the terms of the Contract, OWNER may not require CONTRACTOR to retain any Subcontractor

or Supplier to furnish or perform any of the Work against which CONTRACTOR has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, CONTRACTOR shall submit to OWNER the identity of the proposed Subcontractor or Supplier (unless OWNER has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to OWNER unless OWNER raises a substantive, reasonable objection within 5 days.

E. OWNER may require the replacement of any Subcontractor or Supplier. OWNER also may require CONTRACTOR to retain specific replacements; provided, however, that OWNER may not require a replacement to which CONTRACTOR has a reasonable objection. If CONTRACTOR has submitted the identity of certain Subcontractors or Suppliers for acceptance by OWNER, and OWNER has accepted it (either in writing or by failing to make written objection thereto), then OWNER may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. CONTRACTOR shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If OWNER requires the replacement of any Subcontractor or Supplier retained by CONTRACTOR to perform any part of the Work, then CONTRACTOR shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and CONTRACTOR shall initiate a Change Proposal for such adjustment within 30 days of OWNER's requirement of replacement.

G. No acceptance by OWNER of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of OWNER to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, CONTRACTOR shall submit to ENGINEER a complete list of all Subcontractors and Suppliers having a direct contract with CONTRACTOR, and of all other Subcontractors and Suppliers known to CONTRACTOR at the time of submittal.

I. CONTRACTOR shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for CONTRACTOR by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of OWNER and ENGINEER.

L. OWNER may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to CONTRACTOR for Work performed for CONTRACTOR by the Subcontractor or Supplier.

M. CONTRACTOR shall restrict all Subcontractors and Suppliers from communicating with ENGINEER or OWNER, except through CONTRACTOR or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of OWNER or ENGINEER, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, and its officers, directors, members, partners, employees, agents, consultants, and Subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERs, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER, and the officers, directors, members, partners, employees, agents, consultants and Subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERs, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, CONTRACTOR shall obtain and pay for all construction permits, licenses, and certificates of occupancy. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of CONTRACTOR's Bid (or when CONTRACTOR became bound under a negotiated contract). OWNER shall pay all charges of utility OWNERs for connections for providing permanent service to the Work.

7.10 *Taxes*

A. CONTRACTOR shall pay all sales, consumer, use, and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. CONTRACTOR shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR's compliance with any Laws or Regulations.

B. If CONTRACTOR performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, CONTRACTOR shall bear all resulting costs and losses, and shall indemnify and hold harmless OWNER and ENGINEER, and the officers, directors, members, partners, employees, agents, consultants, and Subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERs, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not CONTRACTOR's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve CONTRACTOR of its obligations under Paragraph 3.03.

C. OWNER or CONTRACTOR may give written notice to the other party of any changes after the submission of CONTRACTOR's Bid (or after the date when CONTRACTOR became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice CONTRACTOR may submit a Change Proposal, or OWNER may initiate a Claim.

7.12 *Record Documents*

A. CONTRACTOR shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. CONTRACTOR shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to ENGINEER for reference. Upon completion of the Work, CONTRACTOR shall deliver these record documents to ENGINEER.

7.13 *Safety and Protection*

A. CONTRACTOR shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. CONTRACTOR shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and

Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. CONTRACTOR shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. CONTRACTOR shall notify OWNER; the OWNERs of adjacent property; the OWNERs of Underground Facilities and other utilities (if the identity of such OWNERs is known to CONTRACTOR); and other CONTRACTORs and utility OWNERs performing work at or adjacent to the Site, in writing, when CONTRACTOR knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. CONTRACTOR shall comply with the applicable requirements of OWNER's safety programs, if any. Any OWNER's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. CONTRACTOR shall inform OWNER and ENGINEER of the specific requirements of CONTRACTOR's safety program with which OWNER's and ENGINEER's employees and representatives must comply while at the Site.

I. CONTRACTOR's duties and responsibilities for safety and protection will continue until all the Work is completed, ENGINEER has issued a written notice to OWNER and CONTRACTOR in accordance with Paragraph 15.06.C that the Work is acceptable, and CONTRACTOR has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. CONTRACTOR's duties and responsibilities for safety and protection will resume whenever CONTRACTOR or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. CONTRACTOR shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, CONTRACTOR is obligated to act to prevent damage, injury, or loss. CONTRACTOR shall give ENGINEER prompt written notice if

CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of CONTRACTOR's response to an emergency. If ENGINEER determines that a change in the Contract Documents is required because of an emergency or CONTRACTOR's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, CONTRACTOR shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to CONTRACTOR's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR's review of that Submittal, and that CONTRACTOR approves the Submittal.

3. With each Shop Drawing or Sample, CONTRACTOR shall give ENGINEER specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: CONTRACTOR shall label and submit Shop Drawings and Samples to ENGINEER for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. CONTRACTOR shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show ENGINEER the services, materials, and equipment CONTRACTOR proposes to provide, and to enable ENGINEER to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

    a. CONTRACTOR shall submit the number of Samples required in the Specifications.

    b. CONTRACTOR shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as ENGINEER may require to enable ENGINEER to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to ENGINEER's review and approval of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.

C. *ENGINEER's Review of Shop Drawings and Samples*

1. ENGINEER will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. ENGINEER's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. ENGINEER's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. ENGINEER's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. ENGINEER's review and approval of a Shop Drawing or Sample will not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has complied with the requirements of Paragraph 7.16.A.3 and ENGINEER has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. ENGINEER will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. ENGINEER's review and approval of a Shop Drawing or Sample will not relieve CONTRACTOR from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. ENGINEER's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither ENGINEER's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. CONTRACTOR shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. CONTRACTOR shall make corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous Submittals.

2. CONTRACTOR shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. ENGINEER will record ENGINEER's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and CONTRACTOR shall be responsible for ENGINEER's charges to OWNER for such time. OWNER may impose a set-off against payments due CONTRACTOR to secure reimbursement for such charges.

3. If CONTRACTOR requests a change of a previously approved Shop Drawing or Sample, CONTRACTOR shall be responsible for ENGINEER's charges to OWNER for its review time, and OWNER may impose a set-off against payments due CONTRACTOR to secure reimbursement for such charges, unless the need for such change is beyond the control of CONTRACTOR.

E. *Submittals Other than Shop Drawings, Samples, and OWNER-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and OWNER-delegated designs:

   a. CONTRACTOR shall submit all such Submittals to the ENGINEER in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. ENGINEER will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. ENGINEER's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

   d. If any such Submittal is not accepted, CONTRACTOR shall confer with ENGINEER regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. OWNER-delegated Designs: Submittals pursuant to OWNER-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *CONTRACTOR's General Warranty and Guarantee*

A. CONTRACTOR warrants and guarantees to OWNER that all Work will be in accordance with the Contract Documents and will not be defective. ENGINEER is entitled to rely on CONTRACTOR's warranty and guarantee.

B. OWNER's rights under this warranty and guarantee are in addition to, and are not limited by, OWNER's rights under the correction period provisions of Paragraph 15.08. The time in which OWNER may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. OWNER shall give CONTRACTOR written notice of any defective Work within 60 days of the discovery that such Work is defective; and
2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than CONTRACTOR, Subcontractors, Suppliers, or any other individual or entity for whom CONTRACTOR is responsible; or
2. normal wear and tear under normal usage.

D. CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents, or a release of OWNER's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by ENGINEER;
2. Recommendation by ENGINEER or payment by OWNER of any progress or final payment;
3. The issuance of a certificate of Substantial Completion by ENGINEER or any payment related thereto by OWNER;
4. Use or occupancy of the Work or any part thereof by OWNER;
5. Any review and approval of a Shop Drawing or Sample submittal;
6. The issuance of a notice of acceptability by ENGINEER;
7. The end of the correction period established in Paragraph 15.08;
8. Any inspection, test, or approval by others; or
9. Any correction of defective Work by OWNER.

E. If the Contract requires the CONTRACTOR to accept the assignment of a contract entered into by OWNER, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to CONTRACTOR's performance obligations to OWNER for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of CONTRACTOR under the Contract or otherwise, CONTRACTOR shall

indemnify and hold harmless OWNER and ENGINEER, and the officers, directors, members, partners, employees, agents, consultants and Subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of ENGINEERs, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against OWNER or ENGINEER, or any of their officers, directors, members, partners, employees, agents, consultants, or Subcontractors, by any employee (or the survivor or personal representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. OWNER may require CONTRACTOR to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that CONTRACTOR must furnish to ENGINEER with respect to the OWNER-delegated design.

B. CONTRACTOR shall cause such OWNER-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the OWNER-delegated design is prepared by CONTRACTOR, a Subcontractor, or others for submittal to ENGINEER, then such Shop Drawing or other Submittal must bear the written approval of CONTRACTOR's design professional when submitted by CONTRACTOR to ENGINEER.

D. OWNER and ENGINEER shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by CONTRACTOR under an OWNER-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, ENGINEER's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications,

and other Submittals furnished by CONTRACTOR pursuant to an OWNER-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;
2. Confirming that CONTRACTOR (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
3. Establishing that the design furnished by CONTRACTOR is consistent with the design concept expressed in the Contract Documents.

F. CONTRACTOR shall not be responsible for the adequacy of performance or design criteria specified by OWNER or ENGINEER.

G. CONTRACTOR is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the OWNER may perform other work at or adjacent to the Site. Such other work may be performed by OWNER's employees, or through contracts between the OWNER and third parties. OWNER may also arrange to have third-party utility OWNERs perform work on their utilities and facilities at or adjacent to the Site.

B. If OWNER performs other work at or adjacent to the Site with OWNER's employees, or through contracts for such other work, then OWNER shall give CONTRACTOR written notice thereof prior to starting any such other work. If OWNER has advance information regarding the start of any third-party utility work that OWNER has arranged to take place at or adjacent to the Site, OWNER shall provide such information to CONTRACTOR.

C. CONTRACTOR shall afford proper and safe access to the Site to each CONTRACTOR that performs such other work, each utility OWNER performing other work, and OWNER, if OWNER is performing other work with OWNER's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. CONTRACTOR shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that CONTRACTOR may cut or alter others' work with the written consent of ENGINEER and the others whose work will be affected.

E. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others, CONTRACTOR shall inspect such other work and promptly report to ENGINEER in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of CONTRACTOR's Work. CONTRACTOR's failure to so report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with OWNER, or that is performed

without having been arranged by OWNER. If such work occurs, then any related delay, disruption, or interference incurred by CONTRACTOR is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If OWNER intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with OWNER's employees, or to arrange to have utility OWNERs perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to CONTRACTOR prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various CONTRACTORs;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, OWNER shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for OWNER at or adjacent to the Site, the OWNER's employees, any other CONTRACTOR working for OWNER, or any utility OWNER that OWNER has arranged to perform work, causes damage to the Work or to the property of CONTRACTOR or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then CONTRACTOR shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. CONTRACTOR must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to CONTRACTOR in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to CONTRACTOR under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on CONTRACTOR assigning to OWNER all CONTRACTOR's rights against such other CONTRACTOR or utility OWNER with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. CONTRACTOR's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. CONTRACTOR shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of OWNER, any other CONTRACTOR, or any utility OWNER performing other work at or adjacent to the Site.

1. If CONTRACTOR fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other CONTRACTOR or utility OWNER, then OWNER may impose a set-off against payments due CONTRACTOR, and assign to such other CONTRACTOR or utility OWNER the

OWNER's contractual rights against CONTRACTOR with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When OWNER is performing other work at or adjacent to the Site with OWNER's employees, CONTRACTOR shall be liable to OWNER for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by OWNER as a result of CONTRACTOR's failure to take reasonable and customary measures with respect to OWNER's other work. In response to such damage, delay, disruption, or interference, OWNER may impose a set-off against payments due CONTRACTOR.

C. If CONTRACTOR damages, delays, disrupts, or interferes with the work of any other CONTRACTOR, or any utility OWNER performing other work at or adjacent to the Site, through CONTRACTOR's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of CONTRACTOR's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other CONTRACTOR or utility OWNER against CONTRACTOR, OWNER, or ENGINEER, then CONTRACTOR shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other CONTRACTOR or utility OWNER, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless OWNER and ENGINEER, and the officers, directors, members, partners, employees, agents, consultants and Subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of ENGINEERs, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to CONTRACTOR*

A. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through ENGINEER.

9.02 *Replacement of ENGINEER*

A. OWNER may at its discretion appoint an ENGINEER to replace ENGINEER, provided CONTRACTOR makes no reasonable objection to the replacement ENGINEER. The replacement ENGINEER's status under the Contract Documents will be that of the former ENGINEER.

9.03 *Furnish Data*

A. OWNER shall promptly furnish the data required of OWNER under the Contract Documents.

9.04 *Pay When Due*

A. OWNER shall make payments to CONTRACTOR when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. OWNER's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. OWNER's duties with respect to providing ENGINEERing surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to OWNER's identifying and making available to CONTRACTOR copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. OWNER's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. OWNER's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. OWNER's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on OWNER's Responsibilities*

A. The OWNER shall not supervise, direct, or have control or authority over, nor be responsible for, CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. OWNER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. OWNER's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of CONTRACTOR, OWNER shall furnish CONTRACTOR reasonable evidence that financial arrangements have been made to satisfy OWNER's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, OWNER's employees and representatives shall comply with the specific applicable requirements of CONTRACTOR's safety programs of which OWNER has been informed.

B. OWNER shall furnish copies of any applicable OWNER safety programs to CONTRACTOR.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *OWNER's Representative*

A. ENGINEER will be OWNER's representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. ENGINEER will make visits to the Site at intervals appropriate to the various stages of construction as ENGINEER deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work. Based on information obtained during such visits and observations, ENGINEER, for the benefit of OWNER, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. ENGINEER's efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, ENGINEER will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defective Work.

B. ENGINEER's visits and observations are subject to all the limitations on ENGINEER's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of ENGINEER's visits or observations of CONTRACTOR's Work, ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If OWNER and ENGINEER have agreed that ENGINEER will furnish a Resident Project Representative to represent ENGINEER at the Site and assist ENGINEER in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If OWNER designates an individual or entity who is not ENGINEER's consultant, agent, or employee to represent OWNER at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *ENGINEER's Authority*

A. ENGINEER has the authority to reject Work in accordance with Article 14.

B. ENGINEER's authority as to Submittals is set forth in Paragraph 7.16.

C. ENGINEER's authority as to design drawings, calculations, specifications, certifications and other Submittals from CONTRACTOR in response to OWNER's delegation (if any) to CONTRACTOR of professional design services, is set forth in Paragraph 7.19.

D. ENGINEER's authority as to changes in the Work is set forth in Article 11.

E. ENGINEER's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. ENGINEER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. ENGINEER will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, ENGINEER will not show partiality to OWNER or CONTRACTOR, and will not be liable to OWNER, CONTRACTOR, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on ENGINEER's Authority and Responsibilities*

A. Neither ENGINEER's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by ENGINEER, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. ENGINEER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

C. ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. ENGINEER's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by CONTRACTOR under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, ENGINEER's employees and representatives will comply with the specific applicable requirements of OWNER's and CONTRACTOR's safety programs of which ENGINEER has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other ENGINEERing or technical matters, must be supported by ENGINEER's recommendation. OWNER and CONTRACTOR may amend other terms and conditions of the Contract without the recommendation of the ENGINEER.

11.02 *Change Orders*

A. OWNER and CONTRACTOR shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an OWNER set-off, unless CONTRACTOR has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by OWNER pursuant to Paragraph 11.05, (b) required because of OWNER's acceptance of defective Work under Paragraph 14.04 or OWNER's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for ENGINEER's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other ENGINEERing or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If OWNER or CONTRACTOR refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

B. If OWNER has issued a Work Change Directive and:

1. CONTRACTOR believes that an adjustment in Contract Times or Contract Price is necessary, then CONTRACTOR shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. OWNER believes that an adjustment in Contract Times or Contract Price is necessary, then OWNER shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. ENGINEER may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on OWNER and also on CONTRACTOR, which shall perform the Work involved promptly.

B. If CONTRACTOR believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, CONTRACTOR shall submit a Change Proposal as provided herein.

11.05 *OWNER-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other ENGINEERing or technical matters will be supported by ENGINEER's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if OWNER and CONTRACTOR have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates CONTRACTOR to undertake work that CONTRACTOR reasonably concludes cannot be performed in a manner consistent with CONTRACTOR's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a CONTRACTOR's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *CONTRACTOR's Fee*: When applicable, the CONTRACTOR's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the CONTRACTOR's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the CONTRACTOR's fee will be 5 percent;

c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the CONTRACTOR's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to CONTRACTOR itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by OWNER will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by CONTRACTOR to OWNER for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in CONTRACTOR's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: CONTRACTOR shall submit a Change Proposal to ENGINEER to request an adjustment in the Contract Times or Contract Price; contest an initial decision by ENGINEER concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: CONTRACTOR shall submit each Change Proposal to ENGINEER within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The CONTRACTOR shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the ENGINEER and OWNER within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which CONTRACTOR believes it is entitled as a result of said event.

3. *ENGINEER's Initial Review*: ENGINEER will advise OWNER regarding the Change Proposal, and consider any comments or response from OWNER regarding the Change Proposal. If in its discretion ENGINEER concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then ENGINEER may request that CONTRACTOR submit such additional supporting data by a date specified by ENGINEER, prior to ENGINEER beginning its full review of the Change Proposal.

4. *ENGINEER's Full Review and Action on the Change Proposal*: Upon receipt of CONTRACTOR's supporting data (including any additional data requested by ENGINEER), ENGINEER will conduct a full review of each Change Proposal and, within 30 days after such receipt of the CONTRACTOR's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and

deny it in part. Such actions must be in writing, with a copy provided to OWNER and CONTRACTOR. If ENGINEER does not take action on the Change Proposal within 30 days, then either OWNER or CONTRACTOR may at any time thereafter submit a letter to the other party indicating that as a result of ENGINEER's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: ENGINEER's decision is final and binding upon OWNER and CONTRACTOR, unless OWNER or CONTRACTOR appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other ENGINEERing or technical matters, then ENGINEER will notify the parties in writing that the ENGINEER is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and CONTRACTOR may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: CONTRACTOR shall not submit any Change Proposals after ENGINEER issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be CONTRACTOR's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between OWNER and CONTRACTOR are subject to the Claims process set forth in this article:

1. Appeals by OWNER or CONTRACTOR of ENGINEER's decisions regarding Change Proposals;

2. OWNER demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that ENGINEER has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other ENGINEERing or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after ENGINEER has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the ENGINEER, for its information only. The responsibility to substantiate a

Claim rests with the party making the Claim. In the case of a Claim by CONTRACTOR seeking an increase in the Contract Times or Contract Price, CONTRACTOR shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of CONTRACTOR's knowledge and belief the amount of time or money requested accurately reflects the full amount to which CONTRACTOR is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to ENGINEER.

D. *Mediation*

1. At any time after initiation of a Claim, OWNER and CONTRACTOR may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If OWNER and CONTRACTOR agree to mediation, then after 60 days from such agreement, either OWNER or CONTRACTOR may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. OWNER and CONTRACTOR shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either OWNER or CONTRACTOR may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as

further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, CONTRACTOR is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by OWNER, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by OWNER.
2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts will accrue to OWNER. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained.
3. Payments made by CONTRACTOR to Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from Subcontractors acceptable to OWNER and CONTRACTOR and shall deliver such bids to OWNER, which will then determine, with the advice of ENGINEER, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as CONTRACTOR's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to ENGINEERs, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of CONTRACTOR.

        1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. CONTRACTOR will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

    c. *Construction Equipment Rental*

        1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by OWNER as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

        2) Costs for equipment and machinery owned by CONTRACTOR or a CONTRACTOR-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

        3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

    d. Sales, consumer, use, and other similar taxes related to the Work, and for which CONTRACTOR is liable, as imposed by Laws and Regulations.

    e. Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

    f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in

connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of OWNER. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining CONTRACTOR's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that CONTRACTOR is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of CONTRACTOR's officers, executives, principals, general managers, ENGINEERs, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by CONTRACTOR, whether at the Site or in CONTRACTOR's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the CONTRACTOR's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the Site.

4. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.

5. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *CONTRACTOR's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. CONTRACTOR's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, CONTRACTOR's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then CONTRACTOR's fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, CONTRACTOR and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, OWNER will be afforded reasonable access, during normal business hours, to all CONTRACTOR's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and CONTRACTOR's fee. CONTRACTOR shall preserve all such documents for a period of three years after the final payment by OWNER. Pertinent Subcontractors will afford such access to OWNER, and preserve such documents, to the same extent required of CONTRACTOR.

13.02 *Allowances*

A. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to OWNER and ENGINEER.

B. *Cash Allowances*: CONTRACTOR agrees that:

1. the cash allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. CONTRACTOR's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *OWNER's Contingency Allowance*: CONTRACTOR agrees that an OWNER's contingency allowance, if any, is for the sole use of OWNER to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an

amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to CONTRACTOR for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for each separately identified item.

D. ENGINEER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. ENGINEER will review with CONTRACTOR the ENGINEER's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). ENGINEER's written decision thereon will be final and binding (except as modified by ENGINEER to reflect changed factual conditions or more accurate data) upon OWNER and CONTRACTOR, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. CONTRACTOR or OWNER shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by CONTRACTOR differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. CONTRACTOR's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in CONTRACTOR's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to OWNER and CONTRACTOR.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. OWNER, ENGINEER, their consultants and other representatives and personnel of OWNER, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. OWNER shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by OWNER, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish ENGINEER the required certificates of inspection or approval.

D. CONTRACTOR shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to OWNER;
2. to attain OWNER's and ENGINEER's acceptance of materials or equipment to be incorporated in the Work;
3. by manufacturers of equipment furnished under the Contract Documents;
4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
5. for acceptance of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to OWNER and ENGINEER.

E. If the Contract Documents require the Work (or part thereof) to be approved by OWNER, ENGINEER, or another designated individual or entity, then CONTRACTOR shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by CONTRACTOR without written concurrence of ENGINEER, CONTRACTOR shall, if requested by ENGINEER, uncover such Work for observation. Such uncovering will be at CONTRACTOR's expense unless CONTRACTOR had given ENGINEER timely notice of CONTRACTOR's intention to cover the same and ENGINEER had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *CONTRACTOR's Obligation*: It is CONTRACTOR's obligation to assure that the Work is not defective.

B. *ENGINEER's Authority*: ENGINEER has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which OWNER or ENGINEER has actual knowledge will be given to CONTRACTOR.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, CONTRACTOR shall correct all such defective Work, whether or not

fabricated, installed, or completed, or, if ENGINEER has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, CONTRACTOR shall take no action that would void or otherwise impair OWNER's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, CONTRACTOR shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against OWNER by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if OWNER and CONTRACTOR are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then OWNER may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, OWNER prefers to accept it, OWNER may do so (subject, if such acceptance occurs prior to final payment, to ENGINEER's confirmation that such acceptance is in general accord with the design intent and applicable ENGINEERing principles, and will not endanger public safety). CONTRACTOR shall pay all claims, costs, losses, and damages attributable to OWNER's evaluation of and determination to accept such defective Work (such costs to be approved by ENGINEER as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by CONTRACTOR. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then OWNER may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, CONTRACTOR shall pay an appropriate amount to OWNER.

14.05 *Uncovering Work*

A. ENGINEER has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of ENGINEER, then CONTRACTOR shall, if requested by ENGINEER, uncover such Work for ENGINEER's observation, and then replace the covering, all at CONTRACTOR's expense.

C. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, then CONTRACTOR, at ENGINEER's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as ENGINEER may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, CONTRACTOR shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of

satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending CONTRACTOR's full discharge of this responsibility the OWNER shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then CONTRACTOR may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *OWNER May Stop the Work*

A. If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work will not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *OWNER May Correct Defective Work*

A. If CONTRACTOR fails within a reasonable time after written notice from ENGINEER to correct defective Work, or to remove and replace defective Work as required by ENGINEER, then OWNER may, after 7 days' written notice to CONTRACTOR, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, OWNER shall proceed expeditiously. In connection with such corrective or remedial action, OWNER may exclude CONTRACTOR from all or part of the Site, take possession of all or part of the Work and suspend CONTRACTOR's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees, OWNER's other CONTRACTORs, and ENGINEER and ENGINEER's consultants access to the Site to enable OWNER to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by OWNER in exercising the rights and remedies under this Paragraph 14.07 will be charged against CONTRACTOR as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of CONTRACTOR's defective Work.

D. CONTRACTOR shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to ENGINEER. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by CONTRACTOR during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by CONTRACTOR for the materials and equipment; (b) at OWNER's request, documentation warranting that OWNER has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect OWNER's interest therein, all of which must be satisfactory to OWNER.

3. Beginning with the second Application for Payment, each Application must include an affidavit of CONTRACTOR stating that all previous progress payments received by CONTRACTOR have been applied to discharge CONTRACTOR's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. ENGINEER will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to OWNER, or return the Application to CONTRACTOR indicating in writing ENGINEER's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application.

2. ENGINEER's recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER's observations of the executed Work as an experienced and qualified design professional, and on ENGINEER's review of the Application for Payment

and the accompanying data and schedules, that to the best of ENGINEER's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

c. the conditions precedent to CONTRACTOR's being entitled to such payment appear to have been fulfilled in so far as it is ENGINEER's responsibility to observe the Work.

3. By recommending any such payment ENGINEER will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract; or

b. there may not be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

4. Neither ENGINEER's review of CONTRACTOR's Work for the purposes of recommending payments nor ENGINEER's recommendation of any payment, including final payment, will impose responsibility on ENGINEER:

a. to supervise, direct, or control the Work;

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

c. for CONTRACTOR's failure to comply with Laws and Regulations applicable to CONTRACTOR's performance of the Work;

d. to make any examination to ascertain how or for what purposes CONTRACTOR has used the money paid by OWNER; or

e. to determine that title to any of the Work, materials, or equipment has passed to OWNER free and clear of any Liens.

5. ENGINEER may refuse to recommend the whole or any part of any payment if, in ENGINEER's opinion, it would be incorrect to make the representations to OWNER stated in Paragraph 15.01.C.2.

6. ENGINEER will recommend reductions in payment (set-offs) necessary in ENGINEER's opinion to protect OWNER from loss because:

a. the Work is defective, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. OWNER has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

d. OWNER has been required to remove or remediate a Hazardous Environmental Condition for which CONTRACTOR is responsible; or

e. ENGINEER has actual knowledge of the occurrence of any of the events that would constitute a default by CONTRACTOR and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to OWNER with ENGINEER's recommendation, the amount recommended (subject to any OWNER set-offs) will become due, and when due will be paid by OWNER to CONTRACTOR.

E. *Reductions in Payment by OWNER*

1. In addition to any reductions in payment (set-offs) recommended by ENGINEER, OWNER is entitled to impose a set-off against payment based on any of the following:

a. Claims have been made against OWNER based on CONTRACTOR's conduct in the performance or furnishing of the Work, or OWNER has incurred costs, losses, or damages resulting from CONTRACTOR's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. CONTRACTOR has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. CONTRACTOR has failed to provide and maintain required bonds or insurance;

d. OWNER has been required to remove or remediate a Hazardous Environmental Condition for which CONTRACTOR is responsible;

e. OWNER has incurred extra charges or ENGINEERing costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. OWNER has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by CONTRACTOR and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of CONTRACTOR's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where CONTRACTOR has delivered a specific bond satisfactory to OWNER to secure the satisfaction and discharge of such Liens; or

l. Other items entitle OWNER to a set-off against the amount recommended.

2. If OWNER imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of ENGINEER, OWNER will give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action and the specific amount of the reduction, and promptly pay CONTRACTOR any amount remaining after deduction of the amount so withheld. OWNER shall promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by OWNER and CONTRACTOR, if CONTRACTOR remedies the reasons for such action. The reduction imposed will be binding on CONTRACTOR unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that OWNER's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *CONTRACTOR's Warranty of Title*

A. CONTRACTOR warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to OWNER free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by OWNER.

15.03 *Substantial Completion*

A. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER and ENGINEER in writing that the entire Work is substantially complete and request that ENGINEER issue a certificate of Substantial Completion. CONTRACTOR shall at the same time submit to OWNER and ENGINEER an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after CONTRACTOR's notification, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor.

C. If ENGINEER considers the Work substantially complete, ENGINEER will deliver to OWNER a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. ENGINEER shall attach to the certificate a punch list of items to be completed or corrected before final payment. OWNER shall have 7 days after receipt of the preliminary certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, ENGINEER concludes that the Work is not substantially complete, ENGINEER will, within 14 days after submission of the preliminary certificate to OWNER, notify CONTRACTOR in writing that the Work is not substantially complete, stating the reasons therefor. If OWNER does not object to the provisions of the certificate, or if despite consideration of OWNER's objections ENGINEER concludes that the Work is substantially complete, then ENGINEER will, within said 14 days, execute and deliver to OWNER and CONTRACTOR a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary

certificate as ENGINEER believes justified after consideration of any objections from OWNER.

D. At the time of receipt of the preliminary certificate of Substantial Completion, OWNER and CONTRACTOR will confer regarding OWNER's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by OWNER. Unless OWNER and CONTRACTOR agree otherwise in writing, OWNER shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon OWNER's use or occupancy of the Work.

E. After Substantial Completion the CONTRACTOR shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases CONTRACTOR may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. OWNER shall have the right to exclude CONTRACTOR from the Site after the date of Substantial Completion subject to allowing CONTRACTOR reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, OWNER may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which OWNER, ENGINEER, and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference with CONTRACTOR's performance of the remainder of the Work, subject to the following conditions:

1. At any time, OWNER may request in writing that CONTRACTOR permit OWNER to use or occupy any such part of the Work that OWNER believes to be substantially complete. If and when CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR, OWNER, and ENGINEER will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, CONTRACTOR may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will promptly make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After CONTRACTOR has, in the opinion of ENGINEER, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, CONTRACTOR may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to OWNER free and clear of any Liens or other title defects, or will so pass upon final payment.

   d. a list of all duly pending Change Proposals and Claims; and

   e. complete and legally effective releases or waivers (satisfactory to OWNER) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER might in any way be responsible, or which might in any way result in liens or other burdens on OWNER's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien, or OWNER at its option may issue joint checks payable to CONTRACTOR and specified Subcontractors and Suppliers.

B. *ENGINEER's Review of Final Application and Recommendation of Payment*: If, on the basis of ENGINEER's observation of the Work during construction and final inspection, and ENGINEER's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract have been fulfilled, ENGINEER will, within 10 days after receipt of the final

Application for Payment, indicate in writing ENGINEER's recommendation of final payment and present the final Application for Payment to OWNER for payment. Such recommendation will account for any set-offs against payment that are necessary in ENGINEER's opinion to protect OWNER from loss for the reasons stated above with respect to progress payments. Otherwise, ENGINEER will return the Application for Payment to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, ENGINEER will also give written notice to OWNER and CONTRACTOR that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the ENGINEER's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from ENGINEER of the final Application for Payment and accompanying documentation, OWNER shall set off against the amount recommended by ENGINEER for final payment any further sum to which OWNER is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. OWNER shall pay the resulting balance due to CONTRACTOR within 30 days of OWNER's receipt of the final Application for Payment from ENGINEER.

15.07 *Waiver of Claims*

A. By making final payment, OWNER waives its claim or right to liquidated damages or other damages for late completion by CONTRACTOR, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by OWNER. OWNER reserves all other claims or rights after final payment.

B. The acceptance of final payment by CONTRACTOR will constitute a waiver by CONTRACTOR of all claims and rights against OWNER other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), OWNER gives CONTRACTOR written notice that any Work has been found to be defective, or that CONTRACTOR's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by OWNER, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. OWNER shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, CONTRACTOR does not promptly comply with the terms of OWNER's written instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. CONTRACTOR shall pay all costs, losses, and damages (including but not limited to all fees and charges of ENGINEERs, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). CONTRACTOR's failure to pay such costs, losses, and damages within 10 days of invoice from OWNER will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

F. CONTRACTOR's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *OWNER May Suspend Work*

A. At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to CONTRACTOR and ENGINEER. Such notice will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *OWNER May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by CONTRACTOR and justify termination for cause:

1. CONTRACTOR's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of CONTRACTOR to perform or otherwise to comply with a material term of the Contract Documents;

3. CONTRACTOR's disregard of Laws or Regulations of any public body having jurisdiction; or

4. CONTRACTOR's repeated disregard of the authority of OWNER or ENGINEER.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving CONTRACTOR (and any surety) 10 days' written notice that OWNER is considering a declaration that CONTRACTOR is in default and termination of the Contract, OWNER may proceed to:

1. declare CONTRACTOR to be in default, and give CONTRACTOR (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to OWNER under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if OWNER has terminated the Contract for cause, OWNER may exclude CONTRACTOR from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and complete the Work as OWNER may deem expedient.

D. OWNER may not proceed with termination of the Contract under Paragraph 16.02.B if CONTRACTOR within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If OWNER proceeds as provided in Paragraph 16.02.B, CONTRACTOR shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERs, architects, attorneys, and other professionals) sustained by OWNER, such excess will be paid to CONTRACTOR. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such claims, costs, losses, and damages incurred by OWNER will be reviewed by ENGINEER as to their reasonableness and, when so approved by ENGINEER, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, OWNER shall not be required to obtain the lowest price for the Work performed.

F. Where CONTRACTOR's services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter accrue, or any rights or remedies of OWNER against CONTRACTOR or any surety under any payment bond or performance bond. Any retention or payment of money due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

G. If and to the extent that CONTRACTOR has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *OWNER May Terminate for Convenience*

A. Upon 7 days' written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy of OWNER, terminate the Contract. In such case, CONTRACTOR shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. CONTRACTOR shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *CONTRACTOR May Stop Work or Terminate*

A. If, through no act or fault of CONTRACTOR, (1) the Work is suspended for more than 90 consecutive days by OWNER or under an order of court or other public authority, or (2) ENGINEER fails to act on any Application for Payment within 30 days after it is submitted, or (3) OWNER fails for 30 days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon 7 days' written notice to OWNER and ENGINEER, and provided OWNER or ENGINEER do not remedy such suspension or failure within that time, terminate the contract and recover from OWNER payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if ENGINEER has failed to act on an Application for Payment within 30 days after it is submitted, or OWNER has failed for 30 days to pay CONTRACTOR any sum finally determined to be due, CONTRACTOR may, 7 days after written notice to OWNER and ENGINEER, stop the Work until payment is made of all such amounts due CONTRACTOR, including interest thereon. The provisions of this paragraph are not intended to preclude CONTRACTOR from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to CONTRACTOR's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between OWNER and CONTRACTOR concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, OWNER or CONTRACTOR may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to OWNER, ENGINEER, or CONTRACTOR, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract

Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither OWNER nor ENGINEER, nor any of their officers, directors, members, partners, employees, agents, consultants, or Subcontractors, shall be liable to CONTRACTOR for any claims, costs, losses, or damages sustained by CONTRACTOR on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of CONTRACTOR.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. OWNER and CONTRACTOR each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SECTION 00 80 00
SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement Section 00 72 00 General Conditions (EJCDC® C-700, Standard General Conditions of the Construction Contract (2018)). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, “Paragraph SC-4.05.”

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

No suggested Supplementary Conditions in this Article.

ARTICLE 2—PRELIMINARY MATTERS

2.02 *Copies of Documents*

SC-2.02 Amend the first sentence of Paragraph 2.02.A. to read as follows:

OWNER shall furnish to CONTRACTOR one copy in electronic portable document format (PDF).

SC-2.02 Delete Paragraph 2.02.A in its entirety and insert the following new paragraph in its place:

A. OWNER shall furnish to CONTRACTOR one copy in electronic portable document format (PDF).

2.06 *Electronic Transmittals*

SC-2.06 Delete Paragraphs 2.06.B and 2.06.C in their entirety and insert the following in their place:

B. *Electronic Documents Protocol:* The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol (“EDP” or “Protocol”) for exchange of electronic transmittals.

1. *Basic Requirements*

a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.

b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.

c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, subject to the same

governing requirements, limitations, and restrictions, set forth in the Contract Documents.

d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with ENGINEER. Nothing herein will modify the requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.

e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party's use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.

f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or 3) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.

2. *System Infrastructure for Electronic Document Exchange*

a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost and sufficient for complying with the EDP requirements. With the exception of minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.

1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is 20 MB. Attachments larger than that may be exchanged using large file transfer functions or physical media.

2) Each Party assumes full and complete responsibility for any and all of its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software, for use with respect to this EDP.

b. Each party is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with the party's individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.

c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are

intended to protect the other party from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. To the extent that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.

d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the issues; but, failing resolution, the OWNER is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to CONTRACTOR, not reasonably anticipated under the original EDP, CONTRACTOR may seek an adjustment in price or time under the appropriate process in the Contract.

e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.

f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.

g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.

C. *Software Requirements for Electronic Document Exchange; Limitations*

1. Each party will acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the software formats required in this section of the EDP.

   a. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or adjust its transmission to comply with this EDP.

2. The parties agree not to intentionally edit, reverse ENGINEER, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains

the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

No Supplementary Conditions in this Article.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

No Supplementary Conditions in this Article**.**

ARTICLE 5—SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which CONTRACTOR may rely:

Report Title	Date of Report	Technical Data
Geotechnical Investigation Salem Trail Culverts Approximately Woodland Hills Drive & Salem Canal Road Approximately Elk Ridge Drive & Salem Canal Road Salem, Utah	8/26/22	Subsurface Conditions, Page 3 Subsurface Water, Page 6 Recommendations, Page 7 - 12

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which CONTRACTOR may rely:

Drawings Title	Date of Drawings	Technical Data
Salem City Pressure Irrigation Project 2007	1/20/2010	Existing East Pump Station Record Drawings

G. CONTRACTOR may request copies from ENGINEER of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents.

5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to OWNER relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which CONTRACTOR may rely:

Report Title	Date of Report	Technical Data
None		

5. The following table lists the drawings known to OWNER relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which CONTRACTOR may rely: **[If there are no such drawings, so indicate in the table]**

Drawings Title	Date of Drawings	Technical Data
None		

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

C-6.01 Add the following paragraphs immediately after Paragraph 6.01.A:

1. *Required Performance Bond Form:* The performance bond that CONTRACTOR furnishes will be in the form of EJCDC® C-610, Performance Bond (2010, 2013, or 2018 edition).

2. *Required Payment Bond Form:* The payment bond that CONTRACTOR furnishes will be in the form of EJCDC® C-615, Payment Bond (2010, 2013, or 2018 edition).

6.02 *Insurance—General Provisions*

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

1. CONTRACTOR may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

6.03 *Contractor's Insurance*

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to OWNER and ENGINEER) the following: Hansen, Allen & Luce, and Salem City**.**

E. *Workers' Compensation and Employer's Liability:* CONTRACTOR shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Jones Act (if applicable)	
Bodily injury by accident—each accident	$1,000,000.00
Bodily injury by disease—aggregate	$1,000,000.00
Employer's Liability	
Each accident	$1,000,000.00
Each employee	$1,000,000.00
Policy limit	$1,000,000.00

F. *Commercial General Liability—Claims Covered:* CONTRACTOR shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of CONTRACTOR, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* CONTRACTOR's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.
    b. CONTRACTOR shall furnish OWNER and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of CONTRACTOR's contractual indemnity obligations in Paragraph 7.18.
3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
4. Underground, explosion, and collapse coverage.

5. Personal injury coverage.

6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If CONTRACTOR demonstrates to OWNER that the specified ISO endorsements are not commercially available, then CONTRACTOR may satisfy this requirement by providing equivalent endorsements.

7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—ENGINEERs, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if CONTRACTOR is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).

2. Any exclusion for water intrusion or water damage.

3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.

4. Any exclusion of coverage relating to earth subsidence or movement.

5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).

6. Any limitation or exclusion based on the nature of CONTRACTOR's work.

7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	**Policy limits of not less than:**
General Aggregate	$1,000,000.00
Products—Completed Operations Aggregate	$1,000,000.00
Personal and Advertising Injury	$1,000,000.00
Bodily Injury and Property Damage—Each Occurrence	$1,000,000.00

J. *Automobile Liability:* CONTRACTOR shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	**Policy limits of not less than:**
Bodily Injury	
Each Person	$1,000,000.00
Each Accident	$1,000,000.00

Automobile Liability	Policy limits of not less than:
Property Damage	
Each Accident	$1,000,000.00

K. *Umbrella or Excess Liability:* CONTRACTOR shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$1,000,000.00
General Aggregate	$2,000,000.00

L. *CONTRACTOR's Professional Liability Insurance:* If CONTRACTOR will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then CONTRACTOR shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

CONTRACTOR's Professional Liability	Policy limits of not less than:
Each Claim	$1,000,000.00
Annual Aggregate	$2,000,000.00

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. *Builder's Risk Requirements:* The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

   a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.

   b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth

movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to OWNER and CONTRACTOR.

2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including OWNER-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of CONTRACTORs, ENGINEERs, and architects).
4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier). If this coverage is subject to a sublimit, such sublimit will be a minimum of $5,000,000.00.
5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of $5,000,000.00.
6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.
7. allow for partial occupancy or use by OWNER by endorsement, and without cancellation or lapse of coverage.
8. include performance/hot testing and start-up, if applicable.
9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of OWNER's procurement of property insurance following Substantial Completion, whichever occurs first.
10 include as named insureds the OWNER, CONTRACTOR, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds."

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.03 *Labor; Working Hours*

SC-7.03 Add the following new paragraph immediately after Paragraph 7.03.C:

D. CONTRACTOR shall be responsible for the cost of any overtime pay or other expense incurred by the OWNER for ENGINEER's services (including those of the Resident

Project Representative, if any), OWNER's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If CONTRACTOR is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then OWNER may impose a reasonable set-off against payments due under Article 15.

ARTICLE 8—OTHER WORK AT THE SITE

No Supplementary Conditions in this Article.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.13 *OWNER's Site Representative*

SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:

9.13 *OWNER's Site Representative*

A. OWNER will furnish an "OWNER's Site Representative" to represent OWNER at the Site and assist OWNER in observing the progress and quality of the Work. OWNER's Site Representative is not ENGINEER's consultant, agent, or employee. OWNER's Site Representative will be James Thomas, Public Works Director. The authority and responsibilities of OWNER's Site Representative follow:

1. *Conferences and Meetings:* Attend meetings with CONTRACTOR, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including CONTRACTOR's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to OWNER's Site Representative, and if required to do so by such safety programs, receive safety training specifically related to OWNER's Site Representative's own personal safety while at the Site.

3. *Liaison*

   a. Serve as ENGINEER's liaison with CONTRACTOR. Working principally through CONTRACTOR's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

   b. Assist ENGINEER in serving as OWNER's liaison with CONTRACTOR when CONTRACTOR's operations affect OWNER's on-Site operations.

   c. Assist in obtaining from OWNER additional details or information, when required for CONTRACTOR's proper execution of the Work.

4. *Review of Work; Defective Work*

   a. Conduct on-Site observations of the Work to assist ENGINEER in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.

   b. Observe whether any Work in place appears to be defective.

c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

5. *Inspections and Tests*

a. Observe CONTRACTOR-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.

b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

6. *Payment Requests:* Review Applications for Payment with CONTRACTOR.

7. *Completion*

a. Participate in ENGINEER's visits regarding Substantial Completion.

b. Assist in the preparation of a punch list of items to be completed or corrected.

c. Participate in ENGINEER's visit to the Site in the company of OWNER and CONTRACTOR regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by CONTRACTOR.

d. Observe whether items on the final punch list have been completed or corrected.

D. The OWNER's Site Representative will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of ENGINEER's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of CONTRACTOR, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of OWNER or CONTRACTOR.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by ENGINEER.

7. Authorize OWNER to occupy the Project in whole or in part.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

SC-10.03 Add the following new subparagraph immediately after Paragraph 10.03.A:

1. On this Project, by agreement with the OWNER, the ENGINEER will not furnish a Resident Project Representative to represent ENGINEER at the Site or assist ENGINEER in observing the progress and quality of the Work.

ARTICLE 11—CHANGES TO THE CONTRACT

No Supplementary Conditions in this Article.

ARTICLE 12—CLAIMS

No Supplementary Conditions in this Article.

ARTICLE 13—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

No Supplementary Conditions in this Article.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCCEPTANCE OF DEFECTIVE WORK

No Supplementary Conditions in this Article.

ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 *Progress Payments*

SC-15.01 Add the following new Paragraph 15.01.F:

F. For contracts in which the Contract Price is based on the Cost of Work, if OWNER determines that progress payments made to date substantially exceed the actual progress of the Work (as measured by reference to the Schedule of Values), or present a potential conflict with the Guaranteed Maximum Price, then OWNER may require that CONTRACTOR prepare and submit a plan for the remaining anticipated Applications for Payment that will bring payments and progress into closer alignment and take into account the Guaranteed Maximum Price (if any), through reductions in billings, increases in retainage, or other equitable measures. OWNER will review the plan, discuss any necessary modifications, and implement the plan as modified for all remaining Applications for Payment.

15.03 *Substantial Completion*

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by ENGINEER, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by CONTRACTOR to OWNER. If CONTRACTOR does not pay, or the parties are unable to agree as to the amount owed, then OWNER may impose a reasonable set-off against payments due under this Article 15.

15.08 *Correction Period*

G. The correction period specified as one year after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be the number of years set forth in SC-6.01.B.1; or if no such revision has been made in SC-6.01.B, then the correction period is hereby specified to be One (1) years after Substantial Completion.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

No Supplementary Conditions in this Article.

ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

17.02 *Arbitration*

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

17.02 *Arbitration*

A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of $100,000 or less will be settled in accordance with the American Arbitration Association's supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be sent to ENGINEER for information. The demand for arbitration will be made within the specific time required in Article 17, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event will any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.

C. The arbitrator(s) must be licensed ENGINEERs, CONTRACTORs, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration Rules that contemplate in-person hearings. The arbitrators will have no authority to award punitive or other damages not measured by the prevailing party's actual damages, except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.

D. The Arbitrators will have the authority to allocate the costs of the arbitration process among the parties, but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.

E. The award of the arbitrators must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.

F. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.

G. No arbitration arising out of or relating to the Contract will include by consolidation, joinder, or in any other manner any other individual or entity (including ENGINEER,

and ENGINEER's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:

1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;
2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration, and which will arise in such proceedings;
3. such other individual or entity is subject to arbitration under a contract with either OWNER or CONTRACTOR, or consents to being joined in the arbitration; and
4. the consolidation or joinder is in compliance with the arbitration administrator's procedural rules.

H. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.

I. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.

17.03 *Attorneys' Fees*

A. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

ARTICLE 18—MISCELLANEOUS

No Supplementary Conditions in this Article.

EXHIBIT A—SOFTWARE REQUIREMENTS FOR ELECTRONIC DOCUMENT EXCHANGE

Item	Electronic Documents	Transmittal Means	Data Format	Note (1)
a.1	General communications, transmittal covers, meeting notices and responses to general information requests for which there is no specific prescribed form.	Email	Email	
a.2	Meeting agendas, meeting minutes, RFI's and responses to RFI's, and Contract forms.	Email w/ Attachment	PDF	(2)
a.3	Contactors Submittals (Shop Drawings, "or equal" requests, substitution requests, documentation accompanying Sample submittals and other submittals) to OWNER and ENGINEER, and OWNER's and ENGINEER's responses to CONTRACTOR's Submittals, Shop Drawings, correspondence, and Applications for Payment.	Email w/ Attachment	PDF	
a.4	Correspondence; milestone and final version Submittals of reports, layouts, Drawings, maps, calculations and spreadsheets, Specifications, Drawings and other Submittals from CONTRACTOR to OWNER or ENGINEER and for responses from ENGINEER and OWNER to CONTRACTOR regarding Submittals.	Email w/ Attachment or LFE	PDF	
a.5	Layouts and drawings to be submitted to OWNER for future use and modification.	Email w/ Attachment or LFE	DWG	
a.6	Correspondence, reports and Specifications to be submitted to OWNER for future word processing use and modification.	Email w/ Attachment or LFE	DOC	
a.7	Spreadsheets and data to be submitted to OWNER for future data processing use and modification.	Email w/ Attachment or LFE	EXC	

Notes:	
(1)	All exchanges and uses of transmitted data are subject to the appropriate provisions of Contract Documents.
(2)	Transmittal of written notices is governed by Paragraph 18.01 of the General Conditions.

Key:	
Email	Standard Email formats (.htm, .rtf, or .txt). Do not use stationery formatting or other features that impair legibility of content on screen or in printed copies
LFE	Agreed upon Large File Exchange method (FTP, CD, DVD, hard drive)
PDF	Portable Document Format readable by Adobe® Acrobat Reader
DWG	Autodesk® AutoCAD .dwg format
DOC	Microsoft® Word .docx format
EXC	Microsoft® Excel .xls or .xml format

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PART 4
TECHNICAL SPECIFICATIONS

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.1 GENERAL

A. The Work to be performed under this Project shall consist of furnishing all labor, materials, and equipment necessary or required to complete the work in all respects as shown on the Contract Drawings and as herein specified. All work, materials, and services not expressly shown or called for in the Contract Documents which may be necessary to complete the construction of the Work in good faith shall be performed, furnished, and installed by CONTRACTOR as though originally so specified or shown, at no increase in cost to OWNER.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The work consists of construction of a new cast-in-place pressure reducing valve (PRV) vault and associated piping and appurtenances. The vault is to be a below grade cast-in-place concrete structure. The vault will include two PRVs, valves, flowmeters, pressure relief valves, and associated piping. The project includes the installation of steel pipe, ductile iron pipe, PVC pipe, RCP pipe, storm drain manholes, and associated site restoration. Detailed information on the scope of work is contained in the project plans and specifications.

B. The PRV vault will be located at Salem’s existing pump station at the intersection of Salem Canal Road and Woodland Hills Drive

1.3 CONTRACT METHOD

A. The Work hereunder will be constructed under a single Lump Sum contract.

1.4 CONTRACTOR USE OF PROJECT SITE

A. CONTRACTOR's use of the Project Site shall be limited to its construction operations, including on-site storage of materials and on-site fabrication facilities.

1.5 PROJECT SECURITY

A. CONTRACTOR shall make all necessary provisions to protect the Project and CONTRACTOR's facilities from fire, theft, and vandalism, and the public from unnecessary exposure to injury.

1.6 CHANGES IN THE WORK

A. It is mutually understood that it is inherent in public works construction that some changes in the plans and Specifications may be necessary during construction to adjust them to unforeseen field conditions, and that it is of the essence of the Contract to recognize a normal and expected margin of change. ENGINEER shall have the right to make such changes, from time to time, in the plans, in the character of the Work, and in the scope of the Project as may be necessary or desirable to ensure the completion of the Work in the most satisfactory manner without invalidating the Contract.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 14 00
WORK RESTRICTIONS

PART 1 GENERAL

A. OWNER and/or utility owners may be working within the Project area while this Contract is in progress. If so, CONTRACTOR shall schedule Work in conjunction with these other entities to minimize mutual interference.

B. OWNER requires 24 hour access to the Pump Station throughout the Project.

C. All compaction and other testing requirements specified shall be provided and paid for by CONTRACTOR.

D. CONTRACTOR shall notify ENGINEER of the schedule for materials testing as required in Section 01 45 00 Quality Control and Materials Testing and Section 01 45 23 Testing and Inspection Services a minimum of 24 hours in advance in order to provide ENGINEER time to be present during desired testing. CONTRACTOR shall be responsible for obtaining copies of testing reports or data and ensuring that the Work is in full compliance with the Contract Documents.

E. CONTRACTOR shall notify owners of Private rights-of-way 72 hours prior to work being performed across owner's right-of-way.

F. If required to work in City Streets or Utah Department of Transportation (UDOT) right-of-way, CONTRACTOR shall notify right-of-way owner 72 hours prior to work being performed therein. Work within the City Streets or UDOT right-of-way shall be in accordance with required permits and any license agreement with OWNER. CONTRACTOR shall obtain and comply with all required permits.

G. CONTRACTOR must work with all adjacent property owners to ensure no harm or damage is caused to homes or property during construction of the project.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

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SECTION 01 22 00
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 General

A. All work completed under this contract shall be in accordance with the Contract Drawings and Specifications and will be measured by ENGINEER/OWNER. The quantities appearing on the Bid Schedule are approximate only and are prepared for the comparison of bids. Payment to CONTRACTOR on bid items with unit prices other than "Lump Sum" will be made for actual quantities of work performed and accepted, or material furnished in accordance with the Contract. The scheduled quantities of work to be done and materials to be furnished may be increased or decreased in accordance with the General Conditions.

B. The term "Lump Sum" when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure, portion of work, or unit is specified "Lump Sum" as the unit of measurement, the unit will include fittings, accessories, and all work necessary to complete the work as shown on the Drawings and as specified.

C. When the accepted quantities of work vary from the quantities in the Bid Schedule, CONTRACTOR shall accept as payment in full, so far as contract items are concerned, payment at the original contract unit prices for the work done. OWNER reserves the right to add to or delete from quantities listed in the bid schedule in order to match the total bid with the budgeted money available.

1.2 BASE BID SCHEDULE

A. BID ITEM – “EAST PUMP STATION PRV”

1. **GENERAL** This bid item covers all costs associated with the Work including CONTRACTOR's cost for all labor, equipment, materials, and general and miscellaneous responsibilities and operations required for construction of a well house; and any and all incidentals or procedures required to complete the Work as specified herein and shown on the Contract Drawings.

2. **METHOD OF MEASUREMENT** This item shall not be measured but shall be paid for on a lump sum basis for the completion of the work.

3. **BASIS OF PAYMENT** Payment will be made at the contract lump sum bid price. Payments will be made based on the Schedule of Values as described in Section 01 29 00, Payment Procedures.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

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SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 GENERAL

1.1 GENERAL

A. This Section includes the requirements for preparing a Schedule of Values (SOV) as required per the 7.16.E.2 of Section 00 72 00 - General Conditions and will be the Basis of Payment as indicated in Section 01 22 00 – Measurement and Payment.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 00 72 00 General Conditions
2. Section 01 50 00 Temporary Construction Utilities and Environmental Controls
3. Section 01 71 13 Mobilization
4. Section 01 33 00 Submittal Procedures

1.3 SUBMITTALS

A. Informational Submittals:

1. Schedule of Values: Submit in accordance with Section 00 72 00 - General Conditions, including preliminary and detailed schedules. Submit the SOV using the CONTRACTOR's Standard Form unless indicated otherwise.
2. Schedule of Estimated Progress Payments:
   a. Initial submittal shall correspond with the initially accepted Schedule of Values.
   b. Submit adjustment thereto with Application for Payment.
3. Application for Payment.
4. Final Application for Payment.

1.4 PRELIMINARY SCHEDULE OF VALUES

A. Within 30 calendar days after the date of receipt of the Notice to Proceed, submit a Preliminary Schedule of Values for the major components of work showing, at a minimum, the proposed total value for each separately listed work component applicable to the Work, as follows:

1. Mobilization, (not more than 5% of Total Lump Sump Price) including initial mobilization of CONTRACTOR's equipment and personnel, permits, insurance, and bonds; Construction Schedule and Schedule of Values, temporary utilities, demobilization, site cleanup, and site maintenance.
2. Construction Surveying
3. Testing Agency Services
4. Storm Water Pollution and Prevention Plan
5. Site Excavation
6. Cast In Place Concrete PRV Vault, Access Hatch and Manholes, Ladders, Vents, and Appurtenances
7. PRV Vault Piping, Pressure Reducing Valves, Pressure Relief Valves, Flow Meters, Check Valves, Fittings, and Appurtenances

8. 10-inch Diameter DIP Waterline and Appurtenances
9. 12-inch Diameter PVC Waterline and Appurtenances
10. 6-inch Diameter PVC Waterline and Appurtenances
11. 24-inch RCP Storm Drain and Manholes
12. 6-inch PVC Drain Pipeline and Appurtenances
13. 4-inch PVC Drain Pipeline and Appurtenances
14. Electrical and Instrumentation
15. Asphalt Restoration
16. Site Grading and Restoration

1.5 SCHEDULE OF VALUES

A. Prepare a separate Schedule of Values for each schedule of the Work under the Agreement.

B. Upon request of ENGINEER, provide documentation to support the accuracy of the Schedule of Values.

C. Unit Price Work: Reflect unit price quantity and price breakdown from conformed Bid Form.

D. Lump Sum Work:

1. Reflect specified allowances and alternates, as applicable.
2. List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, equipment testing, facility startup, and contract closeout separately.
    a. Mobilization includes, at minimum, items identified in Section 01 50 00, Temporary Construction Utilities and Environmental Controls and Section 01 71 13 - Mobilization.
    b. Include item(s) for monthly progress schedule update.
3. Develop in coordination with the Critical Path Method (CPM) Schedule.
4. Incorporate into CPM cost loading function.
5. Consult with ENGINEER and provide a breakdown of costs acceptable to ENGINEER.

E. An unbalanced or front-end loaded schedule will not be acceptable.

F. Summation of the complete Schedule of Values representing all the Work shall equal the Contract Price.

G. Submit Schedule of Values in format approved by OWNER and ENGINEER.

1.6 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

A. Show estimated payment requests throughout Contract Times aggregating initial Contract Price.

B. Base estimated progress payments on initially acceptable progress schedule. Adjust to reflect subsequent adjustments in progress schedule and Contract Price as reflected by modifications to the Contract Documents.

1.7 APPLICATION FOR PAYMENT

A. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of CONTRACTOR.

B. Use detailed Application for Payment Form acceptable to OWNER, unless otherwise indicated.

C. Provide separate form for each schedule as applicable.

D. Include accepted Schedule of Values for each schedule or portion of lump sum Work and the unit price breakdown for the Work to be paid on a unit priced basis.

E. include separate line item for each Change Order executed prior to date of submission. Provide further breakdown of such as requested by ENGINEER.

F. Preparation:

1. Round values to nearest dollar.
2. Submit Application for Payment, including a Transmittal Summary

G. Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by ENGINEER.

1.8 MEASUREMENT – GENERAL

A. Weighing, measuring, and metering devices used to measure quantity of materials for Work shall be suitable for purpose intended and conform to tolerances and specifications as specified in National Institute of Standards and Technology, Handbook 44.

B. Whenever pay quantities of material are determined by weight, weigh material on scales furnished by CONTRACTOR and certified accurate by the state agency responsible. Provide weight or load slip to OWNER's representative at point of delivery of material.

C. If material is shipped by rail, car weights will be accepted provided that actual weight of material only will be paid for and not minimum car weight used for assessing freight tariff, and provided further that car weights will not be acceptable for material to be passed through mixing plants.

D. Vehicles used to haul material being paid for by weight shall be weighed empty daily and at such additional times as required by ENGINEER. Each vehicle shall bear a plainly legible identification mark.

E. Haul materials that are specified for measurement by the cubic yard measured in the vehicle in transport vehicles of such type and size that actual contents may be readily and accurately determined. Unless all vehicles are of uniform capacity, each vehicle must bear a plainly legible identification mark indicating its water level capacity. Load vehicles to at least their water level capacity. Loads hauled in vehicles not meeting the above requirements or loads of a quantity less than the capacity of the vehicle, measured after being leveled off as above provided, will be subject to rejection, and no compensation will be allowed for such material.

F. Quantities Based on Profile Elevations: Quantities will be based on ground profiles shown. Field surveys will not be made to confirm accuracy of elevations shown unless approved by OWNER.

G. Where measurement of quantities depends on elevation of existing ground, elevations obtained during construction will be compared with those shown on the Contract Drawings. Variations of 1 foot or less will be ignored, and profiles shown on the Contract Drawings will be used for determining quantities.

H. Units of measure shown on Bid Form shall be as follows, unless specified otherwise.

Item	Method of Measurement
AC	Acre - Field Measure by ENGINEER
CY	Cubic Yard - Field Measure by ENGINEER within limits specified or shown
CY-VM	Cubic Yard - Measured in Vehicle by Volume
EA	Each - Field Count by ENGINEER
GAL	Gallon - Field Measure by ENGINEER
HR	Hour
LB	Pound(s) - Weight Measure by Scale
LF	Linear Foot - Field Measure by ENGINEER
SF	Square Foot
SY	Square Yard
TON	Ton - Weight Measure by Scale (2,000 pounds)

1.9 PAYMENT

A. Payment for all Lump Sum Work shown or specified in Contract Documents is included in the Contract Price. Payment will be based on a percentage complete basis for each line item of the accepted Schedule of Values.

B. Payment for Lump Sum Work covers all Work specified or shown within the limits or Specification sections for the Work indicated in the applicable schedules of the Bid Form.

C. Payment for unit price items covers all the labor, materials, and services necessary to furnish and install the applicable items indicated in the schedules of the Bid Form.

1.10 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of CONTRACTOR to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.
5. Defective Work not accepted by OWNER.
6. Material remaining on hand after completion of Work.

1.11 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial Payment: No partial payments will be made for materials and equipment delivered or stored unless Shop Drawings and preliminary operation and maintenance data are acceptable to ENGINEER.

B. Final Payment: Will be made only for products incorporated in Work; remaining products, for which partial payments have been made, shall revert to CONTRACTOR unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

- END OF SECTION -

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SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, Submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.

C. After OWNER occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of OWNER's activities.

D. OWNER, and/or utility owners may be working within the project area while this contract is in progress. If so, CONTRACTOR shall schedule Work in conjunction with these other organizations to minimize mutual interference.

E. All existing OWNER waterlines and service connections shall remain active during the construction of this project. All connections to the existing waterlines, except those being hot-tapped, shall only be done upon successful completion of mainline installation and testing.

F. Water service to this area can be interrupted for a maximum of 4 hours. CONTRACTOR shall provide a minimum notice of 24 hours to each home or business affected. A copy of CONTRACTOR'S notification letter shall be reviewed and approved by Owner prior to distribution.

G. If required to work in City Streets, CONTRACTOR shall notify OWNER 72 hours prior to work being performed therein. Work within the City right-of-way shall be in accordance with their required permit and their license agreement with OWNER. CONTRACTOR shall obtain and comply with all required permits.

H. Coordination with Adjacent Property Owner

1. Once each week, CONTRACTOR shall hand deliver or mail a written **"Construction Status Update Notice"** to all residents, businesses, schools and property owners adjacent to and affected by the Work. Notice shall be on CONTRACTOR's company letterhead paper and be secured to doorknob should occupants not be home. Obtain ENGINEER's review of notice prior to distribution. As a minimum the notice shall contain the following:

    a. name and phone number of CONTRACTOR's representative for the project
    b. work anticipated for the next 7 days including work locations and work by subcontractors and utility companies
    c. rough estimate of construction schedule through end of project
    d. anticipated driveway approach closures
    e. anticipated water, sewer or power outages

f. anticipated vehicular traffic impacts, rerouting or lane closures
g. anticipated pedestrian impacts and sidewalk closures
h. changes to public transportation bus routes
i. any other construction or work items which will impact or restrict the normal use of streets and amenities

2. Failure to comply with this contract provision is considered grounds for project suspension per Article 16.01 of the General Conditions (EJCDC 00 72 00).

1.2 FIELD ENGINEERING

A. Construction staking and surveying shall be performed by a registered Land Surveyor in the State of Utah.

B. CONTRACTOR shall provide all other survey construction staking as necessary to complete the required work according to the Contract Documents.

C. ENGINEER shall not be responsible for stakes, etc. removed through negligence of CONTRACTOR and in that event shall be compensated by CONTRACTOR for re-staking efforts.

D. CONTRACTOR shall locate and protect survey control and reference points. Promptly notify ENGINEER of discrepancies discovered.

E. Control datum for survey is that shown on Contract Drawings.

F. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

G. Promptly report to ENGINEER loss or destruction of reference point or relocation required because of changes in grades or other reasons.

H. CONTRACTOR shall be responsible to coordinate with all property owners to determine the location of existing sewer and water service laterals. CONTRACTOR shall be responsible to coordinate with all property owners during installation or relocation of existing service laterals.

I. All service laterals shall be verified and indicated on the Record Drawings supplied by CONTRACTOR to ENGINEER.

1.3 PRECONSTRUCTION MEETING

A. Prior to the commencement of work at the site, a preconstruction conference will be held at a mutually agreed time and place which shall be attended by CONTRACTOR's Project Manager, its superintendent, and its subcontractors as appropriate. Other attendees will be:

1. ENGINEER and the Resident Project Representative (RPR)
2. Representatives of OWNER
3. Governmental representatives as appropriate
4. Others as requested by CONTRACTOR, OWNER, or ENGINEER.

B. Unless previously submitted to ENGINEER, CONTRACTOR shall bring to the conference one copy of each of the following:

1. Progress schedule
2. Procurement schedule of major equipment and materials and items requiring long lead time
3. Shop Drawings/Sample/Substitute or "Or Equal" submittal schedule.

C. 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 may include the following:

1. CONTRACTOR's tentative schedules
2. Transmittal, review, and distribution of CONTRACTOR's submittals
3. Processing applications for payment
4. Maintaining record documents
5. Critical work sequencing
6. Field decisions and Change Orders
7. Use of project site, office and storage areas, security, housekeeping, and OWNER's needs
8. Major equipment deliveries and priorities
9. CONTRACTOR's assignments for safety and first aid

D. ENGINEER will preside at the preconstruction conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

E. CONTRACTOR should plan on the conference taking no less than 1 hour.

1.4 PROGRESS MEETINGS

A. CONTRACTOR shall schedule and hold regular on-site progress meetings at least weekly and at other times as required by ENGINEER or as 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.

B. ENGINEER shall preside at the meetings and provide for keeping and distribution of the minutes. 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.

C. At each construction progress meeting a progress report shall be presented by CONTRACTOR containing an updated Progress Schedule. Where the delayed completion date of a project phase is noted, CONTRACTOR shall describe the anticipated delays or problems and outline the action plan being taken to resolve the issues.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

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SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 GENERAL

A. This Section outlines the general terms that CONTRACTOR must follow for preparing and providing Submittals to ENGINEER for review.

B. CONTRACTOR shall anticipate resubmitting Submittals for major equipment or complex systems.

C. If CONTRACTOR has questions about submittal requirements, CONTRACTOR is encouraged to communicate with ENGINEER to discuss requirements prior to submitting the Submittal.

D. Substitutions shall be clearly identified on the Submittal transmittal form and shall include all the information required per Section 01 60 00 – Product Requirements.

1.2 DEFINITIONS

A. Shop Drawings: Drawings, diagrams, schedules, and other data specially prepared for the Work by CONTRACTOR to illustrate some portion of the Work.

B. Product Data: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by CONTRACTOR to illustrate materials or equipment for some portion of the Work. Product data is typically collected from catalogs, technical data sheets, or other materials supplied by manufacturers and are not specifically prepared for the project. Product data shall be marked up and/or highlighted to show the model, style, or options of a product to be incorporated in the Work.

C. Samples: Physical examples that illustrate materials, equipment, workmanship, or colors, and establish standards by which the Work will be judged.

D. Submittal Dispositions shall be defined as follows:

1. No Exception Taken: ENGINEER and/or OWNER has reviewed the Submittal with skill, care, and judgement consistent with the applicable standard of care and, in accordance with the General Conditions, has determined the submittal appears to be consistent with the contract documents and the design professional's design intent for the completed project.
2. Make Corrections Noted: ENGINEER and/or OWNER has reviewed the Submittal and approval is conditioned on CONTRACTOR, subcontractor, or supplier complying fully with ENGINEER's written comments on the Submittal. Failure of the CONTRACTOR, subcontractor, or supplier to comply fully with the written comments nullifies the approval.
3. Revise and Resubmit: ENGINEER and/or OWNER has reviewed the Submittal and believes the Submittal, as furnished, cannot be approved without revisions and resubmittal. "Revise and Resubmit" does not constitute an approval.

4. Rejected: ENGINEER and/or OWNER has reviewed the Submittal and determined that it cannot be approved because it is incomplete, does not meet the product requirements or specifications, or does not meet the Submittal Procedure requirements as noted below.
5. For Information Only: Submittal is for record only and was not reviewed by ENGINEER and/or OWNER.

1.3 SUBMITTAL PROCEDURES

A. Wherever Submittals are required by the Contract Documents, transmit 5 copies of each Submittal or a single electronic PDF file to ENGINEER with a Submittal transmittal form which is acceptable to ENGINEER.

B. Sequentially number transmittal forms. Mark revised Submittals with original number and sequential alphabetic or numeric suffix, i.e., Submittal 1, Submittal 1.A, Submittal 1.1, etc.

C. Identify Project, Contractor, subcontractor and/or supplier, pertinent drawing and detail number, and Specification section number, appropriate to Submittal.

D. Each Submittal shall contain material pertaining to no more than one equipment or material item.

E. Each Submittal shall have the Specification section and applicable paragraph number clearly identified on the front of the Submittal transmittal form. A copy of the Specification section and applicable paragraph shall be included with the Submittal and items included shall be clearly marked as either in compliance or not in compliance. For items not in compliance a description shall be provided explaining the reason for non-compliance.

F. CONTRACTOR shall review Submittals prior to submission to ENGINEER. Apply Contractor's stamp, signed and dated, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents. Identify any deviations from the Contract Documents on the Submittal transmittal form.

G. Schedule Submittals to expedite Project and deliver to ENGINEER at their business address. Coordinate submission of related items.

H. Submittals shall be submitted sufficiently in advance to allow ENGINEER not less than ten regular working days for examining the drawings. These drawings shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items and unit assemblies in relation to the Contract Drawings and/or specifications.

I. Identify variations from Contract Documents and product or system limitations which may adversely affect successful performance of completed Work.

J. If a Submittal is returned to CONTRACTOR marked “NO EXCEPTIONS TAKEN”, or similar notification, formal revision and resubmission will not be required.

K. If a Submittal is returned marked “MAKE CORRECTIONS NOTED”, or similar notification, CONTRACTOR shall make the corrections on the Submittal, however, formal revision and resubmission will not be required.

L. Resubmittals

1. If a Submittal is returned marked “REVISE AND RESUBMIT”, or similar notification, CONTRACTOR shall revise the Submittal and resubmit the required number of copies.
2. Identify changes made since the previous submission.

M. Rejected Submittals

1. If a Submittal is returned marked “REJECTED”, or similar notification, it shall mean either that the proposed material or product does not satisfy the specification, the Submittal is so incomplete that it cannot be reviewed or is a substitution request not submitted in accordance with Section 01 60 00 – Product Requirements.
2. CONTRACTOR shall prepare a new Submittal or submit a substitution request according to Section 01 60 00 – Product Requirements and shall submit the required number of copies.

N. Distribute copies of reviewed Submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

O. Submittals not requested will not be recognized or processed.

P. Unless noted otherwise, corrections indicated on Submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as changes to the Contract requirements.

Q. Fabrication or purchase of an item may only commence after ENGINEER has reviewed the pertinent Submittals and returned copies to CONTRACTOR marked either “NO EXCEPTIONS TAKEN” or “MAKE CORRECTIONS NOTED”.

R. ENGINEER's review of CONTRACTOR Submittals shall not relieve CONTRACTOR of the entire responsibility for the corrections of details and dimensions. CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR Submittals. CONTRACTOR shall be responsible for dimensions and quantities, coordinating with all trades, the design of adequate connections and details, and satisfactory and safe performance of the work.

1.4 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedules within 15 days after date of Owner-Contractor Agreement. After review comments on the initial schedule are received from ENGINEER and OWNER, CONTRACTOR shall resubmit required revised data within ten days.

B. Submit revised Progress Schedules with each Application for Payment.

C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

D. Submit computer generated horizontal bar chart with separate line for each major portion of Work or operation, identifying first workday of each week.

E. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.

F. Indicate estimated percentage of completion for each item of Work at each submission.

G. Submit separate schedule of submittal dates for shop drawings, product data, and samples.

1.5 PRODUCT DATA

A. Product Data: Submit to ENGINEER for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 78 50 - Project Closeout.

1.6 SHOP DRAWINGS

A. Shop Drawings: Submit to ENGINEER for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Fabrication of an item may be commenced only after ENGINEER has reviewed the pertinent submittals and returned copies to CONTRACTOR marked either "NO EXCEPTIONS TAKEN", or "MAKE CORRECTIONS NOTED". Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

C. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.

1. Include signed and sealed calculations to support design.
2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 78 50 - Project Closeout.

1.7 SAMPLES

A. Whenever indicated in the Specifications or requested by ENGINEER, CONTRACTOR shall submit at least 1 sample of each item or material to ENGINEER for acceptance at no additional cost to OWNER.

B. Samples, as required herein, shall be submitted for acceptance prior to ordering such material for delivery to the jobsite, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delay in the Work.

C. Unless otherwise specified, all colors and textures of specified items will be selected by ENGINEER from the manufacturer's standard colors and standard materials, products, or equipment lines.

1.8 CERTIFICATES

A. When specified in individual Specification sections, submit certification by manufacturer, installation/application subcontractor, or CONTRACTOR to ENGINEER, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product but must be acceptable to ENGINEER.

1.9 NSF CERTIFICATION

A. Where NSF/ANSI 61 and/or NSF/ANSI 600 approval is required, submit ANSI/NSF 61/600 certification letter from the testing agency, i.e., NSF International (NSF), ALS - Truesdail Laboratories, UL Solutions, Water Quality Association (WQA), etc., for each item indicating the product fabrication location and application limits such as plant location, size of tank or diameter of piping, or other limitations.

B. See example NSF certificate below in Exhibit A.

1.10 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual Specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to ENGINEER for delivery to OWNER in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.11 MANUFACTURER'S FIELD REPORTS

A. When required in individual sections, have Manufacturer or Supplier provide qualified representative to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable and to make written report of observations and recommendations to ENGINEER.

1.12 OPERATIONS AND MAINTENANCE MANUAL SUBMITTAL

A. CONTRACTOR shall furnish to ENGINEER five (5) identical sets of Operations and Maintenance Manuals. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl, hard-cover binder suitable for

bookshelf storage. Binder ring size shall not exceed 2.5 inches. A Table of Contents shall be provided which indicates all equipment and suppliers in the Operations and Maintenance Manuals.

B. CONTRACTOR shall also furnish ENGINEER one copy of the Operations and Maintenance Manuals in PDF electronic format.

C. CONTRACTOR shall include in the Operations and Maintenance manuals full details for care and maintenance for all visible surfaces as well as the following for each item of mechanical, electrical, and instrumentation equipment (except for equipment furnished by OWNER):

1. Complete operating instructions, including location of controls, special tools or other equipment required, related instrumentation, and other equipment needed for operation.
2. Preventative maintenance procedures and schedules
3. A description of proper maintenance activities
4. Complete parts lists, by generic title, identification number, and catalog number, complete with exploded views of each assembly.
5. Disassembly and reassembly instruction
6. Name and location of nearest supplier and spare parts warehouse
7. Name and location of manufacturer
8. Recommended troubleshooting and start-up procedures
9. Prints of the record drawings, including diagrams and schematics, as required under the electrical and instrumentation portions of these specifications.

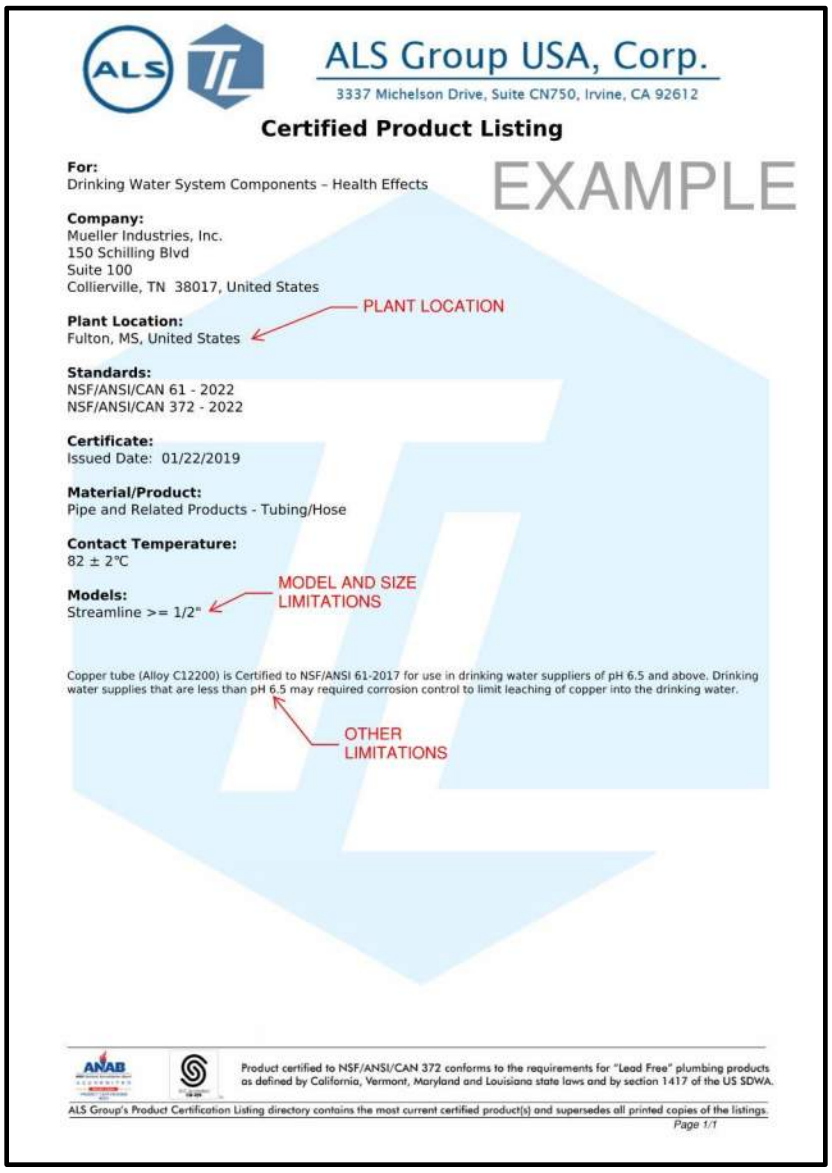
D. All Operations and Maintenance manuals shall be submitted in final form to ENGINEER not later than the 75 percent of construction completion date. All discrepancies found by ENGINEER in the Operations and Maintenance manuals shall be corrected by CONTRACTOR prior to final acceptance of the project.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

Exhibit A - Example NSF 61 Certification



ALS Group USA, Corp.
3337 Michelson Drive, Suite CN750, Irvine, CA 92612

Certified Product Listing

EXAMPLE

For:
Drinking Water System Components – Health Effects

Company:
Mueller Industries, Inc.
150 Schilling Blvd
Suite 100
Collierville, TN 38017, United States

Plant Location:
Fulton, MS, United States

PLANT LOCATION

Standards:
NSF/ANSI/CAN 61 - 2022
NSF/ANSI/CAN 372 - 2022

Certificate:
Issued Date: 01/22/2019

Material/Product:
Pipe and Related Products - Tubing/Hose

Contact Temperature:
82 ± 2°C

Models:
Streamline >= 1/2"

MODEL AND SIZE LIMITATIONS

Copper tube (Alloy C12200) is Certified to NSF/ANSI 61-2017 for use in drinking water suppliers of pH 6.5 and above. Drinking water supplies that are less than pH 6.5 may required corrosion control to limit leaching of copper into the drinking water.

OTHER LIMITATIONS

Product certified to NSF/ANSI/CAN 372 conforms to the requirements for "Lead Free" plumbing products as defined by California, Vermont, Maryland and Louisiana state laws and by section 1417 of the US SDWA.

ALS Group's Product Certification Listing directory contains the most current certified product(s) and supersedes all printed copies of the listings.

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SECTION 01 42 13
ABBREVIATIONS

PART 1 GENERAL

1.1 DESCRIPTION

A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these Specifications, the following acronyms or abbreviations which may appear in these Specifications shall have the meanings indicated herein.

1.2 ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of the State Highway and Transportation Officials
ABMA	American Bearing Manufacturers Association (formerly AFBMA)
ACI	American Concrete Institute
AGC	American General Contractors
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American Nation Standards Institute, Inc.
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASOC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DIPRA	Ductile Iron Pipe Research Association
DWQ	Department of Water Quality
DWR	Drinking Water Regulations
ECTC	Erosion Control Technology Council
EIA	Electronic Industries Association
EPA	Environmental Protection Agency
ETC	Electrical Test Laboratories
FEMA	Federal Emergency Management Agency
FM	Factory Mutual System
IBC	International Building Code
ICBO	International Conference of Building Officials
ICC	International Code Council
ICC-ES	International Code Council Evaluation Service
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society

IMC	International Mechanical Code
IME	Institute of Makers of Explosives
IPC	International Plumbing Code
ISA	Instrument Society of America
ISO	International Organization of Standardization
ITE	Institute of Traffic Engineers
LPI	Lightning Protection Institute
LRQA	Lloyd’s Register Quality Assurance
MBMA	Metal Building Manufacturer's Association
MSS	Manufacturers Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NISO	National Information Standards Organization
NSF	NSF International (formerly National Sanitation Foundation)
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
RCRA	Resource Conservation and Recovery Act
RMA	Rubber Manufacturers Association
SAE	Society of Automotive Engineers
SSPC	Society for Protective Coating (formerly Steel Structure Painting Council)
SSPWC	Standard Specification for Public Works Construction
UDOT	Utah Department of Transportation
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCRSI	Western Concrete Reinforcing Steel Institute
WRI	Wire Reinforcements Institute, Inc.
WWPA	Western Wood Products Association

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 GENERAL

1.1 QUALITY ASSURANCE

A. TITLES OF SECTIONS AND PARAGRAPHS. Captions accompanying Specifications sections and paragraphs are for convenience of reference only, and do not form a part of the Specification.

B. APPLICABLE PUBLICATIONS. Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards or requirements of the respective issuing agencies which have been published as of the date that the work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the drawings shall be waived because of any provision of, or omission from, said standards or requirements.

C. SPECIALISTS, ASSIGNMENTS. In certain instances, specifications test requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such assignments shall be recognized as special requirements and shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the work; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of contract requirements remains with CONTRACTOR.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all Work specified herein shall conform to or exceed the requirements of all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications nor the applicable codes.

B. Reference herein to "Building Code" or “Uniform Building Code” shall mean the International Building Code of the International Code Council. The latest edition of the code as approved and used by the local agency as of the date of award, as adopted by the agency having jurisdiction, shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

C. In case of conflict between codes, reference standards, drawings and the other Contract Document, the most stringent requirements shall govern. All conflicts shall be brought to the attention of ENGINEER for clarification and directions prior to ordering or providing any materials or labor. CONTRACTOR shall bid the most stringent requirements.

D. APPLICABLE STANDARD SPECIFICATIONS. CONTRACTOR shall construct the Work specified herein in accordance with the requirements of the Contract Documents and the

referenced portions of those referenced codes, standards, and Specifications listed herein; except, that wherever references to "Standard Specifications" are made, the provisions therein for measurement and payment shall not apply.

E. References in the Contract Documents to "Standard Specifications" shall mean the Contract Documents including all current supplements, addenda, and revisions thereof.

F. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

G. References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including changes and amendments thereto.

H. UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY. Wells, tanks, pumping stations and culinary water pipelines shall conform to the requirements of Utah Administrative Code Rule R 309. Water and sewer pipeline installation shall conform to the requirements of Utah Administrative Code Rule R 317-3-2.9 “Protection of Water Supplies” for horizontal and vertical separation.

I. UTAH DEPARTMENT OF TRANSPORTATION (UDOT) REQUIREMENTS. CONTRACTOR's work on UDOT property or right-of-way shall conform to UDOT’s latest edition of Standard Specifications For Road and Bridge Construction.

J. U.S. ARMY CORPS OF ENGINEERS (COE) REQUIREMENTS. CONTRACTOR's work shall conform to COE Specifications in accordance with Section 404 of the Clean Water Act for excavation in wetlands.

K. Reference herein to APWA shall mean the latest edition of the “Manual of Standard Specifications” and “Manual of Standard Plans” as prepared by the American Public Works Association and the Associated General Contractors of America.

L. All provisions of the Manual of Standard Specifications, Latest Edition and Manual of Standard Plans, Latest Edition both published by the Utah Chapter of the American Public Works Association are hereby made a part of the Contract Documents by reference. The publications may be purchased separately from the Utah Technology Transfer Center, Utah State University, 4111 Old Main Hill, Logan, UT 84322-4111. Any conflicts, between the technical specifications, drawings, and other provisions or documents contained in the Contract Form or Contract Documents versus provisions contained in the Manual of Standard Specifications, Latest Edition and Manual of Standard Plans, Latest Edition published by the Utah Chapter of the American Public Works Association, shall be resolved in favor of the technical specifications, drawing, and provisions contained in the Contract form or Contract Documents.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 45 00
QUALITY CONTROL AND MATERIALS TESTING

PART 1 GENERAL

1.1 SUMMARY

A. This Section outlines responsibilities for controlling the quality of materials, products, and workmanship.

1.2 MATERIALS

A. All materials incorporated in the project shall be new and shall fully comply with the Specifications. Unless otherwise clearly provided in the Specifications, all workmanship, equipment, materials, and articles incorporated in the Work covered by the Contract are to be of the best available grade of their respective kinds. Whenever, in the specifications, any material, article, device, product, fixture, form, type of construction, or process 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 and shall be deemed to be followed by the words "or approved equal" and CONTRACTOR may in such case, upon receiving ENGINEER's approval, purchase and use any item, type, or process which shall be substantially equal in every respect to that indicated or specified.

B. Materials and equipment may be used in the Work based upon receipt of a Supplier's certificate of compliance. Certificate must be in possession of CONTRACTOR and reviewed by ENGINEER prior to use.

C. Quality Assurance Testing by OWNER and/or ENGINEER shall not relieve CONTRACTOR of responsibility to furnish materials and work in full compliance with Contract Documents.

1.3 MANUFACTURER'S INSTRUCTIONS

A. Should instructions conflict with Contract Documents, request clarification before proceeding.

B. When required in individual sections, submit manufacturer's instructions in the quantity required for product data, delivery, handling, storage, assembly, installation, start-up, adjusting, balancing, and finishing, as appropriate.

1.4 WORKMANSHIP

A. Maintain performance control and supervision over Subcontractors, Suppliers, manufacturers, products, services, workmanship, and site conditions, to produce work in accordance with Contract Documents.

B. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

C. Provide suitable qualified personnel to produce specified quality.

D. Ensure finishes match approved samples.

1.5 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerance to accumulate.

B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from ENGINEER before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.6 TESTING AND INSPECTION SERVICES

A. The testing agency and testing for quality control and material testing shall be furnished by CONTRACTOR as part of the project. Results of testing shall be reported to CONTRACTOR and ENGINEER. Reports of the testing shall be transmitted directly to OWNER and ENGINEER.

B. OWNER shall provide and pay for Special Inspections and Testing for the structures including, but not limited to, soil foundation and structural fill, reinforcement, concrete, and grout.

C. Materials to be supplied under this contract will be tested and/or inspected either at their place of origin or at the site of the work by the testing agency. CONTRACTOR shall give ENGINEER written notification well in advance of actual readiness of materials to be tested and/or inspected at point of origin so ENGINEER may witness testing by the testing agency. Satisfactory tests and inspections at the point of origin shall not be construed as a final acceptance of the material nor shall it preclude retesting or reinspection at the site of the work.

D. CONTRACTOR shall furnish such samples of materials as requested by ENGINEER, without charge. No material shall be used until reports from the testing agency have been reviewed and accepted by ENGINEER. See Section 01 33 00 - Submittal Procedures.

1.7 UNSATISFACTORY CONDITIONS

A. Examine areas and conditions under which materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

1.8 AUTHORITY AND DUTIES OF PROJECT REPRESENTATIVE

A. Refer to Section 00 72 00 "Supplementary Conditions" sub-section SC 10.03 "Resident Project Representative".

1.9 QUALITY CONTROL TESTING

A. ENGINEER's failure to detect any defective Work or materials does not prevent later rejection when such defect is discovered nor does it obligate ENGINEER for acceptance.

B. CONTRACTOR shall provide 24-hours minimum notice to ENGINEER for all testing required by these specifications so ENGINEER may coordinate or be present during testing.

1.10 TESTING ACCEPTANCE AND FREQUENCY

A. Minimum Quality Control Testing Frequency: As defined in Table 01 45 00-1, CONTRACTOR shall be responsible to ensure that all testing is performed at the frequencies shown. CONTRACTOR shall uncover any work at no cost to OWNER to allow the testing agency to perform required testing at the frequency shown.

B. Acceptance of Defective Work: As defined in Article 14.04 EJCDC of the General Conditions.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying the next material or substance.

B. Seal cracks or openings of substrate prior to applying the next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

TABLE 01 45 00-1: QUALITY CONTROL TESTING FREQUENCY

SYSTEM or MATERIAL	TESTS	MINIMUM REQUIRED FREQUENCY
SUBGRADE AND BACKFILL MATERIALS		
Section 31 23 15 Excavation and Backfill for Buried Pipelines	Field Density	1 test per 200 linear feet per 1.5 feet of backfill thickness placed.
	Laboratory	1 test for each material type which includes proctor, classification, and gradation.
Section 31 22 00 Site Grading	Field Density	Embankment Fills – 1 test per lift for every 10,000 square feet of embankment
	Laboratory	1 test for each material type which includes proctor, classification, and gradation.
Section 31 23 23 Excavation and Backfill for Structures	Field Density	Footing and Wall Backfill – 1 test per every other lift for each 50 linear feet
		Under Structures – 1 test per lift for every 1,000 square feet of structure
		Around Structures – 1 test per lift for every 1,500 square feet of structure
		Unimproved Area – 1 test per lift for every 25,000 square feet of unimproved area
	Laboratory	1 test for each material type which includes proctor, classification, and gradation.
Section 32 11 23 Road Base - Untreated Base Course	Field Density	Base course subgrade: 1 test per 2,000 square feet of area. Base course: 1 test per 2,000 square feet of area.
	Laboratory	Base course: 1 test for each material type which includes proctor, classification, and gradation.
ASPHALT		
Section 32 12 16 Hot-Mix Asphalt Concrete Paving	Mix Design	Marshall Test Method: 1 test initially per each type of material and each change in target, and for each day of production thereafter. Specific Gravity: 1 per each Marshall Test Extraction: 1 test per each Marshall Test
	Field Density	Bituminous surfaces: 1 test per 2,000 square feet placed or part thereof.
	Asphalt Thickness and Core Density	Bituminous surfaces: 1 test sample every 300 linear feet of completed roadway.

SYSTEM or MATERIAL	TESTS	MINIMUM REQUIRED FREQUENCY
Section 3 30 00 Cast-in-Place Concrete	Slump	1 test every day of placement (if less than 100 cubic yards in a day), 1 test for every 100 cubic yards, or 1 test for each 3,000 square feet of surface area for slabs and more frequently if batching appears inconsistent.
	Entrained air	1 test with slump test.
	Ambient and concrete temperatures	1 test with slump test.
	Water cement ratio.	to be verified and provided with batch tickets.
	Compressive strength	1 set of 5 cylinders (See Note 5). 1 test every day of placement (if less than 100 cubic yards in a day), 1 test for every 100 cubic yards, or 1 test for each 3,000 square feet of surface area for slabs, and more frequently if batching appears inconsistent. (See Section 03 30 00-3.5.A.3 for additional requirements.) Each sample used to mold strength test specimens shall be tested for slump, air content, and temperature.

NOTES:

1 Additional tests shall be conducted when variations occur due to CONTRACTOR's operations, weather conditions, site conditions, etc.

2 Classification, moisture content, Atterberg limits and specific gravity tests shall be conducted for each compaction test, if applicable.

3 Tests can substitute for same tests required under "Aggregates" (from bins or source), although gradations will be required when blending aggregates.

4 Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for water/cement calculations.

5 Strength tests shall be the average of the strengths of at least two (2) 6-inch diameter by 12-inch high cylinders. If 4-inch diameter cylinders are used, collect an additional cylinder (6 total) and the strength test shall be the average of the strengths of at least three (3) 4-inch by 8-inch high cylinders.

- END OF SECTION -

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SECTION 01 45 23
TESTING AGENCY SERVICES

PART 1 GENERAL

1.1 SUMMARY

A. CONTRACTOR shall be responsible for providing Construction Quality Control Testing of all soils, concrete, etc. as required by the various sections of these Specifications. This section includes the following:

1. Use of independent testing agency
2. Control testing report submittal requirements
3. Responsibilities of testing agency

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D 3740 Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
2. ASTM D 4561 Standard Practice for Quality Control Systems for Organizations Producing and Applying Bituminous Paving Materials
3. ASTM E 329 Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.4 DEFINITIONS

A. Independent Testing Agency: A testing agency NOT owned by CONTRACTOR, and an agency that does not have any preferential affiliation or association with CONTRACTOR, or any of CONTRACTOR's Subcontractors and Suppliers other than entering into a contract with CONTRACTOR to perform the duties defined in these Specifications.

B. Professional Engineer: An engineer who complies with Utah licensing law and is acceptable to the authority having jurisdiction.

1.5 QUALITY ASSURANCE

A. CONTRACTOR shall employ and pay for services of an independent testing agency which complies with ASTM D 3740, ASTM D 4561, and ASTM E 329 to test materials for contract compliance.

1.6 CONTRACTOR SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures

B. If CONTRACTOR is employing and paying for an independent testing agency, prior to start of Work, submit testing agency's name, address, telephone number and the following:

1. Concrete Technician: Approved by ENGINEER or ACI certified.
2. Person charged with engineering managerial responsibility
3. Professional engineer on staff to review services
4. Level of certification of technicians

1.7 TESTING AGENCY SUBMITTALS

A. Field Test Report: Submit report no later than the end of the current day.

B. Laboratory Test Report: Submit original report within 48 hours after test results are determined.

C. Final Summary Report: Submit prior to final payment

D. On all reports include:

1. Project title, number and date of the report
2. Date, time and location of test
3. Name and address of material Supplier
4. Identification of product being tested and type of test performed
5. Identify whether test is initial test or retest
6. Results of testing and interpretation of results
7. Name of technician who performed the testing

1.8 RESPONSIBILITIES OF TESTING AGENCY

A. Calibrate testing equipment at least annually with devices with an accuracy traceable to either National Bureau of Standards or acceptable values of natural physical constraints.

B. Provide sufficient personnel at site and cooperate with CONTRACTOR, ENGINEER and OWNER's Representative in performance of testing service.

C. Secure samples using procedures specified in the applicable testing code.

D. Perform testing of products in accordance with applicable sections of the Contract Documents.

E. Immediately report any compliance or noncompliance of materials and mixes to CONTRACTOR, ENGINEER, and OWNER's Representative.

F. When an out-of-tolerance condition exists, perform additional inspections and testing until the specified tolerance is attained, and identify retesting on test reports.

1.9 LIMITS ON TESTING AGENCY AUTHORITY

A. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Agency may not suspend Work.

C. Agency has no authority to accept Work for OWNER.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

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SECTION 01 50 00
TEMPORARY CONSTRUCTION UTILITIES AND ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers temporary utilities, including electricity, lighting, telephone service, water, and sanitary facilities; temporary controls, including barriers, protection of work, and water control; and construction facilities, including parking, progress cleaning, and temporary buildings.

1.2 TEMPORARY UTILITIES

A. Temporary Electricity: CONTRACTOR shall provide, maintain, and pay for all power required by CONTRACTOR, including electrical service to CONTRACTOR's and OWNER/ENGINEER's field offices.

B. Temporary Lighting: CONTRACTOR shall provide all temporary lighting required for execution of his work and for employee and public safety. As a minimum, lighting levels during working hours shall meet the requirements of OSHA Subsection 1926.56 illumination.

C. Temporary Heating and Cooling

1. Provide heating and cooling devices as needed to maintain specified conditions for construction operations.

D. Temporary Ventilation

1. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Internet Service: CONTRACTOR shall provide, maintain, and pay for internet service to the field office for OWNER and ENGINEER at time of project mobilization.

F. Temporary Water Service

1. CONTRACTOR shall provide for all his workers on the project, adequate and reasonably convenient uncontaminated drinking water supply. All facilities shall comply with the regulations of the local and State Departments of Health.
2. CONTRACTOR shall be responsible to arrange for water, both potable and non-potable water.
3. When water is taken from a city water system or any other potable water supply source for construction purposes, suitable precautions shall be taken to prevent cross connections and contamination of the water supply.

G. Temporary Sanitary Facilities: CONTRACTOR shall provide and maintain sanitary facilities for his employees and his subcontractors' employees that will comply with the regulations of the local and State Departments of Health.

1.3 TEMPORARY CONTROLS

A. Barriers: Provide barriers as necessary to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

B. Project Security

1. CONTRACTOR shall make all necessary provisions to protect the project and CONTRACTOR's facilities from fire, theft, and vandalism, and the public from unnecessary exposure to injury.
2. Entry Control:
   a. Restrict entrance of persons and vehicles into Project site.
   b. Allow entrance only to authorized persons.

C. Dust Control: Execute Work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into the atmosphere. Give all unpaved streets, roads, detours, or haul roads used in the construction area an approved dust-preventive treatment or periodically water to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.

D. Pest Control: Provide methods, means, and facilities to prevent rodents, pests, and insects from damaging the Work.

E. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. All chemicals used during construction or furnished for project operation whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instruction of the manufacturer.

F. Protection of Work: CONTRACTOR shall protect installed work and provide special protection where specified in individual specifications sections. CONTRACTOR shall provide temporary and removable protection for installed products and shall control activity in immediate work area to minimize damage.

G. Open Burning: No open burning of waste materials will be allowed.

H. Explosives and Blasting: The use of explosives on the work will not be permitted.

I. Noise Abatement: In inhabited areas, particularly residential, operations shall be performed in a manner to minimize unnecessary noise generation.

J. STORM AND GROUND WATER

1. CONTRACTOR shall provide and maintain at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water entering the excavation or other parts of the work, whether the water be from surface or underground water sources.

2. In excavation, fill, and grading operations, care shall be taken to disturb the pre-existing drainage pattern as little as possible. Care shall be taken not to direct drainage water into private property or into streets or drainage ways inadequate for the increased flow.
3. CONTRACTOR shall maintain effective means to minimize the quantity of sediments leaving the work area either by storm water or CONTRACTOR's own dewatering operations. CONTRACTOR shall be responsible for obtaining required permits and complying with all City, State, and Federal storm water management regulations and requirements, including preparing and implementing a Storm Water Pollution Prevention Plan (SWPPP) for Construction Activities. If required, CONTRACTOR shall submit a copy of the Notice of Intent and the SWPPP to OWNER for review and approval.

1.4 CONSTRUCTION FACILITIES

A. VEHICULAR ACCESS

1. Construct temporary access roads from public thoroughfares to serve construction area, of width and load bearing capacity to accommodate unimpeded traffic for construction purposes.
2. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.
3. Location of temporary access roads and detours shall be approved by ENGINEER.
4. Provide unimpeded access for emergency vehicles.
5. Provide and maintain access to fire hydrants and control valves free of obstructions.
6. Provide means of removing mud from vehicle wheels before entering streets.
7. When possible, use existing on-site roads for construction traffic.

B. Parking: CONTRACTOR shall provide temporary parking areas to accommodate construction personnel. Parking shall be in an area approved by ENGINEER.

C. Progress Cleaning

1. CONTRACTOR shall maintain areas free of waste materials, debris, and rubbish. Maintain the site in a clean and orderly condition. Upon completion of work, repair all damage caused by equipment and leave the project site free of rubbish or excess materials of any kind.
2. Thoroughly clean all spilled dirt, gravel, or other foreign materials caused by the construction operations from all streets and roads at the conclusion of each day's operation.
3. It shall be the responsibility of CONTRACTOR to promptly clean up and remove any oil and/or fuel spills caused by CONTRACTOR or his Sub-contractors during the project. Contaminated soil shall be properly disposed of by CONTRACTOR in accordance with all applicable laws. CONTRACTOR shall be responsible for any damages to OWNER resulting from CONTRACTOR's negligence in promptly cleaning up said spills.

1.5 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Prior to Final Application for Payment, CONTRACTOR shall remove temporary above grade or buried utilities, equipment, facilities, and materials; clean and repair damage

caused by installation or use of temporary work; and restore existing facilities used during construction to original condition.

1.6 CULTURAL RESOURCES

A. CONTRACTOR's attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800 which provides for the preservation of potential historical architectural, archeological, or cultural resources (hereinafter called "cultural resources").

B. CONTRACTOR shall conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources.

C. If a suspected or unsuspected historical, archaeological, or paleontological item, feature, or site or other cultural resource is encountered during subsurface excavations at the site of construction, the following procedures shall be instituted:

1. Construction operations shall be immediately stopped in the vicinity of the discovery and ENGINEER and OWNER shall be notified of the nature and exact location of the finding. CONTRACTOR shall not damage the discovered objects and shall provide written confirmation of the discovery to ENGINEER within two (2) calendar days.
2. OWNER and ENGINEER will then immediately notify the State Historical Preservation Office (SHPO) and the Utah Geological Survey (UGS).
3. SHPO and UGS will investigate the finding and determine if the resource requires protection and the disposition of the said resource.

D. If SHPO and UGS determine that the potential find is a bona fide cultural resource, CONTRACTOR shall suspend work at the location of the find under the provisions for changes contained in Articles 11, 12, and 13 of Section 00 72 00 – General Conditions.

PART 2 PRODUCTS

2.1 TEMPORARY EROSION CONTROL MATERIALS

A. EROSION CONTROL BLANKETS

1. Erosion control blankets shall meet the requirements of the Erosion Control Technology Council (ECTC) and the FHWA Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-03 Section 713.17 as a Type 3.B Extended Term Double Net Erosion Control Blanket. The erosion control blanket shall be fabricated from UV-stabilized polypropylene and a straw/coconut blend. The blanket shall be **Model SC150 by Tensar North American Green, Excel CS-3 by Western Excelsior**, or approved equal. The functional longevity shall be 24 months minimum.

B. SILT FENCE

1. Use woven fabric meeting the following properties.

Table 01 50 00-1 - Silt Fence Geotextile			
Property	**ASTM**	**MARV's**	
		Standard	**High Performance**
Grab Tensile Strength, lbs.	D 4632	90[(a)]	120[(a)]
Grab Elongation, %	D 4632	< 40	< 40
Flux, gal/min/ft^2	D 4491	15	90
Apparent Opening Size, (AOS-US sieve)	D 4751	> 20	> 30
Ultraviolet Degradation, %	D 4355	70	90
Notes: (a) Percent of tensile strength retained determined after weathering per ASTM D 4355 for 500-hours			

2. High performance fence to have tape yarns in one principal direction only.
3. Add stabilizers or inhibitors to make the filaments resistant to sunlight or heat deterioration.
4. Finish edges to prevent outer yarn from pulling away from the fabric.
5. Sheets of fabric may be sewn or bonded together. Provide minimum width recommended by manufacturer.
6. No deviation from any requirement in Table 2 due to the presence of seams.
7. Manufactured with pockets for posts, hems with cord, or with posts pre-attached using staples or button head nails.

C. POSTS

1. Minimum length: 4-feet.
2. Steel: Round, U shaped, T shaped, or C shaped with a minimum weight of 1.3-pounds per foot and have projections for fastening wire.
3. Wood as follows:
   a. Soft wood posts at least 3-inches in diameter, or nominal 2 x 4-inches and straight to provide a fence without noticeable misalignment.
   b. Hard wood post with a minimum cross-sectional area of 2.25 square-inches.
4. Fasteners for Wooden Posts:
   a. Wire staples No. 17 gage minimum with a crown at least 3/4-inches wide and legs at least 1/2-inch long.
   b. Nails 14 gage minimum, 1-inch long with 3/4-inch button.

PART 3 EXECUTION

3.1 SILT FENCE

A. Beginning work means acceptance of existing conditions.

B. Maintain the silt fence until revegetation is complete (defined as when cover reaches a density of at least 70% of pre-disturbance levels.

C. Clear area of any debris and obstructions that may damage geotextile.

D. Place post in all low points.

E. Install posts a maximum of 8-feet apart with at least 18-inches in the ground. If not possible to achieve depth, secure posts to prevent overturning.

F. Attach filter fabric by wire, cord, pockets, staples, nails, or other effective means.

1. When using a wire support fence, provide at least 6 horizontal wires with a minimum of 12 gage wire. Space vertical wires 6-inches maximum. Secure geotextile to the up-slope side of the post. Extend wire into the trench a minimum of 2-inches and extend a maximum or 36-inches above the ground surface.

G. Install fabric so 6 to 8-inches of fabric remain at the bottom to be buried. Splice together only at support posts with at least a minimum overlap of 18-inches. Extend buried portion 6-inches deep and the rest upstream of the fabric fence.

H. Sediment Removal: Remove sediment before deposit reaches 1/2 of the height of the silt fence or raise the height of silt fence. After removal of sediment, dress landscape.

I. Schedule of Locations: Typical locations include the toe of fill slopes, the downhill side of fill slopes, the downhill side of large cut areas, and natural drainage areas. Limit geotextile materials to handle an area equivalent to 1,000 square feet per 10-feet of fence. Use caution should the site slope be steeper than 1:1 (horizontal to vertical), and water flow rates exceed 1 cubic foot per second per 10-feet of fence face.

- END OF SECTION -

SECTION 01 50 30
PROTECTION OF EXISTING FACILITIES

PART 1 GENERAL

1.1 DESCRIPTION

A. Any existing facilities, disturbed which are located in or adjacent to the line of work such as curbs, gutters, drive approaches, sidewalks, driveways, fences, underground pipes, conduits, or utilities, shall be cleaned up and restored in kind by CONTRACTOR and in accordance with the Specifications contained herein governing the various types of services involved.

B. CONTRACTOR shall not perform work that would affect any oil, gas, sewer, or water pipeline; any telephone, fiber optic, television cable, or electric transmission line; any fence; or any structure, until authorization has been obtained from owner of the improvement. Provide owner of the improvement due notice of the beginning of the work, and remove, shore, support, or otherwise protect such improvement or replace the same.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

Section 01 78 50 Project Closeout

1.3 RESTORATION OF FENCES

A. Where it is necessary to remove any fence to facilitate CONTRACTOR's operation, CONTRACTOR shall obtain prior agreement with the owner of the fence for removal of the fence and shall be responsible for any damage due to negligence of CONTRACTOR. As soon as practical, the fence shall be restored substantially to the same or improved condition as it was prior to the commencement of the work. Where livestock is present CONTRACTOR shall provide temporary fencing to keep livestock away from the construction area.

1.4 UNDERGROUND SERVICE ALERT

A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, CONTRACTOR shall notify the regional notification center (Blue Stakes of Utah) at 1-800-662-4111 or 811 or submit an on-line request at www.bluestakes.org at least 2 days, but no more than 7 days, prior to such excavation.

1.5 INTERFERING STRUCTURES AND UTILITIES

A. CONTRACTOR shall exercise all possible caution to prevent damage to existing structures and utilities, whether above ground or underground. Prior to submittal of Shop Drawings, and prior to commencing any excavations for new pipelines or structures, conduct investigations, including exploratory excavations and borings, to determine the location and type of underground utilities and services connections that could result in

damage to such utilities. It shall be the responsibility of CONTRACTOR to locate and expose all existing underground and overhead structures and utilities in such a manner as to prevent damage to same. CONTRACTOR shall notify all utility offices concerned at least 48 hours in advance of construction operations in which a utility agency's facilities may be involved. This shall include, but not be limited to, irrigation water, culinary water, telephone, television cables, fiber optic communication, gas, and electric. CONTRACTOR shall be responsible for any and all changes to, reconnections to public utility facilities encountered or interrupted during prosecution of the work, and all costs relating hereto shall be at CONTRACTOR's expense. CONTRACTOR shall contract with and pay Public Utility Agencies for work required in connection with all utility interferences and handle all necessary notifications, scheduling, coordination, and details. The cost of public utility interferences shall be included in CONTRACTOR's lump sum or unit price bid covering the major contract facility to which interference or changes are attributable.

B. All exploratory excavations shall be performed as soon as practicable after Notice to Proceed and, in any event, a sufficient time in advance of the construction to avoid possible delays to CONTRACTOR's progress. Prepare a report identifying each utility by its size, elevation, station, and material of construction. Immediately notify ENGINEER and the utility in writing as to any utility discovered in a different position than as marked in the field or shown on the Drawings, or any utility which is not marked in the field or not shown on the Drawings.

C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility. Conform to local agency requirements for backfill and pavement repair after performing exploratory excavations.

D. Any damage to private property, either inside or outside the limits of the easements provided by OWNER, shall be the responsibility of CONTRACTOR. Any roads, structures, or utilities damaged by the work shall be repaired or replaced in a condition equal to or better than the condition prior to the damage. Such repair or replacement shall be accomplished at CONTRACTOR's expense without additional compensation from OWNER.

E. CONTRACTOR shall remove and replace small miscellaneous structures such as fences and culverts which are damaged by the construction activity at his own expense without additional compensation from OWNER. CONTRACTOR shall replace these structures in a condition as good as or better than their original condition.

F. At points where CONTRACTOR's operations are adjacent to or across properties of railway, telegraph, telephone, irrigation canal, power, gas, water, or adjacent to other property (damage to which might result in considerable expense, loss, and inconvenience), no work shall be started until all arrangements necessary for the protection thereof have been made.

G. The locations of the major existing culinary water lines, gas pipes, underground electric, cable television, and telephone lines that are shown on the plans were taken from city maps, and maps supplied by the utility owner. No excavations were made to verify the locations shown for underground utilities, unless specifically stated on the Contract Drawings. It should be expected that some location discrepancies will occur. Neither OWNER nor its officers or agents shall be responsible for damages to CONTRACTOR as a result of the locations of the utilities being other than those shown on the plans or for the existence of utilities not shown on the plans.

H. CONTRACTOR shall be solely and directly responsible to owners and operators of such properties for any damage, injury, expense, loss or inconvenience, delay, suits, actions, or claims of any character brought because of an injury or damage which may result from the carrying out of the work to be done under the contract.

I. All utilities including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities encountered along the line of the work shall remain continuously in service during all operations under the Contract, unless other arrangements satisfactory to ENGINEER are made with owner of said utility.

J. In the event of interruption to either domestic or irrigation water, or to other utility services as a result of accidental breakage, or as a result of being exposed or unsupported, CONTRACTOR shall promptly notify the proper authority. CONTRACTOR shall cooperate with the authority in restoration of service as soon as possible and shall not allow interruption of any water or utility service outside working hours unless prior approval is received.

K. In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of CONTRACTOR, be notified by OWNER to move such property within a specified reasonable time. When utility lines that are to be moved are encountered within the area of operations, CONTRACTOR shall notify ENGINEER a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.

L. Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing Utility or other improvement which is indicated, CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such Utility or improvement in a manner satisfactory to ENGINEER and OWNER of the facility. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished by CONTRACTOR in a manner that will restore or replace the Utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

1.6 RIGHTS-OF-WAY

A. CONTRACTOR shall be required to confine construction operations within the dedicated rights-of-way for public thorough fares, or within areas for which construction easements have been obtained, unless they have made special arrangements with the affected property owners in advance. CONTRACTOR shall be required to protect stored materials, cultivated trees and crops, and other items adjacent to the proposed construction site.

B. CONTRACTOR shall submit for approval by ENGINEER the type and size of equipment used, and the methods for work performed on the rights-of-way across private properties, to avoid or minimize injury to trees, shrubs, gardens, lawns, fences, driveways, retaining walls, or other improvements within the rights-of-way.

C. The construction easement widths and access to private properties are as shown on the Drawings and as described in the easement documents; however, CONTRACTOR is to minimize impacts to surface improvements within the right-of-way. CONTRACTOR shall obtain a signed release from the property owner, approving restoration of work in the

construction easements across or bordering private properties. See Project Closeout Section 01 78 50, 1.4.D.

D. Property owners affected by the construction shall be notified by CONTRACTOR at least 48 hours in advance of the time the construction begins. During all construction operations, CONTRACTOR shall construct and maintain such facilities as may be required to provide access by all property owners to their property. No person shall be cut off from access to his property for a period exceeding 8 hours unless CONTRACTOR has made special arrangements with the affected persons. CONTRACTOR shall, daily or more frequently, if necessary, grade all disturbed areas to be smooth for motor vehicle traffic.

1.7 PROTECTION OF SURVEY, STREET OR ROADWAY MARKERS

A. CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced. Survey markers or points disturbed by CONTRACTOR shall be accurately restored after street or roadway resurfacing has been completed.

1.8 TREES OR SHRUBS WITHIN PROJECT LIMITS

A. Except where trees or shrubs are indicated to be removed, CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way and project limits, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or OWNER. Existing trees and shrubs which are damaged during construction shall be trimmed or replaced by CONTRACTOR or a certified tree company under permit from the jurisdictional agency and/or OWNER. Tree trimming and replacement shall be accomplished in accordance with the following paragraphs.

1. The symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch. Spikes shall not be used for climbing live trees. Cuts over 1-1/2 inches in diameter shall be coated with a tree paint product that is waterproof, adhesive, and elastic, and free from kerosene's, coal tar, creosote, or other material injurious to the life of the tree.
2. CONTRACTOR shall immediately notify the jurisdictional agency and/or OWNER if any tree or shrub is damaged by CONTRACTOR's operations. If, in the opinion of said agency or OWNER, the damage is such that replacement is necessary, CONTRACTOR shall replace the tree or shrub at its own expense. The tree or shrub shall be of a like size and variety as the one damaged, or, if of a smaller size, CONTRACTOR shall pay to OWNER of said tree a compensatory payment acceptable to the tree or shrub owner, subject to the approval of the jurisdictional agency or OWNER. The size of the tree or shrub shall be not less than 1-inch diameter nor less than 6 feet in height.

1.9 RESTORATION OF PAVEMENT

A. Pavement work shall meet the specifications for installation as noted in APWA Section 33 12 16.

B. All paved areas damaged during construction shall be replaced with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract or in the requirements of the agency issuing the permit. The pavement restoration requirement to match existing sections shall apply to all components of existing sections, including sub-base, base, and pavement. Pavements which are subject to partial removal shall be neatly sawcut in straight lines.

C. Wherever required by the local agency having jurisdiction, CONTRACTOR shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.

1.10 CONCRETE WORK

A. Concrete work shall meet the specifications for installation as noted in APWA Section 32 16 13 Driveway, Sidewalk, Curb and Gutter.

B. All flat work in streets tying into existing flatwork shall be doweled into the existing concrete. Dowels to be spaced at 12" O.C. and be No. 5 rebar x 14" for slabs up to 8 inches in thickness and No. 8 rebar x 18" for slabs over 8 inches.

1.11 LAWNS

A. Lawns that are damaged or destroyed during performance of the work shall be repaired or replaced with turf sod according to APWA Section 32 92 00 - Turf and Grass.

1.12 FENCES

A. Fences that are damaged or destroyed during performance of the work shall be repaired or replaced back to the original condition or better to the satisfaction of the landowner and OWNER.

1.13 LANDSCAPING

A. All landscaping on private property that is damaged or destroyed during performance of the work shall be repaired or replaced back to the original condition or better to the satisfaction of the landowner and OWNER.

1.14 OTHER SURFACE IMPROVEMENTS

A. All other surface improvements not explicitly mentioned herein that are damaged or destroyed during performance of the work shall be repaired or replaced back to original condition or better.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

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SECTION 01 55 26
TRAFFIC CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall comply with all rules and regulations of Salem City, County, and State authorities regarding the closing of public streets or highways. If conditions justify, ENGINEER may authorize CONTRACTOR to conduct his work in specific areas and to specific tasks to avoid sporadic and unorganized work efforts.

B. All work performed on or within the right-of-way of state roads shall have traffic control devices in place before work begins that meet the requirements of Utah Department of Transportation's "Specifications for Excavation on State Highways".

C. No road shall be closed by CONTRACTOR to the public except by express permission of ENGINEER and after obtaining the required permits. Where it is necessary to close a county or city road to thru traffic, the road shall be closed to thru traffic only - not local traffic. The road shall be closed for one block only, not over 700 feet. The road shall be barricaded at each point of public access with barricades meeting the Utah Department of Transportation's specifications.

D. Traffic must be kept open on those roads and streets where no detour is possible. CONTRACTOR shall, at all times, conduct his work so as to ensure the least possible obstruction to traffic and normal commercial pursuits. All obstructions within traveled roadways shall be protected by approved signs, barricades, and lights where necessary for the safety of the traveling public. The convenience of the general public and residents, and the protection of persons and property are of prime importance and shall be provided for by CONTRACTOR in an adequate and satisfactory manner.

E. Excavations on project sites from which the public is excluded shall be marked or guarded in a manner appropriate for the hazard.

1.2 TRAFFIC CONTROL

A. For the protection of traffic in public or private streets and ways, CONTRACTOR shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the "Manual on Uniform Traffic Control Devices for Streets and Highways, Part VI - Temporary Traffic Control," published by U.S. Department of Transportation, Federal Highway Administration. CONTRACTOR shall take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. CONTRACTOR shall station such guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals, and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.

B. If at any time the conditions indicate that CONTRACTOR's protective facilities and service are inadequate to assure the safety of the public or CONTRACTOR's workers, CONTRACTOR shall provide additional facilities or services as may be necessary to assure protection at no additional cost to OWNER.

C. Where required, CONTRACTOR shall obtain a traffic control permit from the governing agency prior to beginning work, and shall comply with all requirements of the permit.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

SECTION 00 56 00
DUST CONTROL

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, and equipment as required to provide dust control for the project.

B. All materials and services shall comply with the requirements of the State of Utah, Department of Environmental Quality, Division of Air Quality and the City's Municipal Code.

PART 2 PRODUCTS

2.1 MATERIALS

A. Water: CONTRACTOR shall be responsible to arrange and pay for water for dust control.

B. Calcium chloride shall be added to the water used to provide dust control, if required by the City or agency having jurisdiction.

PART 3 EXECUTION

3.1 DUST CONTROL

A. CONTRACTOR shall comply with the requirements of the State of Utah Department of Environmental Quality, Air Quality Regulations (including R301-205 Emission Standards: Fugitive Emissions and Fugitive Dust, and R307-309 Fugitive Emissions and Fugitive Dust, of the Utah Air Conservation Rules (UACR). CONTRACTOR shall submit a Fugitive Dust Control Plan to the Utah Division of Air Quality, which meets the requirements of R307-309-4. CONTRACTOR shall obtain a permit from the Division of Air Quality.

B. CONTRACTOR shall execute Work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into the atmosphere. Give all unpaved streets, roads, detours, or haul roads used in the construction area an approved dust-preventive treatment or periodically water to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.

3.2 WATER PLACEMENT FOR DUST CONTROL

A. CONTRACTOR is responsible for placement of sufficient water to control dust on the project. Dust control is defined by the permit requirements of the State of Utah, Division of Environmental Quality, Division of Air Quality. Permit shall be obtained by CONTRACTOR.

3.3 WATER AND CALCIUM CHLORIDE MIXTURE FOR DUST CONTROL

A. CONTRACTOR may also use a water and calcium chloride solution to abate the dust for the project. The mixture of calcium chloride per 10,000-gallon truck shall be 10 pounds.

The calcium chloride shall be added to the water truck container as the water is being put into the water truck in order to provide sufficient mixing.

B. In the absence of providing the water and calcium chloride mixture, CONTRACTOR shall meet the requirements of Subsection 3.2 of this document, or shall use other approved methods by OWNER that will allow CONTRACTOR to meet permit requirements.

- END OF SECTION -

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

C. Furnish interchangeable components from same manufacturer for components being replaced.

1.2 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.3 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.4 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.5 PRODUCT SUBSTITUTION PROCEDURES

A. ENGINEER will consider requests for Substitutions only after Notice of Award.

B. Substitutions may be considered when a product becomes unavailable through no fault of CONTRACTOR.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that CONTRACTOR:

1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
2. Will provide same warranty for Substitution as for specified product.
3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to OWNER.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse OWNER for review or redesign services associated with re-approval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:

1. Submit four copies of request for Substitution for consideration to ENGINEER.
2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
3. ENGINEER may require CONTRACTOR to provide additional data about the proposed substitution.
4. ENGINEER will be the sole judge as to the type, function, and quality of any such substitution and ENGINEER’s decision shall be final.
5. ENGINEER will notify CONTRACTOR in writing of decision to accept or reject request.
6. Acceptance by ENGINEER of a substitution proposed by CONTRACTOR shall not relieve CONTRACTOR of the responsibility for full compliance with the Contract Documents and for the adequacy of the substitution.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION-

SECTION 01 71 13
MOBILIZATION

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section is provided to cover CONTRACTOR's cost of general and miscellaneous responsibilities and operations not normally attributed to, or included in, any other single bid item. This shall include, but not necessarily be limited to, work described or enumerated in this section under the following subsections.

1.2 MOVING TO AND FROM THE JOB SITE

A. This shall include CONTRACTOR's preliminary arrangement for starting and stopping construction operations, work schedules, and transportation of equipment and personnel to and from the project.

1.3 CLEAN-UP

A. The cost of all clean-up work as specified and not covered under other items shall be included in the Bid. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

1.4 TEMPORARY UTILITIES

A. The cost of water, power, etc. required by CONTRACTOR in performing the Work specified in the Contract shall be included in the Bid. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

1.5 PERFORMANCE BOND, PAYMENT BOND, AND INSURANCE

A. The cost of the Performance Bond, Payment Bond, and any required insurance and/or other miscellaneous cost associated with this Project shall be included with the Bid. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

1.6 PERMITS

A. CONTRACTOR shall provide all necessary permits for completion of the Work. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

1.7 PRE-CONSTRUCTION VIDEO RECORDS

A. CONTRACTOR is required to produce a preconstruction video recording of areas where Work is to be performed. The video record shall be of professional quality and the coverage shall be such, as to allow accurate determination of location, size, and conditions, etc. of existing features and improvements within the rights-of-way. CONTRACTOR shall provide OWNER with a copy of the rights-of-way video in electronic format on a digital video disc (DVD) or solid-state drive (USB or Thumb Drive) before construction begins.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 78 50
PROJECT CLOSEOUT

PART 1 GENERAL

1.1 FINAL CLEANUP

A. CONTRACTOR shall promptly remove from the vicinity of the completed Work all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the Work by OWNER will be withheld until CONTRACTOR has satisfactorily complied with the foregoing requirements for final cleanup of the Project Site.

1.2 TOUCH-UP AND REPAIR

A. CONTRACTOR shall touch up or repair all finished surfaces on structures, equipment, fixtures, etc., that have been damaged prior to final acceptance. Surface on which such touch-up or repair cannot be successfully accomplished shall be completely refinished or in the case of hardware and similar small items, the item shall be replaced.

1.3 CLOSEOUT TIMETABLE

A. CONTRACTOR shall establish dates for equipment testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow OWNER, ENGINEER, and their authorized representatives sufficient time to schedule attendance at such activities.

1.4 MAINTENANCE AND GUARANTEE

A. CONTRACTOR shall comply with the maintenance and guarantee requirements contained in Article 7.17 of the General Conditions, Section 00 72 00.

B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as part of such required repair work, and any repair or resurfacing which becomes necessary by reason of such required repair work shall be completed by CONTRACTOR at no cost to OWNER.

C. CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from OWNER. If CONTRACTOR fails to make such repairs or replacement promptly, OWNER reserves the right to do the work and CONTRACTOR and his surety shall be liable to OWNER for the cost thereof.

D. CONTRACTOR shall obtain a signed release from the property owner approving restoration of work in the construction easements across or bordering private property.

1.5 BOND

A. CONTRACTOR shall provide a bond to guarantee performance of the provisions contained in Paragraph "Maintenance and Guarantee" above, and Article 6 of the General Conditions, Section 00 72 00.

1.6 FINAL ACCEPTANCE

A. Final acceptance and final payment shall not be made until all provisions of the General Conditions Section 00 72 00 Article 15.06 have been satisfied.

1.7 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed Shop Drawings, Product Data, and Samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by OWNER.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail
4. Details not on original Contract drawings

G. Submit documents to ENGINEER with claim for final Application for Payment.

1.8 CONTRACT CLOSEOUT

A. As a condition precedent to final acceptance of the project, CONTRACTOR shall complete the following forms and submit the original and two copies of each form to the Project Representative.

1. Contractor’s Certificate of Substantial Completion
2. Contractor’s Certificate of Final Completion
3. Contractor’s Final Waiver of Lien
4. Consent of Surety for Final Payment
5. Affidavit of Payment
6. Affidavit of Release of Liens by the Contractor

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

CONTRACTOR'S CERTIFICATE OF SUBSTANTIAL COMPLETION

OWNER

TO: Name
Address
City, State, Zip Code

PROJECT: _____

ATTENTION: _____

FROM: _____
Firm or Corporation

This is to certify that I, _____ am an authorized official of _____ working in the capacity of _____ and have been properly authorized by said form or corporation to sign the following statements pertaining to the subject contract.

I know of my own personal knowledge, and do hereby certify, that the work of the Contract described above has been substantially performed, and materials used and installed to date in accordance with, and in conformity to, the Contract drawings and specifications. A list of all incomplete work is attached.

The Contractor hereby releases the Owner and its agents from all claims and liability to the Contractor for anything done or finished for or relating to the Work, as specified in the Project Manual, except demands against the Owner for the remainder of progress payments retained to date, and unresolved written claims prior to this date.

The Contract Work is now substantially complete, ready for its intended use, and ready for your inspection. You are requested to issue a Certificate of Substantial Completion.

Signature: _____

Date: _____

CONTRACTOR'S CERTIFICATE OF FINAL COMPLETION

OWNER

TO:
Name
Address
City, State, Zip Code

PROJECT: _____

ATTENTION: _____

FROM: _____
Firm or Corporation

This is to certify that I, _____ am an authorized official of _____ _____ working in the capacity of _____ _____ and have been properly authorized by said form or corporation to sign the following statements pertaining to the subject contract.

I know of my own personal knowledge, and do hereby certify, that the work of the Contract described above has been substantially performed, and materials used and installed to date in accordance with, and in conformity to, the Contract drawings and specifications.

The Contractor hereby releases the Owner and its agents from all claims and liability to the Contractor for anything done or finished for or relating to the Work. The Contract Work is now complete in all parts and requirements, ready for its intended use, excepting the attached list of minor deficiencies and the reason for each being incomplete to date, for which exemption from final payment requirements is requested (if no exemptions requested, write "none") ___ _____. The Work is now ready for your final inspection. The following items are required from the Contractor prior to application for final payment and are submitted herewith, if any:

_____

_____

I understand that neither the issuance, by the Owner, or a Certificate of Final Completion, nor the acceptance thereof by the Owner, shall operate as a bar claim against the Contractor under the terms of the guarantee provisions of the Contract Documents.

Signature: _____
Date: _____

CONTRACTORS FINAL WAIVER OF LIEN

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has furnished labor and materials for (A) _____

_____

in the City of _____, County of _____, State of Utah, of which City of _____ is the Owner.

NOW THEREFOR, this _____ day of _____, 20_____, for and in consideration of the sum of (B) _____ dollars paid simultaneously herewith, the receipt whereof is hereby acknowledged by the undersigned, the undersigned does hereby waive and release any lien* right to, or claim of lien with respect to and on said above described premises, and the improvements thereon, and on the monies or other consideration due or to become due from the Owner, on account of labor, services, materials, fixtures, apparatus or machinery heretofore or which may hereafter be furnished by the undersigned to or for the above described premises by virtue of said contract.

(C) _____ (SEAL)
(Name of sole ownership, corporation or partnership)

(C) _____ (SEAL)
(Signature of Authorized Representative)

Title: _____

INSTRUCTION FOR FINAL WAIVER:

A. Project name.

B. Final Contract amount received (total amount of Contract as adjusted).

C. If the waiver is for a corporation, corporate name should be used, corporate seal affixed, and title of officer signing waiver should be set forth; if waiver is for a partnership, the partnership name should be used, partner should sign and designate himself/herself as partner.

* The word Lien as used herein shall include Stop Orders, Stop Notices, or Freeze Orders on monies or other consideration of the Owner which are due or are to become due on the Contract referenced above.

CONSENT OF SURETY FOR FINAL PAYMENT

Project Name: _____

Location: _____

Type of Contract: _____

Amount of Contract: _____

In accordance with the provisions of the above named contract between the Owner and the Contractor, the following named surety:

_____

_____

_____

on the Payment Bond of the following named Contractor:

_____

_____

_____

hereby approves of final payment to the Contractor, and further agrees that said final payment to the Contractor shall not relieve the Surety Company named herein of any of its obligations to the following named Owner (as set forth in said Surety Company's bond):

Owners Name
Owners Address
City, State, Zip Code

IN WITNESS WHEREOF, the Surety Company has hereunto set its hand and seal this _ day of _____, 20___.

_____
(Name of Surety Company)

_____
(Signature of Authorized Representative)

Title: _____

AFFIDAVIT OF PAYMENT

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by (Insert Owners Name) to furnish labor and materials under a contract dated _____ for the project named _____ _____ in the City of _____County of _____, State of Utah.

NOW THEREFORE, this _____ day of _____ , 20____, the undersigned, as the Contractor for the above named Contract pursuant to the conditions of the Contract, hereby certifies that, except as listed below, he has paid in full or has otherwise satisfied all obligations for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or its property might in any way be held responsible.

EXCEPTIONS: (If none, write “none”. If required by the Owner, the Contractor furnish bond satisfactory to the Owner for each exception).

{AFFIX CORPORATE}
{SEAL HERE}

_____
Contractor (Name of sole ownership, Corporation or partnership)

_____
(Signature of Authorized Representative)

Title: _____

AFFIDAVIT OF RELEASE OF LIENS BY THE CONTRACTOR

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by (Insert Owners Name) to furnish labor and materials under a contract dated _____ for the project named _____ _____ in the City of _____County of , State of Utah.

NOW THEREFOR, this _____ day of _____ , 20_____, the undersigned, as the Contractor for the above named Contract pursuant to the conditions of the Contract, hereby certifies that to the best of his/her knowledge, information and belief, except as listed below, the Releases or Waivers of Lien* attached hereto include the Contractor, all subcontractors, all suppliers of material and equipment, and all performers of work, labor or services, who have or may have liens against any property of the Owner and on the monies or other consideration due to becomes due from the Owner arising in any manner in connection with the performance of the Contract referenced above.

EXCEPTIONS: (If none, write "none". If required by the Owner, the Contractor furnish bond satisfactory to the Owner for each exception).

ATTACHMENTS:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

2. Separate Release or Waiver of Liens from subcontractors and material suppliers.

{AFFIX CORPORATE}
{SEAL HERE}

_____
Contractor (Name of sole ownership, Corporation or partnership)

_____
(Signature of Authorized Representative)

Title: _____

* The word Lien as used herein shall include Stop Orders, Stop Notices, or Freeze Orders on monies or other consideration of the Owner which are due or are to become due on the Contract referenced above.

- END OF SECTION -

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SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the work necessary to furnish, install, and complete, the concrete formwork.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 03 30 00 Cast-in-Place Concrete

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American Concrete Institute (ACI) -ACI 347R- Guide to Formwork for Concrete
2. American Hardboard Association (AHA) -AHA A135.4- Basic Hardboard
3. Department of Commerce (DOC) -DOC PS 1- Structural Plywood
4. ACI 350R-01 – Code Requirements for Environmental Engineering Concrete Structures and Commentary
5. NSF International (NSF) 61 - Drinking Water System Components - Health Effects

1.4 DESIGN

A. Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the finish specified in Section 03 30 00 Cast-in-Place Concrete. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

1.5 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. The following shall be submitted:

1. Drawings showing details of forming, shoring and bracing for footings, walls, and floors shall be submitted to ENGINEER at least 3 weeks prior to their use. Drawings showing details of formwork shall include joints, supports, studding and shoring, and sequence of form and shoring removal.
2. If requested by ENGINEER, design analysis and calculations shall be submitted for form design and methodology used in the design. The analysis and calculations shall verify the selection of form ties, horizontal and vertical stiff-backs or braces for wall panels, forming and form openings, or any other part of forming, shoring or bracing which may be considered critical by ENGINEER.

3. Manufacturer's data including literature describing form materials, accessories, and form releasing agents.
4. Manufacturer's recommendation on method and rate of application of form releasing agent.

C. ENGINEER's review will not relieve CONTRACTOR from any responsibility as to the adequacy of the forming, shoring and bracing design. Any formwork installed by CONTRACTOR shall be solely at CONTRACTOR's risk. ENGINEER's review will not lessen or diminish CONTRACTOR's liability.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Walls, Suspended Slabs, and Beams Forms

1. Form surfaces shall be in "new and undamaged" condition and may be plywood, hard plastic finished plywood, overlaid waterproof particle board, and steel of sufficient strength and surface smoothness to produce the specified finish. CONTRACTOR shall verify that his types of form surfaces and panel sizes satisfy all requirements of these specifications.

B. Column Forms:

1. Square or Rectangular Columns: Shall be the same as wall forms.
2. Circular Columns: Fabricated steel or fiber reinforced plastic (FRP) with bolted sections.

C. Slab-on-Grade:

1. Lumber, steel, or plywood forms.

D. Other:

1. Shall be the same as wall forms or other as approved by ENGINEER.

E. The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete, and which shall permit ready removal of the forms without spalling or damaging the concrete.

F. Rustication (Reveal Strips) and Chamfer Strips: Wood or nonabsorbent material, compatible with the form surface, fully sealed on all sides prohibiting loss of cement paste or water between the two surfaces. The manufacturer shall be **Sylvan Products, LLC, Victory Bear Construction Products, Nox-Crete, Superior Profiles,** or approved equal.

2.2 FORM TIES

A. Form ties on exposed surfaces shall be located in a uniform pattern. Snap ties shall not be broken until the concrete has reached the design concrete strength. The use of tie wires as form ties will not be permitted. Snap ties, designed so that the ends must be

broken off before the forms can be removed, shall not be used. Form ties shall be **Plastic Cone Snap Tie by Dayton-Superior, Wrench Head Snap Tie by MASCO Mason Supply,** or approved equal.

B. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical recess made therefore in the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess. Taper ties shall be **Taper Tie by Dayton-Superior, Taper-Tie by MASCO Mason Supply**, or approved equal.

C. Waterstop for Tie Rods: For hydraulic structures and below grade structures, furnish on of the following:

1. Provide hydrophilic waterstop to seal form tie rods. Waterstop shall be **Adeka Ultra-C Rings, BeSealed Sealing UFO,** or approved equal.

D. Taper Tie Plug:

1. Design and size of the plug shall allow insertion with the insertion tool to elongate the plug while inserting and which will return to the approximate original size to form a watertight seal. Plug shall be soft PVC or EPDM and rated for a minimum hydrostatic pressure of 275 feet. The manufacturer shall be **Dayton Superior A58 Sure Plug, Sika X-Plug, Corkjoint CJ,** or approved equal.

2.3 FORM RELEASING AGENTS

A. Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds. Agent shall be a ready-to-use water-based material containing no mineral oil of organic solvents. Form release agents shall be **BASF Master Finish RL 211, Euclid Chemical Formshield WB, WR Meadows Duogard II,** or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03 30 00 Cast-in-Place Concrete. Forms shall be used, whenever necessary, to confine the concrete, to shape the concrete to the required lines and grades, and to obtain a thoroughly compacted dense concrete through proper vibrating. The forms shall have sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure, tamping and vibration, without deflection from the prescribed lines. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar.

B. The surfaces of all forms in contact with the concrete shall be clean, rigid, tight and smooth. All dirt, chips, sawdust, mud, water and other foreign matter shall be removed from within the forms or within the excavated areas, before any concrete is deposited

therein.

C. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be thoroughly cleaned of mortar from previous concreting and of all other dirt and foreign matter before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

D. Bulkheads to form vertical wall joints shall be strong enough to withstand concrete pressures during pouring and vibrating, and shall be properly placed between the forms to avoid mortar seepage. Holes shall be provided in the bulkheads to permit passage of horizontal mild steel reinforcing where required by the Contract Drawings. Unless these are specifically called for on the Contract Drawings, no chamfer strips shall be placed in the corners of vertical construction joints.

3.2 COATING

A. Form inside surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.3 TAPER TIE PLUG

A. Insert the PVC Plug in accordance with the manufacturer's written instructions using the manufacturer's insertion tool. After insertion fill both sides with non-shrink grout.

3.4 ALIGNMENT AND TOLERANCES

Forms shall be properly aligned and adequately supported to produce concrete surfaces conforming to construction tolerance given in Table 03 10 00-1 - Tolerances for Formed Surfaces.

TABLE 03 10 00-1
TOLERANCES FOR FORMED SURFACES

Condition	Measurement	Tolerance
1. Variations from the plumb:	In any 10 feet of length	1/4-inch
a. In the lines and surfaces of columns, piers, walls and in arises	Maximum for entire length	1-inch
b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 20 feet of length Maximum for entire length	1/4-inch 1/2-inch
2. Variation from the level or from the grades indicated on the drawings	In any 10 feet of length In any bay or in any 20 feet of length	1/4-inch 3/8-inch
3. Variation of the linear building lines from established position in plan	In any 20 feet Maximum	1/2-inch 1-inch
4. Variation of distance between walls, columns, partitions	1/4-inch per 10 feet of distance, but not more than 1/2-inch in any one bay, and not more than 1-inch total variation	
5. Variation in the thickness of slabs and walls	Minus Plus	1/4-inch 1/2-inch

3.5 FORM REMOVAL

A. Forms shall be removed in a manner that will prevent injury to the concrete and ensure the complete safety of the structure. Forms shall not be removed until approval is given by ENGINEER. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement.

B. CONTRACTOR shall remove all wood splinters on concrete surfaces after stripping of wood forms.

- END OF SECTION -

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SECTION 03 20 00
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the steel reinforcement bars, wire fabric mats, rod mats, and couplers for use in reinforced cast-in-place concrete

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 03 30 00 Cast-in-Place Concrete

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN CONCRETE INSTITUTE (ACI)

1. ACI 301 Specifications for Structural Concrete
2. ACI 315 Details and Detailing of Concrete Reinforcement
3. ACI 318 Building Code Requirements for Structural Concrete and Commentary
4. ACI 350R Code Requirements for Environmental Engineering Concrete Structures and Commentary

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 184 Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
2. ASTM A 615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. ASTM A 767 Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
4. ASTM A 775 Standard Specification for Epoxy-Coated Steel Reinforcing Bars
5. ASTM A 1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

D. CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

1. CRSI (DA4) Manual of Standard Practice (MSP-1)

E. Wire Reinforcement Institute (WRI)

1. Manual of Standard Practice for Welded Wire Reinforcement

1.4 SUBMITTALS

A. CONTRACTOR shall submit the following in accordance with Section 01 33 00 - Submittal Procedures:

1. Drawings of Concrete Reinforcement System with details showing reinforcing steel schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.
2. Reinforcing Steel with certified copies of mill reports attesting that the reinforcing steel furnished meets the requirements specified, prior to the installation of reinforcing steel.
3. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, manufacturer's literature shall be submitted which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and shop drawings which show the location of each coupler with details of how they are to be installed in the formwork.

1.5 DELIVERY AND STORAGE

A. Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

A. Dowels shall conform to ASTM A 615, Grade 60.

2.2 FABRICATED BAR MATS

A. Fabricated bar mats shall conform to ASTM A 184.

2.3 REINFORCING STEEL

A. Reinforcing steel shall be deformed bars conforming to ASTM A 615 grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 1064. When no grade is indicated use 60 ksi grade steel. Special coated bars (epoxy and zinc) may be specified for use in a highly corrosive atmosphere where concrete cover is not considered sufficient, in which case reference to ASTM A 767 and A 775 will be included.

2.4 WELDED WIRE FABRIC

A. Welded wire fabric reinforcement shall conform to the requirements of ASTM A 1064. Welded wire fabric with longitudinal wire of W4 size and smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches. Welded wire fabric with longitudinal wires larger than W4 size shall be furnished in flat sheets only.

2.5 WIRE TIES

A. Wire ties shall be 16-gauge or heavier black annealed steel wire.

2.6 MECHANICAL COUPLERS

A. Mechanical couplers shall only be provided where shown on the Contract Drawings. The couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.

C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection. Straight threaded type couplers shall require the use of the next larger size reinforcing bar or shall be used with reinforcing bars with specially forged ends which provide upset threads which do not decrease the basic cross section of the bar.

D. Mechanical Couplers shall be **Lenton Form Saver by Erico Products, D51A DBR by Dayton Superior**, or approved equal.

2.7 SUPPORTS

A. Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI (DA4) MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete.

B. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2-inch of concrete surface shall be plastic protected or shall be stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

C. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.

D. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/8-inch minimum thickness of plastic coating which extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.

PART 3 EXECUTION

3.1 GENERAL

A. All reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated, and placed in accordance with the requirements of the Building Code and the requirements specified herein.

3.2 REINFORCEMENT

A. Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete.

B. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety.

C. Placement:

1. Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete.
2. Reinforcement shall be placed in accordance with ACI 318 at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.
3. All reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks.
4. For concrete over formwork, CONTRACTOR shall furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.
5. Limitations on the use of bar support materials shall be as follows.
   a. Concrete Dobies: permitted at all locations except where architectural finish is required.
   b. Wire Bar Supports: permitted only at slabs over dry areas, interior dry wall surfaces, and exterior wall surfaces.
   c. Plastic Bar Supports: permitted at all locations except on grade.
6. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.
7. Bars additional to those shown which may be found necessary or desirable by CONTRACTOR for the purpose of securing reinforcement in position shall be provided by CONTRACTOR at no additional cost to OWNER.
8. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3 feet on centers in any direction.
9. Epoxy coated reinforcing bars shall be stored, transported, and placed in such a manner as to avoid chipping of the epoxy coating. Specially coated bar supports shall be used. CONTRACTOR shall repair all chips or cracks in the epoxy coating with a compatible epoxy repair material prior to placing concrete.
10. Accessories supporting reinforcing bars shall be spaced such that there is no deflection of the accessory from the weight of the supported bars. When used to space the reinforcing bars from wall forms, the forms and bars shall be located so that there is no deflection of the accessory when the forms are tightened into position.

D. Splicing:

1. Splices of reinforcement shall conform to ACI 318 and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6-inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.3 WELDED-WIRE FABRIC

A. Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned using supports.

3.4 DOWELS

A. Dowels shall be installed in slabs on grade at locations indicated and at right angles to the joint being doweled. Dowels shall be accurately aligned parallel to the finished concrete surface and rigidly supported during concrete placement. A PVC sleeve shall cover one end of dowels up to the joint location at the center of the bar. Grease to be placed at the back of the sleeve prior inserting dowel so that the grease will flow out, around, and fully encase the inserted bar. Grease the bar before insertion. Grease shall be semi-solid, inert lubricant, such as lithium grease.

3.5 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS

A. Dowel Epoxy Installation

1. The hole diameter shall be as recommended by the epoxy manufacturer but shall be no larger than 0.25 inch greater than the diameter of the outer surface of the reinforcing bar deformations.
2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless noted otherwise.
3. The hole shall be drilled by methods which do not interfere with the proper bonding of epoxy.
4. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or damaging any existing reinforcing bars.
5. The hole shall be blown clean with clean, dry compressed air to remove all dust and loose particles.
6. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent

formation of air pockets. The hole shall be filled to a depth that ensures that excess material will be expelled from the hole during dowel placement.

7. Dowels shall be twisted during insertion into the partially filled hole to guarantee full wetting of the bar surface with epoxy. CONTRACTOR shall insert the bar slowly enough to avoid developing air pockets.

3.6 CLEANING AND PROTECTION

A. CONTRACTOR shall protect reinforcement steel from conditions conducive to corrosion until concrete is placed.

B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed. Where there is a delay in placing concrete, reinforcement shall be reinspected and if necessary, recleaned.

- END OF SECTION -

SECTION 03 25 00
EXPANSION JOINTS, CONSTRUCTION JOINTS AND WATERSTOPS

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers the work necessary to furnish, install and complete expansion and construction joints, including waterstops.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 03 33 00 Cast-in-Place Concrete

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN CONCRETE INSTITUTE (ACI)

1. ACI 318 Building Code Requirements for Reinforced Concrete

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
2. ASTM D 412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
3. ASTM C 920 Standard Specification for Elastomeric Joint Sealants
4. ASTM D 570 Standard Test Method for Water Absorption of Plastics
5. ASTM D 624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
6. ASTM D 638 Standard Test Method for Tensile Properties of Plastics
7. ASTM D 746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
8. ASTM D 747 Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
9. ASTM D 792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
10. ASTM D 1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
11. ASTM D 1752 Standard Specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
12. ASTM D 2240 Standard Test Method for Rubber Property-Durometer Hardness

D. FEDERAL SPECIFICATIONS (FS)

1. FS-TT-S-00227E Sealing Compound: Elastomeric Type, Multi-Component (For Calking, Sealing, and Glazing in Buildings and Other Structures)

1.4 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 – Submittal Procedures:

1. Submit certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified. ENGINEER, may take samples of any materials and have them tested by an independent testing laboratory to verify their compliance with these Specifications. All such costs shall be borne by OWNER. If any materials should fail to meet these Specifications, all costs for further testing of the replacement material shall be borne by CONTRACTOR.
2. Samples of factory fabricated waterstop joints representing in all respects the material and workmanship of the material that will be furnished under this contract. Samples will be submitted and approved by ENGINEER prior to use of the factory joints in the field.
3. Manufacturer's catalog data and manufacturer's recommended instructions for splicing of waterstops.

1.5 OBSTRUCTIONS

A. CONTRACTOR shall pay particular attention to removing all obstructions such as concrete, nails, etc., from joints when movements of floor or wall sections can be expected under temperature and other conditions.

1.6 QUALITY ASSURANCE

A. Waterstop manufacturer shall demonstrate five years (minimum) continuous, successful experience in production of waterstops.

1.7 DELIVERY AND STORAGE

A. Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.1 HORIZONTAL JOINT SEALANT

A. Horizontal joints not requiring waterstops or when so indicated on the Contract Drawings, shall be sealed using **Sikaflex-2c NS**, or approved equal, and shall meet the requirements of ASTM C-920, Type M, Grade NS, Class 25 and FS-TT-S-00227E, Type II, Class A, and shall be NSF 61 certified (Sikaflex 2c NS EZ) if in contact with potable water. Color shall match color of concrete slab.

2.2 JOINT PRIMER

A. All joints receiving a joint sealant shall be primed using **Sikaflex Primers 429**, or approved equal.

2.3 EXPANSION JOINTS

A. Expansion joints shall be composed of cellular fibers securely bonded together and uniformly saturated with asphalt. Joint shall be resilient, flexible, and non-extruding. Expansion joints shall meet the requirements of ASTM D 1751. Manufacturer shall be **Fibre Expansion Joint by W.R. Meadows, Fiberflex by JD Russel Company**, or approved equal.

2.4 PVC WATERSTOPS

A. Waterstops shall be of an approved type, supplied by an approved manufacturer and shall be plastic made of virgin polyvinylchloride (PVC) compound, shall be ribbed, uniform in dimensions, dense, homogeneous, free from porosity, and as detailed on the Contract Drawings. No reclaimed PVC shall be used in the compound. Waterstop in contact with potable water shall be NSF 61 certified.

B. The finished waterstop material shall meet the following minimum requirements:

Tensile strength	2,000 psi min.	(ASTM D 638)
Ultimate elongation	300% min.	(ASTM D 638)
Shore A hardness	75 ± 5	(ASTM D 2240)
Specific gravity	1.38 max	(ASTM D 792)
Stiffness in flexure	600 psi min.	(ASTM D 747)
Cold brittleness	No Failure at -35°F	(ASTM D 746)
Water absorption: 48 hours	0.15% max	(ASTM D 570)
Tear Resistance	290 lb./in. min.	(ASTM D 624)

C. Manufacturer, or approved equal:

1. Vinylex Waterstop & Accessories
2. Greenstreak, Inc. (Sika Corporation)
3. Durajoint Concrete Accessories

D. Factory made waterstop joints shall have a tensile strength across the joint equal to at least 600 psi. Field splices and joints shall be made in accordance with the waterstop manufacturer's instructions using a thermostatically controlled heating iron.

PART 3 EXECUTION

3.1 WATERSTOPS

A. Waterstops shall be of the type indicated and shall be installed at the locations shown to form a continuous water-tight diaphragm. The waterstop shall be correctly positioned in the forms so that the center of the waterstop is centered on the joint. Waterstop shall be held in place in the forms by use of a split form or other approved method that will positively hold the waterstop in the correct position and to the correct alignment. Vibrate concrete to obtain impervious concrete in the vicinity of all joints. In horizontal joints, ensure that the areas below the water stop are completely filled with concrete.

B. Horizontal plastic waterstops shall be bent up during placing of concrete until the concrete has been brought to the level of the waterstop; additional concrete shall then be placed over the waterstop, after which the concrete shall be thoroughly vibrated. All horizontal and vertical waterstops, which are not accessible during pouring, shall be tied off in two directions every 12 inches in such a manner that bending over one way, or another is prevented. A hog-ring or nail may be driven through both ends of the waterstop to facilitate placing and tying of waterstops to reinforcing steel forms or form-ties.

C. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. All waterstops shall be properly spliced and joints shall be checked for strength and pinholes after splicing. Splices shall be strong enough to develop a pulling force of 75 percent of the strength of the waterstop and shall be watertight. Splices in waterstop shall be made in conformance with the recommendations of the waterstop manufacturer. Continuity of cross-sectional features shall be maintained across the splice. Splices showing evidence of separation after bending shall be remade.

3.2 JOINTS

A. Joints shall be installed at locations indicated and as authorized. Joints shall be constructed to produce straight joints, and shall be vertical or horizontal, except where walls intersect sloping floors.

B. Construction Joints

1. Prior to placing the abutting concrete for all construction joints, the contact surface shall be cleaned by approved means to remove all laitance and expose the aggregate. The exposed portion of the reinforcing steel shall be cleaned of all concrete. The cleaning method shall be conducted to not damage the waterstop, if waterstop is present. Where the joint is to receive a sealant, a recess 3/4-inch deep shall be formed along the joint using a dressed-and-oiled wood strip or other method approved by ENGINEER. The wood strip shall be removed after the concrete has set.

C. Expansion Joints

1. Expansion joint filler shall be used where required on the Contract Drawings. The edges of the joint shall be neatly finished with an edging tool of 1/8-inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed-and-oiled wood strip temporarily secured to the top thereof to form a recess 3/4-inch deep to be filled with sealant. The wood strip shall be removed after the concrete has set. In lieu of the wood strip a removable expansion filler cap designed and fabricated for this purpose may be used.

D. Joint Sealant

1. The joint cavity shall be cleaned by sandblasting or power wire brushing and shall be blown clean of dust and sand with compressed air before the joint sealant may be applied. Joints must be frost-free, free of oils, grease, curing compound residues, and any other foreign matter that might prevent bond. A bond breaker tape shall be installed over the joint per manufacturer's instructions. After the joints have been prepared as described above, the joints shall be primed, and the sealant shall be applied in accordance with the manufacturer's recommendations.

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers cast-in-place concrete mix design and placement.

B. CONTRACTOR shall provide cast-in-place concrete as indicated in the Specifications and the Contract Drawings.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 45 00 Quality Control and Material Testing
3. Section 03 10 00 Concrete Forming and Accessories
4. Section 03 20 00 Concrete Reinforcement
5. Section 03 25 00 Expansion Joints, Construction Joints, and Waterstops
6. Section 09 90 00 Painting and Finishes
7. Section 31 23 23 Excavation and Backfill for Structures

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.

B. AMERICAN CONCRETE INSTITUTE (ACI)

1. ACI 117 Specifications for Tolerances for Concrete Construction and Materials and Commentary
2. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
3. ACI 301 Structural Concrete for Buildings
4. ACI 304 Guide for Measuring, Mixing, Transporting, and Placing Concrete
5. ACI 305R Hot Weather Concreting
6. ACI 306R Cold Weather Concreting
7. ACI 318 Building Code Requirements for Structural Concrete and Commentary
8. ACI 350R Code Requirements for Environmental Engineering Concrete Structures and Commentary

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM C 31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
2. ASTM C 33 Standard Specification for Concrete Aggregates
3. ASTM C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
4. ASTM C 42 Standard Test Method for Obtaining and Testing Drilled Cores and

Sawed Beams of Concrete

5. ASTM C 78 Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
6. ASTM C 94 Standard Specification for Ready-Mixed Concrete
7. ASTM C 109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
8. ASTM C 143 Standard Test Method for Slump of Hydraulic-Cement Concrete
9. ASTM C 150 Standard Specification for Portland Cement
10. ASTM C 171 Standard Specification for Sheet Materials for Curing Concrete
11. ASTM C 172 Standard Specification for Sampling Freshly Mixed Concrete
12. ASTM C 173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
13. ASTM C 192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
14. ASTM C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
15. ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete
16. ASTM C 309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
17. ASTM C 494 Standard Specification for Chemical Admixtures for Concrete
18. ASTM C 595 Standard Specification for Blended Hydraulic Cements
19. ASTM C 618 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
20. ASTM C 1157 Standard Performance Specification for Hydraulic Cement

D. NSF INTERNATIONAL (NSF)

1. NSF/ANSI 61 Drinking Water System Components - Health Effects.

1.4 DEFINITIONS

A. Average Strength (f_{cr}): The required average strength for 30 consecutive strength tests which statistically assures not more than the permissible proportions of tests will fall below Specified Strength.

B. Specified Strength (f_c'): The indicated strength.

1.5 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 – Submittal Procedures.

B. Provide catalog information for all products to be used as part of the submitted mix design.

C. The results of trial mix designs along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of each strength of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the work without additional tests to show that the quality of the concrete is satisfactory. Indicate

whether mixes have been designed for pumping. Include in the report the following information:

1. Water-cement ratio.
2. Air entrainment.
3. Proportion of materials in the mix.
4. Source and type of cement.
5. Analysis of water to be used unless potable.
6. Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used and the resulting change in placement times and strengths.
7. Slump, air content and temperature of samples.
8. Unit weight of fresh and dry light weight concrete.
9. Strength test data showing mix meets indicated strength requirements per ACI-301.

D. Preapproved Mix Design Data: If supplier has on record, an OWNER approved mix design, submit name and address of supplier for each mix design 1 day prior to using concrete mix.

E. Certified copies of laboratory test reports, including all test data, for aggregate, admixtures, and curing compound. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials. Test reports shall meet the following requirements:

1. Date of mix design: No older than 365 days from the date of submission.
2. Physical properties of the aggregate: Test results shall not be older than 455 days from the date of submission. A new report will be required if the aggregate source is changed.

F. Cementitious Materials showing Manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the specification under which it is furnished, for cement and pozzolan.

G. Submit catalog information on the curing compound and the proposed location(s) to be used.

1.6 QUALITY ASSURANCE

A. Do not change material sources, type of cement, air-entraining agent, water reducing agent, other admixtures, or aggregate without ENGINEER'S approval.

B. In proportioning materials for mixing, use scales certified by the State of Utah. Do not use volume measurement except for water and liquid admixtures.

C. Do not change the quantity of cement per cubic yard for approved mix design without written approval of ENGINEER.

D. Use of admixtures will not relax hot or cold weather placement requirements.

E. Ready-mixed concrete to be in accordance with Alternate No. 3 of ASTM C-94 and the requirements in this Section.

F. Tolerances for concrete construction and materials shall be in accordance with ACI 117.

1.7 PRODUCT STORAGE AND HANDLING

A. Store bagged and bulk cement in weatherproof enclosures to exclude moisture and contaminants.

B. Stockpile aggregate to avoid segregation and prevent contamination.

C. Avoid contamination, evaporation, or damage to admixtures. Protect liquid admixtures from freezing.

PART 2 PRODUCTS

2.1 ADMIXTURES

A. Admixtures shall be approved by ENGINEER prior to use. Any admixtures to be used shall be included in proposed concrete mix designs.

B. Air Entrainment: ASTM C 260.

C. Later Reducing and Set Retarding Agents: ASTM C494.

1. Type A: Set water reducing.
2. Type B: Set retarding.
3. Type C: Set accelerating.
4. Type D: Water reducing and set retarding.
5. Type E: Water reducing and set accelerating.
6. Type F: High range water reducing (super plasticizer).*
7. Type G: High range water reducing and set retarding.*

* The relative durability factor of water reducing admixtures shall not be less than 80 and the chlorides content (as Cl^-) expressed as a percent of the cement shall not exceed 0.1 percent by weight.

D. Calcium Chloride: None allowed.

E. Pozzolan: Pozzolan conforming to the requirements of ASTM C 618, Class F, is allowed as a Portland cement replacing agent under the following conditions:

1. The maximum percentage of Portland cement replacement is:
   a. 15 percent, for concrete exposed to weather.
   b. 20 percent, for interior concrete.
2. Pozzolan should not exceed 25% by weight of the cement plus pozzolans.
3. The minimum cement content shall be used in the design formulas before replacement is made.
4. Loss of ignition of pozzolan is less than 3 percent and the water requirement does not exceed 100 percent.
5. All other requirements of this section still apply.
6. Mix designs including trial batches are required for each aggregate source and for each concrete class.

F. Cementitious Materials showing Manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the specification

under which it is furnished, for cement and pozzolan.

2.2 CEMENTITIOUS MATERIALS

A. Cementitious materials shall each be of one type and from one source when used in concrete which will have surfaces exposed in the finished structure. Cementitious materials shall each be of one type and from one source when used in concrete which will have surfaces exposed in the finished structure. Cementitious materials shall conform to one of the following:

1. Cement: Use Portland cement, ASTM C 150, Type II, Type IIA, or Type V, low alkali, or ASTM C 595 and ASTM C 1157 IL(10)-A-MS, unless noted otherwise.
2. Portland - Pozzolan Cement: ASTM C 595, Type IP(20 Max)-A-MS. Do not use Pozzolan cement unless approved by ENGINEER.

B. Only one brand of cement from one manufacturing plant may be used.

2.3 AGGREGATES

A. Aggregates shall be natural aggregates, free from deleterious coatings, and shall conform to the requirements of ASTM C 33, except as modified herein. Aggregates shall not be potentially reactive as defined in Appendix XI of ASTM C 33. CONTRACTOR shall import nonreactive aggregates if local aggregates are reactive.

B. Fine Aggregates

1. Fine aggregate shall consist of clean, sharp, natural sand and shall conform to the requirements of ASTM C 33. Fine aggregate shall be graded as follows:

FINE AGGREGATES	
Sieve Size	Percent Passing by Weight
3/8 inch	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	10-30
#100	2-10

2. Fine aggregates shall have no more than two percent by weight passing #200 sieve.

C. Coarse Aggregate

1. Coarse aggregate shall be washed gravel or crushed stone, or a combination of these materials, consisting of hard, tough, durable particles free from adherent coatings. It shall contain no more than 15 percent flat or elongated particles. A thin, flat or elongated particle is defined as a particle having a maximum dimension in excess of five times its minimum dimension. Aggregate which has disintegrated or weathered badly under exposure conditions similar to those which will be encountered in the work under consideration shall not be used. Coarse aggregate shall be graded as follows (ASTM C 33):

COARSE AGGREGATES	
Sieve Size	Percent Passing by Weight
1-1/2 inch	100
1 inch	95-100
1/2-inch	25-60
#4	0-10
#8	0-5

2. Coarse aggregates shall have no more than 1.75 percent by weight passing #200 sieve. Proof of gradation will be provided to ENGINEER by CONTRACTOR.

2.4 ACI MIX DESIGN

A. The amount by which the average strength (f_{cr}) of a concrete mix exceeds the specified compressive strength (f'_c) shall be based upon no more than 1 in 100 random individual strength tests falling more than 500 psi below the specific strength.

B. Proportion the materials in accordance with ACI 211.1, 211.2 or 211.3 as applicable to produce concrete having the properties or limitations of Table No. 03 30 00-A.

2.5 HAND MIXING

A. Do not hand mix batches exceeding 0.5 cubic yards.

B. Hand mix only on watertight platform. Mix cement and aggregate prior to adding water.

C. Ensure all stones are thoroughly covered with mortar and mixture is of uniform color and consistency.

2.6 HEATING, WATER AND AGGREGATE

A. Do not allow products of fuel combustion to contact the aggregate.

B. Heat mixing water to maximum temperature of 150 degrees F. Heat aggregates uniformly.

C. Do not mix cement with water and aggregate at a mix temperature greater than 100 degrees F.

2.7 WATER

A. Water shall be potable, except that non-potable water may be used if it produces cylinders having 7- and 28-day strengths at least 90 percent of the strength of similar specimens made with water from a municipal supply. The strength comparison shall be made on cylinders, identical except for mixing water, prepared and tested in accordance with ASTM C 109. Water for curing shall not contain any substance injurious to concrete, or which causes staining.

2.8 PROPORTIONS OF MIX

A. Mixture Proportioning, Normal Weight Concrete: All concrete that must be watertight and resistant to freeze-thaw cycles and to naturally occurring or commonly used chemicals should be air entrained. All materials should be proportioned to produce a well-graded

mixture of high density and maximum workability with a minimum specified 28-day compressive strength of concrete classification. Trial batches shall contain materials proposed to be used in the project. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios. Trial mixes shall be proportioned to produce concrete strengths specified. In the case where ground iron blast-furnace slag is used, the weight of the slag will be substituted in the equations for the term P which is used to denote the weight of pozzolan. Trial mixtures shall be designed for maximum permitted slump and air content. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results a curve shall be plotted showing the relationship between water-cement ratio and strength. Maximum water-cement or water-cement plus pozzolan Ratio: 0.45.

B. Average Strength: In meeting the strength requirements specified, the selected mixture proportion shall produce an average compressive strength exceeding the specified strength by the amount indicated below. Where a concrete production facility has test records, a standard deviation shall be established. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at other test age designated for determination of the specified strength. TABLE NO. 03 30 00-1

CONCRETE MIX PROPERTIES (e)		
CONCRETE PROPERTIES	CONCRETE CLASSIFICATION(S)	
	Class 4000	Class 3000
Specified Compressive Strength $f_{c'}$ at 28 days, min., psi	4,000	3,000 (d)
Compressive Strength at 7 days, min., psi (a)	3,015	2,010
Cement content (94 lb. sacks of cement per cubic yard of concrete), min. (b)	7.0	5.5
Entrained air content, (% by volume).	6±1	6±1
Slump Range, in. (c)	1 - 4 (f)	2 - 4
Maximum Water Cement Ratio	0.45	0.45

(a) Used for monitoring purposes only.
(b) May include pozzolan replacements if approved by ENGINEER.
(c) Not more than 8 inches after adding high range water reducing admixture at site.

(d) Not allowed if concrete is exposed to freezing and thawing temperatures. Use Class 4000 or higher compressive strength and 6±1.0 percent air entrainment.
(e) All mix designs must be approved by ENGINEER.
(f) 1-3" for footings, sub-structural walls and 1-4" for slabs, beams, reinforced walls and columns.

2.9 CURING MATERIALS

A. Normal Curing Compound

1. The curing compound shall be white pigmented and shall conform to ASTM C 309, Type 2 Class B.
2. Sodium silicate compounds cannot be used.
3. Manufacturer, or approved equal:
   a. 1200-White by W.R. Meadows
   b. White Resin Cure J10W by Dayton Superior
   c. Safe-Cure 2000 by ChemMasters
   d. Aqua Kure White by Lambert Corporation

B. Dissipating Curing Compound

1. When the curing compound must be removed for finishes or grouting, compounds shall be of a dissipating type, conforming to the requirements of ASTM C 309, Type 1 or Type 2, Class B
2. Manufacturer, or approved equal:
   a. 1100-Clear by W.R. Meadows
   b. Kurez DR VOX by Euclid Chemical Company
   c. Clear Cure VOC J7WB by Dayton Superior
   d. Safe-Cure Clear DR by ChemMasters

PART 3 EXECUTION

3.1 GENERAL

A. CONTRACTOR shall inform ENGINEER at least 72 hours in advance of time and places at which CONTRACTOR intends to place concrete. All preparation work for concrete placements shall be substantially completed at least 2 workdays prior to the scheduled start of concrete placement to allow for ENGINEER's review and any necessary corrections.

B. Provide concrete with the minimum compressive strengths at 28 days per Table 03 30 00-2.

TABLE NO. 03 30 00-2

TYPE OF WORK	MIN 28-DAY COMPRESSIVE STRENGTH (PSI)
Buried Vaults	4,500
Thrust Blocks	3,000

3.2 PREPARATION OF SURFACES

A. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Conduit and other similar items shall be in place and clean of any deleterious substance.

B. Foundations: Earthwork shall be as specified. Flowing water shall be diverted without washing over freshly deposited concrete. Rock foundations shall be cleaned by high velocity air-water jets, sandblasting, or other approved methods. Debris and loose, semi-detached or unsound fragments shall be removed. Rock surfaces shall be moist but without free water when concrete is placed. Semi porous subgrades for foundations and footings shall be damp when concrete is placed. Pervious subgrades shall be sealed by blending impervious material with the top 6 inches of the in-place pervious material or by covering with an impervious membrane.

C. Preparation of Previously Placed Concrete: Concrete surfaces to which other concrete is to be bonded shall be roughened in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be moist but without free water when concrete is placed.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Embedded items shall be free from oil, loose scale or rust, and paint. Embedded items shall be installed at the locations indicated and required to serve the intended purpose. Voids in sleeves, slots and inserts shall be filled with readily removable material to prevent the entry of concrete.

B. Reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms at locations as indicated or shown on the Contract Drawings. Proper placement and locations shall be the responsibility of CONTRACTOR.

3.4 BATCHING, MIXING AND TRANSPORTING CONCRETE

A. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and non-agitating units shall comply with NRMCA TMMB-1. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA-QC 3.

B. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quantity and quality of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by ENGINEER.

C. Truck mixers and their operation must be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than 1 inch when the specified slump is 3 inches or less, or more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of

the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

D. Admixtures: Admixtures shall be batched within an accuracy of 3 percent. Where two or more admixtures are used in the same batch, they shall be batched separately and must be compatible. Retarding admixture shall be added within one minute after addition of water is complete or in the first quarter of the required mixing time, whichever is first. Superplasticizing admixtures shall be added at the project site, and the concrete with the admixture shall be mixed 4 to 5 minutes before placing as recommended by manufacturer. Concrete that shows evidence of total collapse or segregation caused by the use of admixture shall be removed from the site.

E. Control of Mixing Water: No water from the truck system or elsewhere shall be added after the initial introduction of mixing water for the batch. No water shall be added at the jobsite without the approval of ENGINEER.

3.5 SAMPLING AND TESTING

A. Sampling and Testing of the concrete will be as defined in Section 01 45 00 – Quality Control and Material Testing. If there are discrepancies between this Section and Section 01 45 00, the more stringent requirement shall apply.

1. Aggregates: Aggregates for normal weight concrete shall be sampled and tested in accordance with ASTM C 33.
2. Sampling of Concrete: Samples of concrete for air, slump, unit weight, and strength tests shall be taken in accordance with ASTM C 172.
    a. Air Content: Test for air content shall be performed in accordance with ASTM C 173 or ASTM C 231. A minimum of 1 test shall be conducted each time a slump test is made.
    b. Slump: At least 1 slump test shall be made on randomly selected batches of each mixture of concrete for every 100 cubic yards of ready-mixed concrete delivered to the job site. Also note the time batched at the plant and the starting time when unloading began at the site. Tests shall be performed in accordance with ASTM C 143.
    c. Temperature: Concrete and air temperatures shall be measured and recorded with each slump test or with each set of cylinders and the air temperature shall also be recorded when the air temperature at the site is 40 degrees F or below and/or 90 degrees F or above.
3. Evaluation and Acceptance of Concrete
    a. Frequency of Testing: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 100 cubic yards of concrete, nor less than once for each 3,000 square feet of surface area for slabs or walls. If this sampling frequency results in less than 5 strength tests for a given class of concrete, tests shall be made from at least 5 randomly selected trucks or from each truck if fewer than 5 truck loads are used. Field cured specimens for determining form removal time or when a structure may be put in service shall be made in numbers directed to check the adequacy of curing and protection of concrete in the structure. The specimens shall be removed from the molds at the age of 24 hours and shall be cured and protected, insofar as practicable, in the same manner as that given to the portion of the structure the

samples represent. Each sample used to mold strength test specimens shall be tested for slump, air content, and temperature.

b. Testing Procedures: Cylinders for acceptance tests shall be molded and cured in accordance with ASTM C 31. Cylinders shall be tested in accordance with ASTM C 39. A strength test shall be the average of the strengths of two (2) 6-inch diameter by 12-inch high cylinders made from the same sample of concrete and tested at 28 days or at another specified test age. If 4-inch diameter cylinders are used, the strength shall be the average of the strengths of three (3) 4-inch by 8-inch high cylinders.

c. Evaluation of Results: Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength and no individual strength test result falls below the required strength by more than 500 pounds per square inch.

d. Unless noted otherwise, make a minimum of five (5) 6-inch diameter by 12-inch high concrete cylinders or six (6) 4-inch diameter by 8-inch high cylinders each time a test is required. When concrete is being placed in suspended slabs, beams and retaining walls make two (2) extra cylinders which must be cured on site. The extra cylinders will be used to determine when to remove forms and/or when to backfill.

B. Investigation of Low-Strength Test Results: When any strength test of standard-cured test cylinder falls below the specified strength requirement by more than 500 pounds per square inch, or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized. Nondestructive testing in accordance with ASTM C 597, ASTM C 803 or ASTM C 805 may be permitted by ENGINEER to determine the relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used as a basis for acceptance or rejection. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in a place that is considered potentially deficient. The location of cores shall be determined by ENGINEER to least impair the strength of the structure. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for seven days before testing and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C 42. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to or at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. If the core tests are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the structure, load tests may be directed by ENGINEER in accordance with the requirements of ACI 318. Concrete work evaluated by structural analysis or by results of a load test and found deficient shall be corrected in a manner satisfactory to ENGINEER. All investigations, testing, load tests, and correction of deficiencies shall be performed, and approved by ENGINEER, at the expense of CONTRACTOR.

3.6 CONVEYING CONCRETE

A. Concrete shall be conveyed from mixer to forms as rapidly as possible and within the time interval specified in paragraph 3.7 CONCRETE PLACEMENT by methods which will prevent segregation or loss of ingredients. Conveying concrete shall be in accordance with the requirements of ACI 304.

1. Chutes: When concrete can be placed directly from a truck mixer or other transporting equipment, chutes attached to this equipment may be used. Separate chutes will not be permitted except when specifically approved.
   a. Use metal or metal lined chutes with a maximum length of 20-feet.
   b. The minimum slopes of chutes shall be such that concrete of the indicated consistency will readily flow in them.
2. Buckets: Bucket design shall be such that concrete of the required slump can be readily discharged. Bucket gates shall be essentially grout tight when closed. The bucket shall provide means for positive regulations of the amount and rate of deposit of concrete in each dumping position.
3. Pumps: Concrete may be conveyed by positive displacement pumps when approved. Pump shall be the piston or squeeze pressure type. Pipeline shall be steel pipe or heavy-duty flexible hose. Inside diameter of the pipe shall be at least three times the maximum size of the coarse aggregate. Distance to be pumped shall not exceed the limits recommended by the pump manufacturer. Concrete shall be supplied to the pump continuously. When pumping is completed, the concrete remaining in the pipeline shall be ejected without contaminating the concrete in place. After each use, the equipment shall be thoroughly cleaned. Flushing water shall be wasted outside the forms.

3.7 CONCRETE PLACEMENT

A. Mixed concrete which is transported in truck mixers or agitators or concrete which is truck mixed, shall be discharged within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. These limitations may be waived by ENGINEER if the concrete is of such slump after the 1-1/2 hour time or 300 revolution limit has been reached that it can be placed, without the addition of water to the batch. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the truck.

1. Placing Operation: Concrete shall be handled from mixer to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by CONTRACTOR prevent proper consolidation, finishing and curing. Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 4 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Concrete should not be allowed to drop through a cage of reinforcing steel. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be

screened to the proper level to avoid excessive shimming or grouting.

a. Additional requirements for depositing concrete in walls include, but are not limited to:
    1) Deposit concrete in a continuous operation until section is completed.
    2) Place concrete in approximately horizontal layers 2 ft maximum thickness.
    3) Each layer of concrete shall be plastic when covered with the following layer.
    4) Rate of vertical rise not more than 4 ft per hour.
    5) Pump concrete or use a tremie having varying lengths for placing concrete in columns and walls to prevent free fall of more than 4 ft.
    6) Allow concrete to thoroughly settle before top is finished. Remove all laitance, debris, and surplus water from surfaces at tops of forms by screeding, scraping, or other effective means.

b. Additional requirements for depositing concrete in slabs include, but are not limited to:
    1) Deposit concrete in a continuous operation until section is completed.
    2) Concrete shall be deposited as nearly as practicable to its final position to avoid segregation due to rehandling or flowing.
    3) In sloping slabs, proceed uniformly from the bottom of the slab to the top for the full width of the placement.

2. Consolidation: Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 8,000 vibrations per minute, and the head diameter and amplitude shall be appropriate for the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a few inches. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then withdrawn slowly. The use of form vibrators must be specifically approved. Vibrators shall not be used to transport concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique.

B. Cold Weather Requirements: Cold weather requirements shall conform to ACI 306 and this Specification. Special protection measures, approved by ENGINEER, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. Provisions should be made to keep the concrete at a minimum temperature of 50 degrees F for 7 days. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 32 degrees F. No concrete shall be placed on frozen ground. The temperature of the concrete when placed shall be not less than 55 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals, or other materials shall not be incorporated in the concrete to prevent freezing. Calcium chloride shall not be used.

C. Hot Weather Requirements: Hot weather requirements shall conform to ACI 305 and this Specification. The temperature of the concrete placed during hot weather shall not exceed

85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 95 degrees F.

3.8 CONSTRUCTION JOINTS

A. Construction joints shall be located as indicated on the Contract Drawings. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of ENGINEER. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete is no longer plastic, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints are required, a strip of 1-inch square-edge lumber, beveled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph 3.2, PREPARATION OF SURFACES.

3.9 FINISHING CONCRETE

A. Formed Surfaces

1. Repair of Surface Defects: Surface defects shall be repaired within 24 hours after the removal of forms. Honeycombed and other defective areas shall be cut back to solid concrete or to a depth of not less than 1 inch, whichever is greater. Edges shall be cut perpendicular to the surface of the concrete. The prepared areas shall be dampened and brush-coated with neat cement grout. The repair shall be made using mortar consisting of not more than 1 part cement to 2-1/2 parts sand. The mixed mortar shall be allowed to stand to stiffen (approximately 45 minutes), during which time the mortar shall be intermittently remixed without the addition of water. After the mortar has attained the stiffest consistency that will permit placing, the patching mix shall be thoroughly tamped into place by means approved by ENGINEER and finished slightly higher than the surrounding surface. For Class A and Class B finished surfaces the cement used in the patching mortar shall be a blend of job cement and white cement proportioned to produce a finished repair surface matching, after curing, the color of adjacent surfaces. Holes left after the removal of form ties shall be cleaned and filled with patching mortar. Holes left by the removal of tie rods shall be reamed and filled by dry packing. Repaired surfaces shall be cured as required for adjacent surfaces. The temperature of concrete, mortar patching material, and ambient air shall be above 50 degrees F while making repairs and during the curing period. Concrete with defects which affect the strength of the member or with excessive honeycombs will be rejected, or the defects shall be corrected as directed by ENGINEER.
2. Class A Finish: Where a Class A finish is indicated, fins shall be removed. A mortar mix consisting of one-part Portland cement and two parts well-graded sand passing a No. 30 sieve, with water added to give the consistency of thick paint, shall be prepared. White cement shall be used to replace part of the job cement. After the surface has

been thoroughly wetted and allowed to approach surface dryness, the mortar shall be vigorously applied to the area by clean burlap pads or by cork or wood-floating, to completely fill all surface voids. Excess grout shall be scraped off with a trowel. As soon as it can be accomplished without pulling the mortar from the voids, the area shall be rubbed with burlap pads until all visible grout film is removed. The rubbing pads shall have on their surfaces the same sand-cement mix specified above but without any mixing water. The finish of any area shall be completed in the same day, and the limits of a finished area shall be made at natural breaks in the surface. The surface shall be continuously moist cured for 48 hours. The temperature of the air adjacent to the surface shall be not less than 50 degrees F for 24 hours prior to, and 48 hours after, the application. In hot, dry weather the smooth finish shall be applied in shaded areas.

3. Class B Finish: Where a Class B finish is indicated, fins shall be removed. Concrete surface shall be smooth with a texture at least equal to that obtained using Grade B-B plywood forms.
4. Class C Finish: Where a Class C finish is indicated, fins shall be removed. Concrete surfaces shall be relatively smooth with a texture imparted by the forms used.
5. Class D Finish: Where a Class D finish is indicated, fins exceeding 1/4 inch in height shall be chipped or rubbed off. Concrete surfaces shall be left with the texture imparted by the forms used.
6. See Specification Section 09 90 00 Painting and Finishes for required finishes.

B. Unformed Surfaces: In cold weather, the air temperature in areas where concrete is being finished shall not be less than 50 degrees F in accordance with ACI 306R. In hot windy weather when the rate of evaporation of surface moisture, as determined by methodology presented in ACI 305R, may reasonably be expected to exceed 0.2 pounds per square foot per hour; coverings, windbreaks, or fog sprays shall be provided as necessary to prevent premature setting and drying of the surface. The dusting of surfaces with dry materials or the addition of water during finishing will not be permitted. Finished surfaces shall be plane, with no deviation greater than 5/16-inch when tested with a 10-foot straightedge. Surfaces shall be pitched to drains.

1. Rough-Slab Finish: Slabs to receive fill or mortar setting beds shall be screened with straightedges immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible.
2. Float Finish: Slabs to receive a steel trowel finish and slabs where indicated shall be given a float finish. Screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. After the concrete has stiffened to permit the operation and the water sheen has disappeared, it shall be wood floated. Concrete that portrays stickiness shall be finished with a magnesium float in lieu of a wood float and left free of ridges and other projections. Float finish is normally specified for surfaces that will receive other treatment such as built-up roofing, nonslip surfacing material. Float Finish shall not be used on wearing surfaces.
3. Trowel Finish: Slabs where indicated, shall be given a trowel finish immediately following floating. Surfaces shall be trowelled to produce smooth, dense slabs free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. A final hard steel troweling shall be done by hand. Trowel finish shall be used on wearing surfaces and where a smooth finish is required.
4. Broom Finish: After floating, slabs where indicated, shall be lightly troweled, and then

broomed with a fiber-bristle brush in a direction transverse to that of the main traffic.

5. See Specification Section 09 90 00 Painting and Finishes for required finishes.

3.10 CURING AND PROTECTION

A. General: All concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
Concrete with Type II or IIA, or V, low alkali cement	7 days
Concrete with Type IP-A(MS) cement blended with pozzolan	10 days

B. Immediately after placement, concrete shall be protected from premature drying extremes in temperatures, rapid temperature change, mechanical injury and injury from rain and flowing water. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. All materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat shall be permitted near or in direct contact with the concrete at any time. Curing shall be accomplished by any of the following methods, or combination thereof, as approved.

C. Moist Curing: Concrete to be moist cured shall be maintained continuously wet for the entire curing period. If water or curing materials used stains or discolors concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned. When wooden forms are left in place during curing, they shall be kept wet at all times. If the forms are removed before the end of the curing period, curing shall be carried out on unformed surfaces, using suitable materials. Horizontal surfaces shall be cured by ponding, by covering with a 2-inch minimum thickness of continuously saturated sand, or by covering with waterproof paper, polyethylene sheet, polyethylene-coated burlap, or saturated burlap. Once the moist curing has started the concrete surface must not be allowed to become surface dry for the entire curing period.

D. Membrane Curing:

1. Normal membrane curing compound shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete. Use a Dissipating curing compound for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring.
2. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam.
3. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface.
4. Surfaces shall be thoroughly moistened with water and the curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops

of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period.

5. Compound shall be applied in a one-coat continuous operation by mechanical spraying equipment, at a uniform coverage in accordance with the manufacturer's printed instructions.
6. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified.
7. On surfaces permanently exposed to view, the surface shall be shaded from direct rays of the sun for the duration of the curing period.
8. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3.11 QUALITY CONTROL TESTING

A. Quality Control Testing shall be in accordance with Section 01 45 00 – Quality Control and Material Testing.

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SECTION 03 31 05
CONTROLLED LOW STRENGTH MATERIAL

PART 1 GENERAL

1.1 REQUIREMENTS

A. CONTRACTOR shall provide Controlled Low Strength Material (CLSM), complete and in place, in accordance with the Contract Documents.

B. CLSM shall be placed where indicated and may be used, if ENGINEER approves, for the following purposes:

1. Normal CLSM with high slump, non-segregating consistency that readily flows and fills voids and difficult to reach places: pipe zone fill, trench zone fill, pipe abandonment, structure backfill, and structure cavity fill.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 31 23 15 Excavation and Backfill for Buried Pipelines

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM C 33 Standard Specification for Concrete Aggregates
2. ASTM C 94 Standard Specification for Ready-Mixed Concrete
3. ASTM C 138 Standard Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete
4. ASTM C 150 Standard Specification for Portland Cement
5. ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete.
6. ASTM C 403 Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
7. ASTM C 494 Standard Specification for Chemical Admixtures for Concrete
8. ASTM C 595 Standard Specification for Blended Hydraulic Cements
9. ASTM C 618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
10. ASTM C 803 Standard Test Method for Penetration Resistance of Hardened Concrete
11. ASTM C 1157 Standard Performance Specification for Hydraulic Cement
12. ASTM D 4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
13. ASTM D 4832 Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

1.4 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings:

1. CLSM mix designs which show the proportions and gradations of all materials proposed for each type of CLSM indicated. Each mix design shall be accompanied by independent laboratory test results of the indicated properties.
2. If Contractor proposes to provide lower strength CLSM with aggregates that do not conform to ASTM C 33, Shop Drawings shall include a testing program that will be used to control the variability of the aggregates. The testing program shall be acceptable to ENGINEER.

1.5 QUALITY ASSURANCE:

A. All testing will be done by a testing laboratory at CONTRACTOR'S expense, except as otherwise indicated.

B. If tests of the CLSM show non-compliance with the specifications, CONTRACTOR shall make changes as may be required to achieve compliance. Performing and paying for subsequent testing to show compliance shall be CONTRACTOR's responsibility.

C. Correlation Tests

1. CONTRACTOR shall perform a field correlation test for each mix of CLSM used in pipe zone, trench zone, or backfill used in amounts greater than 100 cubic yards or when CLSM is required to support traffic or other live loads on the fill less than 7 days.
2. Field correlation tests shall be performed in a test pit similar in cross section to the WORK and at least 10-feet long at a location near the WORK. The proposed location shall be acceptable to ENGINEER.
3. Laboratory and field tests shall be performed on samples taken from the same CLSM batch mix. All tests shall be performed by a laboratory at CONTRACTOR's expense.
4. Testing shall be performed once each 2-hours during the first 8 hours, once each 8-hours during the first week, and once each 24-hours until the CLSM mix reaches the maximum design strength.
   a. Compression testing shall be in accordance with ASTM D 4832.
   b. Setting test shall be in accordance with ASTM C 403.
   c. Density tests shall be in accordance with ASTM C 138.

PART 2 PRODUCTS

2.1 CONTROLLED LOW STRENGTH MATERIAL

A. CLSM shall be a mixture of cement, pozzolan, coarse and fine aggregate, admixtures, and water, mixed in accordance with ASTM C 94.

B. Composition: The following parameters shall be within the indicated limits and as necessary to produce the indicated compressive strengths.

1. The actual mix proportions and flow characteristics shall be determined by the producer of the CLSM to meet requirements for compressive strength as specified for Normal CLSM.
2. Entrained air content shall be between 15 percent minimum and 30 percent maximum.

3. Water reducing agent content as necessary.

C. Properties

1. Density shall be between 120 PCF minimum and 145 PCF maximum.
2. Slump shall be as required by CONTRACTOR methods, but shall not promote segregation, nor shall slump exceed 10 inches.
3. Compressive strength at 28 days:
   a. Normal CLSM: Between 100 psi minimum and 300 psi maximum. Unless specifically indicated otherwise, all CLSM shall be Normal CLSM.

2.2 CEMENT

A. Cement shall be Type ll in accordance with ASTM C 150 or Type IP(10)-MS or Type IL(10)-MS per ASTM C 595 and ASTM C 1157.

2.3 POZZOLAN

A. Pozzolan shall be Type F or C in accordance with ASTM C 618. Pozzolan content, by weight, in Normal CLSM, shall not be greater than 90 percent.

2.4 AGGREGATE

A. Aggregate shall consist of a well graded mixture of crushed rock, soil, or sand, with a nominal maximum size of 3/8-inch. One hundred percent shall pass the 1 inch sieve; no more than 30 percent shall be retained on the 3/8-inch sieve; and no more than 12 percent shall pass the number 200 sieve. If more than 5 percent of the aggregate passes the number 200 sieve, the material passing the number 200 sieve shall have a plasticity index of less than 0.73(liquid limit-20), when tested in accordance with ASTM D 4318. All aggregate shall be free from organic matter and shall not contain more alkali, sulfates, or salts than the native materials at the Site.

2.5 ADMIXTURES

A. Air entraining admixtures shall be in accordance with ASTM C 260.

B. Water reducing admixtures shall be in accordance with ASTM C 494.

2.6 WATER

A. Water shall be potable, clean, and free from objectionable quantities of silt, organic matter, alkali, salt, and other impurities.

PART 3 EXECUTION

3.1 PREPARATION

A. Subgrade and compacted fill to receive CLSM shall be prepared according to Section 31 23 15 Excavation and Backfill for Buried Pipelines.

3.2 BATCHING, MIXING AND DELIVERY

A. Batching, mixing, and delivery of CLSM shall conform to ASTM C 94. CLSM shall be mixed at a batch plant acceptable to the ENGINEER and shall be delivered in standard transit mix trucks.

3.3 PLACEMENT

A. CLSM shall be placed by tailgate discharge, conveyor belts, pumped, or other means acceptable to the ENGINEER. CLSM shall be directed in place by vibrator, shovel, or rod to fill all crevices and pockets. Avoid over-consolidation which causes separation of aggregate sizes.

B. CLSM shall be continuously placed against fresh material unless otherwise approved by ENGINEER. When new material is placed against existing CLSM, the placement area shall be free from all loose and foreign material. The surface of the existing material shall be soaked a minimum of one hour before placement of fresh material but no standing water shall be allowed when placement begins.

C. CLSM placement for piping. Pipe shall be placed on soil pads and bedding placed under the pipe from one side and vibrated, as necessary, so that the CLSM flows to the opposite side. CLSM shall then be added to both sides of the pipe and vibrated until it fills the space between the pipe and the excavated trench bottom. CLSM shall be deposited in such a manner as to avoid uplift and deposited in its final position to avoid disturbing the pipe trench causing foreign material to mix with the cement slurry.

D. Pipe zone backfill shall not be placed or compacted until the CLSM has reached initial set. Pipes placed on steep slopes may require a stiffer mix to prevent CLSM from flowing down the trench. Vibration may be required to ensure that the CLSM fills all voids.

E. Temperature of the CLSM shall be between 50 and 90 degrees F, when placed. CLSM shall not be placed when the air temperature is below 40 degrees F. No CLSM shall be placed against frozen subgrade or other materials having temperature less than 32 degrees F.

3.4 FINISHING

A. The finish surface shall be smooth and to the grade indicated or directed by the ENGINEER. Surfaces shall be free from fins, bulges, ridges, offsets, and honeycombing. Finishing by wood float, steel trowel, or similar methods is not required.

3.5 CURING

A. CLSM shall be kept damp for a minimum of 7 days or until final backfill is placed.

3.6 PROTECTION

A. CLSM shall be protected from freezing for 72 hours after placement.

B. No fill or loading shall be placed on CLSM until probe penetration resistance, as measured in accordance with ASTM C 803 exceeds 650 psi.

C. CLSM shall be protected from running water, rain, and other damage until the Material has been accepted and final fill completed.

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SECTION 03 60 00
GROUT

PART 1 GENERAL

1.1 REQUIREMENTS

A. CONTRACTOR shall provide grout, complete and in place, in accordance with the Contract Documents.

B. Unless indicated otherwise, grout shall be provided as listed in this Section whether indicated on the Contract Drawings or not.

C. Grout in contact with potable water shall be NSF 61 certified.

D. The following types of grouts are covered in this Section:

1. Cement Grout
2. Non-Shrink Grout – Class I (cement based)
3. Topping Grout and Concrete/Grout Fill

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 60 00 Product Requirements
3. Section 03 30 00 Cast-in-Place Concrete

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. American Society for Testing Materials (ASTM)

1. ASTM C 33 Standard Specification for Concrete Aggregates
2. ASTM C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
3. ASTM C 150 Standard Specification for Portland Cement
4. ASTM C 307 Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings
5. ASTM C 494 Standard Specification for Chemical Admixtures for Concrete
6. ASTM C 496 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
7. ASTM C 531 Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
8. ASTM C 579 Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

9. ASTM C 580 Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
10. ASTM C 595 Standard Specification for Blended Hydraulic Cements
11. ASTM C 827 Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
12. ASTM C 881 Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
13. ASTM C 882 Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear
14. ASTM C 939 Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
15. ASTM C 942 Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory
16. ASTM C 1090 Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout
17. ASTM C 1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
18. ASTM C 1157 Standard Performance Specification for Hydraulic Cement
19. ASTM C 1339 Standard Test Method for Flowability and Bearing Area of Chemical-Resistant Polymer Machinery Grouts
20. ASTM D 648 Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
21. ASTM D 695 Standard Test Method for Compressive Properties of Rigid Plastics

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01 33 00 – Submittal Procedures.

B. Provide the following submittals for each type of grout used on the project:

1. Test reports accompanied by a manufacturer's statement that previously tested material is of similar type, quality, and manufacture as that which is proposed for use on this project shall be submitted for:

    a. Cement
    b. Aggregates
    c. Retardants
    d. Bonding compounds
    e. Epoxy Resin
2. Certifications that grout used on the project contain no chlorides or other chemicals that cause corrosion.
3. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, curing, and appropriate uses for each type of grout used in the WORK, and location of use. ICBO/ES report shall be submitted for epoxy anchor grout for adhesive anchors.
4. Manufacturer's certification that non-shrink grout does not contain aluminum, zinc, or magnesium powders as a method of expansion.
5. Submit manufacturer's written warranty as indicated herein.

6. Name and telephone number of grout manufacturer's representative who will give on-Site service. The representative shall have at least one year of experience with the indicated grout.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Grout and grout materials shall be stored in a dry shelter, protected from moisture, and for prepackaged grout, maintained in accordance with the manufacturer's recommendations.

1.6 QUALITY ASSURANCE

A. The work shall be subject to inspection at all times by OWNER and ENGINEER for the purpose of determining that the work is properly executed in accordance with this specification. Failure to detect defective workmanship or material during any interim inspection shall not constitute acceptance of workmanship and materials.

B. All testing will be done by a testing laboratory at CONTRACTOR'S expense, except as otherwise indicated.

C. Field Tests

1. Compression test specimens will be taken from the first placement of each type of grout, and at intervals thereafter selected by ENGINEER.
2. Compression tests and fabrication of specimens for cement grout and cement based non-shrink grout will be performed in accordance with ASTM C 1107, at intervals during construction selected by ENGINEER. A set of 3 specimens will be made for testing at 7 Days, 28 Days, and each additional time period as appropriate.
3. Compression tests and fabrication of specimens for topping grout and concrete/grout fill will be performed in accordance with Section 03 31 00 - Cast-in-Place Concrete, at intervals during construction selected by ENGINEER.
4. Compression tests and fabrication of specimens for epoxy grouts will be performed in accordance with ASTM C 579, Method B, at intervals during construction selected by ENGINEER. A set of 3 specimens will be made for testing at 7 Days and each earlier time period as appropriate.

D. Construction tolerances shall be as indicated in Section 03 30 00 Cast-in-Place Concrete unless noted otherwise.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement: Portland cement shall be Type II or Type V per ASTM C 150 or Type IL(10)-MS or HS per ASTM C 595 and ASTM C 1157.

B. Aggregate:

1. General: Aggregate shall be non-reactive and shall be washed before use. When sources of aggregate are changed, test reports shall be provided for the material from the new source prior to commencing grout work.
2. Fine Aggregate: Fine aggregate shall be sand or crush stone conforming to ASTM C 33 as modified herein. When tested in accordance with ASTM C 136, gradation shall be such that 100 percent by weight passes a No. 8 sieve and not less than 45 percent by weight passes a standard No. 40 sieve. Variation from the specified gradation in individual tests will be accepted if the average of three consecutive tests is within the following variation:

Standard Sieve	Permissible Variation in Individual Test
No. 30 or coarser	2% by weight
No. 50 or finer	0.5% by weight

C. Admixtures

1. General: Admixtures shall be compatible with the grout and shall comply with the manufacturer's recommendations. Admixtures shall be added to the grout mix separately.
2. Water Reducing Retarder: Water reducing retarder shall comply with ASTM C 494, Type D and shall be **Master Builders (BASF) MasterSet R 300, Sika Corporation Plastiment**, or approved equal.
3. Lubricant: Lubricant additive for cement pressure grouting shall be **Sika Intraplast**, or approved equal.

D. Water:

1. Water for washing aggregate, for mixing and for curing shall be potable, shall not contain more than 1,000 mg/L of chlorides as Cl, nor more than 1,300 mg/L of sulfates as SO_4, and shall not contain impurities which may change the setting time by more than 25 percent or a reduction of more than 5 percent of the compressive strength of the grout at 14 days when compared to the results for grout made with distilled water.

2.2 CEMENT GROUT

A. Application: Surface repairs of concrete.

B. Cement grout shall be composed of one part cement, 3 parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 Days shall be 4000 psi.

C. Cement grout materials shall be as indicated in Section 03 30 00 Cast-in-Place Concrete.

2.3 NON-SHRINK GROUT

A. General

1. Non-shrink cementitious grout shall be a flowable, prepackaged, inorganic, non-metallic, cement type grout requiring only the addition of water. Cement from kilns burning metal-rich hazardous waste fuel shall not be used. The manufacturer shall

have at least 10 years' experience in the manufacture of cement-based grouts. The manufacturer shall provide technical services and provide a representative at the jobsite for product training prior to product installation.

2. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout shall be as recommended by the manufacturer for the application.
3. Grout shall not contain chlorides or additives that may contribute to corrosion.
4. Grout shall be formulated to be used at any consistency from fluid to plastic.
5. Cement-based non-shrink grout shall have the following minimum properties when tested at a fluid consistency, at 28 Days:
   a. Minimum tensile splitting strength of 500 psi per ASTM C 496.
   b. Minimum flexural strength of 1,000 psi per ASTM C 580.
   c. Minimum bond strength (concrete to grout) of 1,900 psi per modified ASTM C 882.
   d. Grout shall be certified for use in freeze/thaw environments.

B. Class I Non-Shrink Grout

1. Application: Anchor bolts and reinforcing steel required to be set in grout in which the average working or operating temperature will be over 100 degrees F or in high fire risk areas; Beam and column (1 or 2 story) base plates less than 16-inches in the least dimension; Storage tanks and other non-motorized equipment and machinery under 30 horsepower; Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc.; Repair of holes, defects, and around the annular space of pipe penetrations in concrete members which are not water bearing and not in contact with soil or other fill material; and any other location not specifically listed in this Section or on the Contract Drawings.
2. Class I non-shrink grout shall have a minimum 28 Day compressive strength of 5,000 psi when mixed at a fluid consistency.
3. Class I non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C, when mixed to fluid, flowable, and plastic consistencies.
4. Grout shall have a maximum early age height change of 4.0% expansion and shall have no shrinkage (0.0%) in accordance with ASTM C 827. The grout when tested shall not bleed or segregate at maximum allowed water.
5. Grout shall have no shrinkage (0.0%) and a maximum of 0.3% expansion in the hardened state when tested in accordance with ASTM C 1090.
6. Furnish certification that the non-shrink property of grout is not based on gas production or gypsum expansion.
7. Class I Non-Shrink Grout shall be **Five Star Grout by Five Star Products, Sikagrout 212 by Sika Corporation, CB-G PG by Hilti**, or equal.

2.4 TOPPING GROUT AND CONCRETE/GROUT FILL

A. Where fill is thicker than 3-inches, structural concrete as indicated in Section 03 31 00 - Cast-in-Place Concrete, may be used when accepted by ENGINEER.

B. Grout for topping of slabs and concrete/grout fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and be mixed as indicated. Materials and procedures indicated for normal concrete in Section 03 31 00 - Cast-in-Place Concrete, shall apply unless indicated otherwise.

C. Topping grout and concrete/grout fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45. Topping grout in clarifiers shall contain between 750 and 800 pounds of cement per cubic yard with a maximum water cement ratio of 0.42.

D. Coarse aggregate shall be graded as follows:

U.S. Standard Sieve Size	Percent By Weight Passing
1/2 in	100
3/8 in	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

E. Final mix design shall be as determined by trial mix design as indicated in Section 03 30 00 - Cast-in-Place Concrete.

F. Topping grout and concrete grout/fill shall contain air-entraining agent per Section 03 30 00 – Cast-in-Place Concrete.

G. **Strength:** Minimum compressive strength of topping grout and concrete/grout fill at 28 Days shall be 4,000 psi.

2.5 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the application. Dry pack consistency is defined such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the application.

B. The slump for topping grout and concrete/grout fill shall be adjusted to match placement and finishing conditions but shall not exceed 4-inches.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

B. Rough concrete lightly, but not enough to interfere with placement of grout.

C. Remove foreign materials from metal surfaces in contact with grout.

D. Align, level, and maintain final positioning of components to be grouted.

3.2 GENERAL

A. CONTRACTOR shall arrange for the manufacturer of prepackaged grouts to provide on-Site technical assistance within 72 hours of request, as part of the WORK.

B. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized otherwise by ENGINEER.

C. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of the saturation period, excess water shall be removed. Concrete substrate shall not be wet prior to placement of epoxy grouts.

D. Surface preparation, curing, and protection of cement grout shall be in accordance with Section 03 30 00 – Cast-in-Place Concrete. The finish of the grout surface shall match that of the adjacent concrete unless otherwise indicated.

E. Surfaces that will be in contact with grout shall be free of dirt, loose rust, oil, wax, grease, curing compounds, laitance, loose concrete, and other deleterious materials.

F. Shade the WORK from sunlight for at least 24 hours before and 48 hours after grouting.

G. Contact the grout manufacturer's representative for assistance on hot and cold weather grouting techniques and precautions if applicable.

3.3 GROUTING PROCEDURES

A. **General:** Mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

B. Structural, equipment, tank, and piping support bases shall be grouted, unless indicated otherwise.

1. The original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum one-inch thickness of grout or other thickness if indicated.
2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout through a headbox of appropriate size. The mixture shall be of a fluid consistency and poured continuously into the space between the plate and the base concrete. Forms for grout shall be tight against retaining surfaces, and joints shall be sealed as recommended by the grout manufacturer to be liquid-tight. Forms shall be coated as recommended by the grout manufacturer for easy form release. Where this method of placement is not practical or where required by ENGINEER, alternate grouting methods shall be submitted for acceptance by ENGINEER.
3. Concrete equipment pads for equipment bases that will be epoxy-grouted shall be sized so that, when the equipment base is fully grouted, the epoxy grout is stopped not less than 4-inches from the edge of the pad.

C. Drilled Anchors and Reinforcing Bars

1. General
   a. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill and cleaned. Drilled anchors shall not be installed until the concrete has reached the required 28 Day compressive strength. Anchors shall not be loaded until the grout has reached its indicated strength in accordance with the manufacturer's instructions.
   b. CONTRACTOR shall identify position of reinforcing steel and other embedded items prior to drilling holes. Care shall be exercised in coring and drilling to avoid damaging existing reinforcing or embedded items. Notify ENGINEER if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and communications conduit, and piping.
2. Epoxy Adhesive Anchors
   a. Grout shall be proportioned and mixed with automatic equipment.
   b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO/ES report, but shall not be less than 8 diameters for threaded rod or 12 diameters for reinforcing or smooth bars.
   c. Holes required for grouting shall be blown or vacuumed clean and are to be free of dust and standing water. Horizontal holes for grouting are to be drilled at a slight downward angle and with the inserted dowel or bolt bent to match.
3. Cement Based Non-Shrink Grout
   a. In places of high temperature or fire hazard, anchor bolts shall be grouted in using cement based non-shrink grout, Class I.
   b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO/ES report, but shall not be less than 16 diameters for threaded rod or 24 diameters for reinforcing or smooth bars.
   c. When the bolt diameter is one-inch or less, the hole diameter should be a minimum of 2-inches. When the bolt diameter is greater than one-inch, the hole diameter should be at least twice the bolt diameter.
   d. Drilled holes shall be saturated with water for not less than 24 hours before installation of anchor/rod/rebar.
   e. The non-shrink grout should be placed in the holes in a non-sag (trowelable) consistency. The grout should be placed in the holes before the anchor and then the anchor inserted and vibrated to ensure proper coverage.

D. Topping Grout and Concrete/Grout Fill

1. Mechanical, electrical, and finish Work shall be completed prior to placement of topping or concrete/grout fill. To ensure bonding to the base slab, the base slab shall be given an exposed aggregate finish. Alternatively, where accepted by ENGINEER, the base slab shall be given a roughened textured surface by a close-spaced rake while the surface is green. After curing, high pressure washing shall expose the aggregates and produce not less than a 3/16-inch amplitude roughness. Jackhammers or chipping hammers shall not be used.

2. The minimum thickness of grout topping and concrete/grout fill shall be one-inch. Where the finished surface of concrete/grout fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2 inches wide by 1-1/2 inches deep.
3. The base slab shall be thoroughly cleaned and wetted to saturated surface dry (SSD) condition per the International Concrete Repair Institute (ICRI) -- Technical Guide for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays, prior to placing topping and fill. No topping concrete shall be placed until the slab is completely free from standing pools or ponds of water. A thin coat of neat cement grout shall be broomed into the surface of the slab just before topping or fill placement. The neat cement grout shall not be allowed to dry before topping placement. If it does dry, it must be immediately removed using wet stiff brooms and reapplied. The topping and fill shall be compacted by rolling or thorough tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade. Coat surface with evaporation retardant as needed to prevent plastic shrinkage cracks.
4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots that shall be immediately eliminated. When the topping or fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement, or mixture of dry cement and sand shall be applied to the surface.
6. As soon as topping or fill finishing is completed, coat surface with curing compound. After the topping is set and sufficiently hard in clarifiers and where required by ENGINEER, the tank shall be filled with sufficient water to cover the entire floor for 14 days.

3.4 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, to assure that the space to be grouted is completely filled.

3.5 CURING

A. Cement based grouts shall be cured per 03 30 00 – Cast-in-Place Concrete and per the manufacturer's recommendations.

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SECTION 05 45 00
MECHANICAL METAL SUPPORTS (PIPE SUPPORTS)

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers materials and installation of mechanical metal supports, pipe supports, hangers, guides, anchors, and appurtenances as specified and indicated.

B. CONTRACTOR shall provide mechanical metal supports in accordance with this Section whether shown on the Contract Drawings or not.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1.	Section 01 33 00	Submittal Procedures
2.	Section 05 50 00	Miscellaneous Specialties
3.	Section 09 90 00	Painting and Finishes
4.	Section 33 05 05	Ductile Iron Pipe
5.	Section 33 12 00	Mechanical Appurtenances
6.	Section 40 05 13.13	Steel Process Piping

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTING INDUSTRY (MSS)

1.	MSS SP-58	Pipe Hangers and Supports – Materials Design and Manufacture
2.	MSS SP-69	Pipe Hangers and Supports – Selection and Application
3.	MSS SP-89	Pipe Hangers and Supports – Fabrication and Installation Practices
4.	MSS SP-127	Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application

C. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

1.	ASME B 31.1	Power Piping

D. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1.	ASTM A 36	Standard Specification for Carbon Structural Steel
2.	ASTM A 47	Standard Specification for Ferritic Malleable Iron Castings
3.	ASTM A 48	Standard Specification for Gray Iron Castings
4.	ASTM A 123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5.	ASTM A 153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6.	ASTM A 575	Standard Specification for Steel Bars, Carbon, Merchant Quality,

M-Grades

7. ASTM A 576 Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. CONTRACTOR shall submit complete shop drawings of mechanical supports, pipe supports, hangers and guides. Provide scaled shop drawings showing locations of the supports and detailed drawings for each support. Identify each type of hanger or support by the manufacturer's part number of figure on the drawing.

C. Provide installation drawings and manufacturer's catalog information on each type of hanger and support.

D. Provide structural calculations for special supports and anchors, stamped, and signed by a professional engineer registered in the State of Utah.

PART 2 MATERIALS

2.1 GENERAL

A. All pipe hangers and supports shall be manufactured to comply with MSS-SP-58, MSS-SP-569, MSS-SP-89 except as modified herein. Where applicable, design and manufacture must also conform to ANSI/ASME B31.1. Supports for plumbing or fire piping shall be in accordance with the latest edition of the applicable plumbing or fire code and the requirements of the local jurisdiction.

B. Hangers, supports, anchors and restraints must be designed in accordance with MSS-SP-127 to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment. Piping supports and equipment must be considered as a total system and appropriate balance calculations made to determine load forces at critical stress points. Loading conditions to be considered may include, but are not limited to:

1. The total load of pipe, fittings, valves, insulation, and any expected contents of the pipe.
2. Thermal expansion and contraction
3. Stress from cycling of equipment or process.
4. Vibration transmitted to or from equipment or terminal connection.
5. Wind, snow, or ice loading on outdoor piping
6. Loading due to seismic forces

C. Static and dynamic forces at points of attachments must be considered to help ensure structural integrity of buildings or equipment. Hangers and supports must be selected to minimize the effect of piping system loading on the structure.

D. In general, piping shall be supported from structural members, such as walls, beams, columns, and slabs, using approved structural attachments. In situations where approved attachments cannot be used, alternative attachments or substructure assemblies must receive approval by ENGINEER prior to installation. Prior approval by ENGINEER must

be given before any cutting or drilling of building structural steel. Damage to the structure through welding, cutting, or drilling will not be permitted if it reduces the structure's strength below the established safety factor for the structure. Any additional structural steel required to properly support piping or equipment shall be furnished and installed by CONTRACTOR at no additional cost to OWNER.

2.2 SUPPORT MATERIALS

A. Pipe supports, hangers, guides, etc. shall be hot-dip galvanized carbon steel, unless noted otherwise on the Contract Drawings. Steel shall be in accordance with ASTM A 36, ASTM A 575, or ASTM A 576. Hot-dip galvanizing shall be in accordance with ASTM A 123 or ASTM A 153. Bases, rollers, and anchors shall be steel as described above or may be cast iron conforming to ASTM A 48. Pipe clamps shall be steel as described above or may be malleable iron conforming to ASTM A 47.

B. Supports fabricated from other materials specified on the Contract Drawings shall have a protective coating in accordance with the requirements of Section 09 90 00 – Painting and Finishes.

2.3 FLOOR MOUNTED SUPPORTS

A. Floor mounted pipe supports shall be the adjustable saddle support with stanchion, base and U-bolt or adjustable flange support type with stanchion and base. Pipe supports with stanchion and base plate shall be sized for the pipe or mechanical appurtenance it supports. All pipe supports shall have a 1-inch-high grouted pad to be used as a leveling base. Pipe supports shall be secured to the floor. A 1/4-inch-thick EPDM Rubber insulation pad shall be provided between the pipe and the U-Bolt.

2.4 CONCENTRATED LOADS

A. Concentrated loads, such as meters, valves, and equipment, on PVC piping systems shall have supports on each side of the concentrated load.

2.5 CONCRETE ANCHORS

A. Anchors shall be in accordance with Section 05 50 00 – Miscellaneous Specialties.

2.6 MANUFACTURERS

A. Mechanical Metal Support (pipe support) manufacturers shall be **ASC-ANVIL, Cooper B-Line, or ITT Grinnel**..

PART 3 EXECUTION

3.1 GENERAL

A. Mechanical metal supports, pipe supports, hangers, guides, etc. shall be installed per the manufacturer's instructions and ASME B31.1 – Power Piping.

B. Pipe supports shall be positioned in order to produce an orderly, neat piping system. Hanger rods shall be vertical without offsets.

C. Set embedded inserts accurately in position and support them rigidly before concrete is

placed and prevent displacement during and after placement of concrete.

D. Provide separate hangers or supports at valves, meters, elbows, tees, and other equipment. Provide separate hangers on each both sides of each non-rigid joint or flexible coupling.

E. Install piping without springing, forcing, or stressing the pipe or any connecting valves, pumps, or other pipe to which the pipe is connected.

F. Use of wire hangers, perforated strap, hanging from unreinforced metal deck and cellular roof deck are not permitted.

G. Repair or replace metal items damaged during installation. Follow the manufacturer's procedures for repairing damaged surfaces.

H. Galvanizing Field Repairs

1. Surface preparation shall consist of removing oil, grease, soil, and soluble material by cleaning with water and detergent (SSPC SP1) followed by brush-off blast cleaning (SSPC SP7) over an area extending at least 4 inches into the undamaged area.
2. The coating shall be applied to at least 3 mils dry film thickness and shall be **Zinc-Clad XI by Sherwin-Williams, Galvax by Alvin Products, Galvite by ZRC Worldwide**, or approved equal.

3.2 SUPPORT LOCATION AND SPACING

A. Supports for horizontal piping shall be spaced to prevent excessive sag, bending and stress in the piping. Spacing shall not exceed the maximum indicated spans.

B. Maximum spans indicated in the tables below are for ambient temperatures or the temperatures listed for the materials and pipe wall thicknesses shown. Adjust the span spacing for different temperatures and/or pipe wall thicknesses per the manufacturer's recommendations.

C. Install pipe supports on horizontal and vertical runs at the spacing shown or detailed on the Contract Drawings. If no spacing or rod sizes are given on the Contract Drawings or in the Specifications for a particular piping system, use the following tables or the recommendations of the support or pipe manufacturer.

1. Support Spacing for Steel Pipe (Section 40 05 13.13 – Steel Process Piping) Std Wt:

Pipe Size (inches)	Maximum Span Water Service (feet)	Maximum Span Vapor Service (feet)	Minimum Hanger Rod Size (inches)
3/8 and smaller	4	5	3/8
1/2 through 1	6	8	3/8
1-1/4 through 2	8	10	3/8
2-1/2 through 3	10	14	1/2
3-1/2 through 4	10	15	5/8
6	12	20	3/4
8	12	24	3/4
10	12	24	3/4
Note: These spacings do not apply where span calculations are made or			

where there are concentrated loads between supports such as flanges, valves, specialties, etc. or changes in direction requiring additional supports.

2. Supports for Ductile Iron Pipe (Section 33 05 05 – Ductile Iron Pipe) should be installed in locations shown on the Contract Drawings with a minimum of one support per 20-foot length of pipe. If longer spans are required, the supports should be designed in accordance with DIPRA – Design of Ductile Iron Pipe on Supports and the pipe manufacturer's recommendations. Supports should be cradle type with a saddle angle of 120 degrees. The table below shows the recommended maximum spans per US Pipe – Long Span and Bridge Crossing Pipe guidelines.

Pipe Size (inches)	Maximum Span Water Service (feet)
6	28
8	30
10	30
12	35
14	35
16	40
18	42
20 to 64	45
Note: These spacings do not apply where span calculations are made or where there are concentrated loads between supports such as flanges, valves, specialties, etc. or changes in direction requiring additional supports.	

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SECTION 05 50 00
MISCELLANEOUS SPECIALTIES

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers materials, fabrication, and installation of miscellaneous metals, specialties, and appurtenances as specified and indicated.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 05 50 00 Miscellaneous Specialties
3. Section 09 90 00 Painting and Finishes

1.3 RELATED SPECIFICATIONS

A. Fabrication and erection of the platforms, ladders and stairs shall be in accordance with the Specification for the Design, Fabrication and Creation of Structural Steel for Buildings of the latest edition of the A.I.S.C. Manual, and Section 1910.27 of the latest edition of the OSHA standards, except as specified herein.

1.4 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

1. Manual of Steel Construction

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 36 Standard Specification for Carbon Structural Steel
2. ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A 123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASMT A 153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
5. ASTM A 276 Standard Specification for Stainless Steel Bars and Shapes
6. ASTM A 307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength
7. ASTM A 615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
8. ASTM F 593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
9. ASTM F 594 Standard Specification for Stainless Steel Nuts

1.5 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. CONTRACTOR shall submit complete shop drawings of fabricated items, such as vents, ladders, stairs, platforms, beams, pipe supports, and miscellaneous metals for approval to Engineer.

C. Shop drawings shall conform to AISC recommendations and specifications, and shall show holes, and the like, as may be required for other parts of the work.

D. Shop drawings shall include complete details of members and connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams for the sequence of erection.

E. Submit manufacturer's catalog data and dimensional drawings for lifting eyebolts and inserts; ladder safety posts, manhole covers and frames, and anchor bolts.

F. Submit ICC ES Evaluation Reports for adhesive and wedge anchors and installer qualifications and procedures.

1.6 QUALITY ASSURANCE

A. Field Measurements: Take field measurement prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.

B. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units to the extent necessary for shipping limitations.

C. Fabricator Qualifications: Fabricators shall be regularly engaged in the manufacture of the types of steel specialties they are providing and shall have at least 5 years of experience in this specialty.

D. Qualifications: Qualify welding operators in accordance with the requirements of current AWS Standard. Provide certification that all welders employed on or to be employed for the Work have satisfactorily passed AWS qualification tests within the previous 12 months. Ensure that all certifications are kept current.

PART 2 MATERIALS

2.1 CARBON STEEL

A. Materials for bolted or welded steel construction shall conform to ASTM A 36.

2.2 STAINLESS STEEL

A. All bolts, expansion bolts, nuts, washers, and expansion sleeve inserts used to attach metal supports shall be stainless steel Type 316.

2.3 HOT-DIPPED GALVANIZED

A. All vents, stairs, vault ladders, handrail, guardrail, stringers, beams, and miscellaneous items shall be galvanized (zinc coated) unless noted otherwise.

B. Zinc coating for plates, bolts, anchor bolts, and threaded parts shall in in accordance with ASTM A 153. Structural steel shall be zinc coated in accordance with ASTM A 123.

2.4 BOLTS

A. Steel anchor and connection bolts for non-corrosive service shall conform to ASTM A 307, Grade A or B, unless otherwise noted. Bolts shall be hot-dip galvanized and provided with self-locking nuts or lock washers and plain nuts.

B. Steel anchor and connection bolts for corrosive service shall be fabricated from stainless steel, unless indicated otherwise in the specifications or on the Contract Drawings. Corrosive service locations are listed below.

1. Buried locations
2. Submerged locations
3. Locations subject to occasional flooding
4. Inside buried manholes, vaults, and structures that do not have a gravity drain or sump pump

C. The nuts shall be capable of developing the full strength of the bolts. Bolts and cap screws shall have hexagon heads and nuts shall be heavy hexagon series. Bolts and nuts shall be installed with washers from material matching the base material of bolts. Lock washers fabricated from the material matching the bolts shall be installed where indicated.

D. The length of the bolts shall be such that the bolt extends at least 1/8 inch beyond the outside face of the nut before tightening, except for anchor bolts which shall be flush with the face of the nut before tightening.

2.5 ADHESIVE ANCHORS

A. Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors. No substitutions will be considered without an ICC ES Report verifying strength and material equivalency.

B. Adhesive anchors shall be a two-component system consisting of an all-threaded anchor rod with nut and washer, and the adhesive capsule. Anchor rods shall be Type 304 stainless steel conforming to ASTM F 593 with nuts conforming to ASTM F 594. The adhesive capsules shall contain a polyvinyl or urethane methacrylate-based resin and accelerator within a sealed dual chamber foil capsule. Adhesive anchors shall be **Hilti HVA Capsule Adhesive Anchoring System**, or approved equal.

2.6 WEDGE ANCHORS

A. Wedge type anchors shall be used only where indicated in the Contract Drawings. Wedge anchors shall be a stud type expansion anchor, torque controlled, with impact section to prevent thread damage. Stud and wedge shall be Type 304 or Type 316 stainless steel conforming to ASTM A 276. Nut shall be Type 304 or Type 316 stainless steel conforming to ASTM F 594 with washer of similar material. Wedge anchor bolts shall be **Hilti Kwik Bolt 3,** or approved equal. Anchors installed in non-submerged or non-corrosive environments may be carbon steel and be **Simpson Strong-Tie Strong Bolt**, or approved equal.

2.7 LADDERS

A. Other ladders shall be fabricated from carbon steel and hot-dip galvanized after fabrication unless noted otherwise on the Contract Drawings. All ladder hardware and supports shall be the same material as the ladder.

2.8 VAULT VENTS

A. Fabricate vault vents as shown on the Contract Drawings. Vault vents shall be welded steel construction and hot-dip galvanized after fabrication. Coating shall be in accordance with Section 09 90 00 – Painting and Finishes.

2.9 COVERS AND FRAMES

A. Manhole covers and frames shall be cast iron and designed for AASHTO HS-20 loading, unless otherwise indicated. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Covers shall seat firmly into the frames without rocking. Covers and frames shall fit together evenly such that the cover fits flush with the surrounding finished surface.

2.10 POLYPROPYLENE STEPS

A. Polypropylene steps shall have a 1/2-inch ASTM A 615 grade 60 steel reinforcement rod encased in polypropylene copolymer plastic. Steps shall have a tread width of 14-inches nominal.

B. Steps shall be manufactured by **American Step Company, Inc., M.A. Industries, D & L Supply No. F-1981,** or approved equal.

PART 3 EXECUTION

3.1 GENERAL

A. Except as otherwise shown, the design, fabrication, and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction".

B. Install miscellaneous specialties as indicated on the Contract Drawings or as recommended by the manufacturer.

C. Store materials above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

D. Clean surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign matter before placing concrete.

E. Set embedded metalwork accurately in position and support it rigidly before concrete is placed and prevent displacement during and after placement of concrete.

F. Repair or replace metal items damaged during installation. Follow the manufacturer's procedures for repairing damaged surfaces.

G. Welding shall be performed by metal-arc method or shielded metal arc method as per the

American Welding Society's (AWS) "Welding Handbook". During welding component parts shall be adequately clamped or supported. Avoid irregular surface, non-uniform bead pattern, and high crown. Upon completion of welding, remove weld splatter, flux, slag, and burrs. Accomplish repair, chipping, and grinding of welds in a manner that will not gouge, groove, or reduce the base metal thickness.

H. Adhesive Anchors. Do not install anchors until the concrete has reached the required 28-day compressive strength. Drill hole in concrete by means of a percussion hammer drill. The hole shall be roughened with a brush on a power drill and then cleaned and dried. Install anchor in accordance with the manufacturer's instructions. Do not load the anchor until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

I. Wedge Anchors. Do not install anchors until the concrete has reached the required 28-day compressive strength. Drill hole in concrete by means of a percussion hammer drill. The hole shall be roughened with a brush on a power drill and then cleaned and dried. Install anchor in accordance with the manufacturer's instructions.

J. Galvanizing Field Repairs:

1. Surface preparation shall consist of removing oil, grease, soil, and soluble material by cleaning with water and detergent (SSPC SP1) followed by brush-off blast cleaning (SSPC SP7) over an area extending at least 4 inches into the undamaged area.
2. The coating shall be applied to at least 3 mils dry film thickness and shall be **Zinc-Clad XI by Sherwin-Williams, Galvax by Alvin Products, Galvite by ZRC Worldwide**, or approved equal.

- END OF SECTION -

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SECTION 08 31 00
ACCESS HATCHES

PART 1 GENERAL

1.1 SUMMARY

A. This section covers all the work necessary to furnish and install all hatches and appurtenances, complete and in place as shown on the Contract Drawings.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 09 90 00 Painting and Finishes

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 123 Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
2. ASTM A 229 Standard Specification for Steel Wire, Quenched and Tempered for Mechanical Springs
3. ASTM A 36 Standard Specification for Carbon Structural Steel
4. ASTM A 653 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process

1.4 DESIGN REQUIREMENTS

A. Flush mounted hatches for vaults not subject to traffic loading shall be designed to handle a minimum live loading of 300 psf.

1.5 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer’s catalog data and preprinted installation instructions for the hatches.

C. Submit a schedule showing the location of each hatch. Shop drawings shall include details and method of anchorage, details of construction, method of assembling sections, location and installation of hardware, shape and thickness of materials, details of joining and connections.

1.6 DELIVERY AND STORAGE

A. Hatches shall be delivered to the job site wrapped in a protective covering with the brands and names clearly marked thereon.

1.7 WARRANTY

A. Manufacturer shall provide to OWNER written guarantee against defects in material or workmanship for a period of five (5) years. Manufacturer must be able to have a representative on site within 48 hours to address any complaint or issues.

PART 2 PRODUCTS

2.1 HATCHES AND ACCESS DOORS

A. Hatches or access doors shall be as noted in the Contract Drawings and meet the requirements specified herein. All hardware shall be stainless steel throughout. Each hatch shall be provided with a permanent label showing the manufacturer's name and address and the model number. Hatches shall have stainless steel hold open arm with positive locking. The hold open arm shall be coated red.

B. Hatches or access doors shall be aluminum. Aluminum frames to be cast in concrete shall be mill finished with a bituminous coating applied to the exterior of the frame.

C. Hatch hardware, including the hinges, shall be fabricated from Type 316 stainless steel.

D. Hatches shall be provided with an automatic hold-open arm with release handle.

E. Hatches shall be designed to be watertight and equipped with an EPDM gasket.

F. Unless otherwise indicated in the Contract Drawings, a fall protection system shall be provided on all hatches which are 6 feet or more above a lower level. Fall protection systems shall be grating panels that conform to OSHA 29 CFR1926.502(c) requirements. The fall protection grating shall be epoxy coated with an OSHA type safety orange color. Safety nets or safety grates fabricated from fiberglass or fiberglass blend are not acceptable, unless approved by OWNER and ENGINEER.

G. Manufacturers shall be **USF Fabrication, Inc., EJ (formerly East Jordan Iron Works)**, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Hatches shall be installed in accordance with the approved detailed shop drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, hardware, and other accessories shall be accurately located. Upon completion, hatches shall be weather tight and shall be free from warp, twist, or distortion. Hatches shall be lubricated, properly adjusted, and demonstrated to operate freely.

B. All surfaces that come in contact with the concrete shall have a protective coating.

- END OF SECTION -

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SECTION 09 90 00
PAINTING AND FINISHES

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers furnishing, surface preparation, and applying paints and coatings, complete and in place, to all specified surfaces including exposed valves, piping, or fittings.

B. Definitions

1. The term “paint”, “coatings”, or “finishes” as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.
2. The term “DFT” means minimum dry film thickness, without any negative tolerance.
3. The term “mil” means thousandths of an inch.
4. The term “SSPC” means The Society for Protective Coatings.

C. The following surfaces shall not be coated:

1. Concrete, unless required by items on the concrete coating schedule below or the Contract Drawings.
2. Stainless steel
3. Machined surfaces
4. Grease fittings
5. Glass
6. Equipment nameplates
7. Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.

D. The protective coatings applicator (Applicator) shall possess a valid state license as required for the performance of the painting and coating work called for in this specification and shall provide 5 references which show the Applicator has previous successful experience with the indicated of comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the Applicator provided the protective coating.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limit to:

1. Section 01 33 00 Submittal Procedures
2. Section 03 30 00 Cast-in-Place Concrete
3. Section 33 05 05 Ductile Iron Pipe
4. Section 33 11 10 Miscellaneous Appurtenances
5. Section 40 05 13.13 Steel Process Piping

1.3 REFERENCES AND STANDARDS

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

1. OSHA — Occupation Safety and Health Act: State of Utah and Federal
2. ICRI — International Concrete Repair Institute Guideline No. 310.2 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI A 13.1 — Standard for Scheme for the Identification of Piping Systems
2. ANSI Z 535 — Standard for Safety Colors

C. AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

1. ASTM C 309 — Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
2. ASTM D 520 — Standard Specification for Zinc Dust Pigment
3. ASTM D 521 — Standard Test Methods for Chemical Analysis of Zinc Dust (Metallic Zinc Powder)
4. ASTM D 6943 — Standard Practice for Immersion Testing of Industrial Protective Coatings Linings
5. ASTM D 1653 — Standard Test Methods for Water Vapor Transmission of Organic Coating Films
6. ASTM D 2370 — Standard Test Method for Tensile Properties of Organic Coatings
7. ASTM D 2794 — Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
8. ASTM D 4263 — Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
9. ASTM D 4414 — Standard Practice for Measurement of Wet Film Thickness by Notch Gages
10. ASTM D 4417 — Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
11. ASTM D 7234 — Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
12. ASTM D 7682 — Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty
13. ASTM E 96 — Standard Test Methods for Water Vapor Transmission of Materials
14. ASTM F 1869 — Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
15. ASTM F 2170 — Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

D. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 210 — Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines

2. AWWA C 222 Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings

E. AMERICAN CONCRETE INSTITUTE (ACI)

1. ACI 301 Specifications for Structural Concrete

F. NACE International (NACE)

1. NACE RP0287 Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape
2. NACE SP0188 Standard Practice for Discontinuity (Holiday) Testing of Protective Linings
3. NACE SP0892 Standard Practice for Coatings and Linings over Concrete for Chemical Immersion and Containment Service
4. NACE No. 1/SSPC-SP 5 White Metal Blast Cleaning
5. NACE No. 2/SSPC-SP10 Near White Metal Blast Cleaning
6. NACE No. 3/SSPC-SP6 Commercial Blast Cleaning
7. NACE No. 6/SSPC-SP13 Surface Preparation of Concrete

G. SSPC: The Society for Protective Coatings (SSPC)

1. SSPC PA1 - Shop, Field, and Maintenance Painting of Steel
2. SSPC-PA2 – Paint Application Specification No. 2: Measurement of Dry Coating Thickness with Magnetic Gages.
3. SSPC-PA11 - Protecting Edges, Crevices, and Irregular Steel Surfaces by Stripe Coating
4. SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning.
5. SSPC-SP10/NACE 2 - Near White Metal Blast Cleaning
6. SSPC-SP16 – Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
7. SSPC-VIS 1 - Guide to Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. CONTRACTOR shall supply shop drawings for approval on all paint materials at least 30 days prior to installation. Submittals shall include the following data sheets:

1. For each paint system used herein, furnish a Paint System Data Sheet (PSDS), Technical Data Sheets, and paint colors available (where applicable) for each product used in the paint system, except for products applied by equipment manufacturers.

C. Quality Control Submittals:

1. Furnish a list of references for the Applicator substantiating the requirements as specified.
2. Manufacturer’s certification stating factory applied coating systems meets or exceeds requirements specified herein.

3. If the manufacturer of finish coating differs from that of shop primer, provide both manufacturers' written confirmation that materials are compatible.

1.5 PAINT DELIVERY, STORAGE, AND HANDLING

A. Deliver paint to the project site in unopened containers that plainly show, at the time of use, the designated name, date of manufacture, color, and name of manufacturer.

B. Store paints in a suitable protected area that is heated or cooled as required to maintain temperatures within the range recommended by the manufacturer.

1.6 QUALITY ASSURANCE

A. All inspection for quality assurance shall ultimately be the responsibility of CONTRACTOR. OWNER retains the right to observe, accept, or reject the work based on the results of CONTRACTOR's inspection or observations by ENGINEER, at OWNER's discretion, in accordance with the Specifications.

B. Repair and recoat all runs, overspray, roughness, or any other signs of improper application in accordance with paint manufacturer's instructions and as reviewed by ENGINEER.

C. Observations by OWNER or ENGINEER, or the waiver of inspection of any particular portion of the work, shall not be construed to relieve CONTRACTOR of his responsibility to perform the work in accordance with these Specifications.

1.7 MANUFACTURER'S SERVICES

A. Furnish paint manufacturer's representative to visit jobsite at intervals during surface preparation and painting as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions and these specifications, and as may be necessary to resolve field problems attributable to, or associated with, manufacturer's products furnished under this Contract.

1.8 SPECIAL CORRECTION OF DEFECTS REQUIREMENTS

A. An inspection may be conducted during the eleventh month following completion of coating work. CONTRACTOR and a representative of the coating material manufacturer shall attend this inspection. Defective work shall be repaired in accordance with these specifications and to the satisfaction of OWNER. OWNER may, by written notice to CONTRACTOR, reschedule the inspection to another date within the one-year correction period or may cancel the inspection altogether. CONTRACTOR is not relieved of its responsibilities to correct defects whether or not the inspection is conducted.

PART 2 PRODUCTS

2.1 GENERAL

A. CONTRACTOR shall use suitable coating materials as recommended by the manufacturer. Materials shall comply with Volatile Organic Compound (VOC) limits applicable at the Site.

B. Where manufacturers and product numbers are listed, it is to show the type and quality of coatings that are required. If a named product does not comply with VOC limits in effect at the time of Bid opening, that product will not be accepted, and CONTRACTOR shall propose a substitute product of equal quality that does comply. Proposed substitute materials will be considered as indicated below. Coating materials shall be materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, and water and wastewater treatment plants.

C. In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to the compatibility of primers and finish coats. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

D. Colors and shades of colors of coatings shall be as indicated or selected by ENGINEER. Each coat shall be of a slightly different shade to facilitate observation of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by OWNER.

E. Substitute or “Or-Equal” Products

1. Basis of Design: The Coating Systems listed below in paragraph 2.3 are based on products from Tnemec Company Incorporated, except where indicated below.
2. Product Substitution: To establish equality under Section 01 60 00 – Product Requirements, the specified coating systems are the minimum standard of quality for this project. Equivalent materials of other manufacturers may be substituted only by approval of ENGINEER. Requests for material substitutions shall be in accordance with the requirements of the project specification.
3. Product Requirements: CONTRACTOR shall furnish satisfactory documentation from the manufacturer of the proposed substitute or "or equal" product that the material meets the indicated requirements and is equivalent or better in the following properties: Quality, Durability, Resistance to abrasion and physical damage, Life expectancy, Ability to recoat in the future, Solids content by volume, Dry film thickness per coat, Compatibility with other coatings, Suitability to chemical attack, Temperature limitations during application and in service, Type and quality of recommended undercoats or topcoats, Ease of repairing damaged areas, and stability of colors.
4. Manufacturers of “or equal” products shall provide direct performance comparison with the materials specified, in addition to complying with all other requirements of these Specifications. “Or equal” products shall employ the same generic type materials and system components as the specified coating systems.
5. Requests for product substitution shall be made and approved at least 10 days prior to bid date.
6. CONTRACTOR shall bear any additional costs, if a proposed substitution requires changes or additional work.

2.2 COLORS

A. Provide colors as selected by OWNER or ENGINEER.

B. Colors shall be formulated with colorants free of lead, lead compounds, or other materials which might be affected by the presence of hydrogen sulfide or other gas likely to be present at the project.

C. Proprietary identification of colors is for identification only. Any authorized manufacturer may supply color matches.

D. Equipment colors;

1. Equipment shall mean the machinery or vessel itself plus the structural supports and fasteners.
2. Paint non-submerged portions of equipment in the same color as the process piping it serves, except as indicated below:

a. Dangerous parts of equipment and machinery:	OSHA Orange
b. Fire protection equipment and apparatus:	OSHA Red
c. Radiation hazards:	OSHA Purple
d. Physical hazards in normal operating area:	OSHA Yellow

3. Fiberglass reinforced plastic (FRP) equipment with an integral colored gel coat does not require painting, provided the color is as specified.

E. Piping color coding shall be in accordance with ANSI A13.1, Division of Drinking Water R-309-525, and International Plumbing Code.

1. Color code non-submerged metal piping except electrical conduit. Paint fittings and valves the same color as the pipe unless otherwise specified.
2. Pipe supports: If pipe supports are not galvanized or stainless steel, supports shall be painted ANSI No. 70 light gray as specified in ANSI Z535.
3. Fiberglass reinforced plastic (FRP) pipe and polyvinyl chloride (PVC) pipe located outside of buildings and enclosed structures will not require painting, unless noted otherwise on the Contract Drawings.

2.3 COATING SYSTEMS

A. System No. 1A Steel Pipe Lining – Potable Water NSF 61 Certification – NOT USED

B. System No. 1B Steel Coating – Immersion Potable Water NSF/ANSI 61/600 Certification – NOT USED

C. System No. 2 Steel – Immersion Non-Potable Water

1. Materials

Type	High Solids Polyamide Epoxy
VOC content, max, g/L	250
Volume Solids, min, %	67
Demonstrated Suitable for	Ferrous surfaces, superior color and gloss retention, exceptional resistance to weathering, chemical fumes, and salt spray

2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
SSPC-SP10 Near-White Blast Cleaning with a minimum angular anchor profile of 1.5 mils	Primer: Tnemec Series 69 Hi-Build Epoxoline II Intermediate: Tnemec Series 69 Hi-Build Epoxoline II Finish: Tnemec Series 69 Hi-Build Epoxoline II	Primer: 4 -6 DFT Intermediate: 4 -6 DFT Finish: 4 - 6 DFT
	Primer: Sherwin Williams Tank Clad HS Intermediate: Sherwin Williams Tank Clad HS Finish: Sherwin Williams Tank Clad HS	
	Primer: Carboline Carboguard 890 Intermediate: Carboline Carboguard 890 Finish: Carboline Carboguard 890	

3. Application
   a. For use on the interior of fabricated steel pipe and fittings.
4. Special Requirements
   a. The surface preparation and primer shall be shop applied to all surfaces prior to installation.

D. System No. 3 Steel – Interior Exposed

1. Materials

Type	Polyamide Epoxy
VOC content, max, g/L	250
Volume Solids, min, %	67
Demonstrated Suitable for	Ferrous, galvanized, surfaces in industrial exposure, resistant to mild corrosion and chemical fumes, has good color and gloss retention
Certification	None

2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
Ferrous Metal: SSPC-SP6 Commercial Blast Cleaning	Primer: Tnemec Series 69 Hi-Build Epoxoline II Finish: Tnemec Series 69 Hi-Build Epoxoline II	Primer: 3-5 DFT Finish: 4-6 DFT

with a minimum angular anchor profile of 1.5 mils Galvanized and Non-Ferrous: SSPC-SP16 with a minimum angular anchor profile of 1.5 mils	Primer: Sherwin Williams Macropoxy 646 Fast Cure Epoxy Finish: Sherwin Williams Macropoxy 646 Fast Cure Epoxy	
	Primer: Carboline Carboguard 60 Finish: Carboline Carboguard 60	

3. Application
   a. All exposed metal surfaces located inside of structures.
4. Special Requirements
   a. The surface preparation and primer shall be shop applied to all surfaces prior to installation. Finish coats need only be applied to the surfaces exposed after completion of construction.

E. System No. 4 Steel – Exterior Exposed – NOT USED

F. System No. 5 Buried Steel Pipe Coating

1. Materials

Type	Modified Polyamine Ceramic Epoxy
VOC content, max, g/L	25 g/L
Demonstrated Suitable for	Buried steel pipelines

2. Surface preparation and Coating System

Surface Preparation	**Products**	**Total System** (mils)
Abrasive Blast, or Centrifugal Wheel Blast SSPC-SP5 with a minimum angular anchor profile of 3.0 mils	Tnemec Series 431 Perma-Shield PL	30-40 mils DFT

3. Application
   a. Shop applied on steel pipe where indicated in Section 40 05 13.13 Steel Process Piping.

G. System No. 6 Steel – Doors and Frames – NOT USED

H. System No. 7 Galvanized Steel and Cast/Ductile Iron – Exterior Exposed

1. Materials

Type	Polyamide Epoxy with

	Aliphatic Acrylic Polyurethane (topcoat)
VOC content, max, g/L	250
Demonstrated Suitable for	Ferrous, galvanized, nonferrous, cast/ductile iron surfaces in industrial exposure, highly resistant to abrasion, wet conditions, corrosive fumes, and exterior weathering

2. Surface preparation and Coating System

Surface Preparation	**Products**	**Total System** (mils)
Galvanized Steel and Non-Ferrous: SSPC-SP16 brush-off blast cleaning of coated and uncoated galvanized steel and non-ferrous metals to achieve a uniform anchor profile of 1.0-2.0 mils. Ductile and Cast Iron: Prepare all surfaces as per NAPF 500-03 - Uniformly abrasive blast the entire exterior surface using abrasive to an NAPF 500-03-04 with a minimum angular anchor profile of 1.5 mils.	Primer: Tnemec Series 69 Hi-Build Epoxoline II Finish: Tnemec Series 1095 Endura-Shield	Primer: 3-5 DFT Finish: 2.5-4 DFT
	Primer: Sherwin Williams Macropoxy 646 Fast Cure Epoxy Finish: Sherwin Williams Hi-Solids Polyurethane 250	
	Primer: Carboline Carboguard 890 Finish: Carboline Carbothane 133LV(Satin) or 134VOC(Gloss)	

3. Application
   a. Exposed galvanized and cast/ductile iron surfaces located outside of structures requiring painting and the following specific surfaces unless noted otherwise:
      1) All exposed galvanized pipe
      2) All exposed cast/ductile iron pipe

L. System No. 8 Galvanized Steel and Cast/Ductile Iron – Interior Exposed

1. Materials

Type	Polyamide Epoxy
VOC content, max, g/L	250
Demonstrated Suitable for	Ferrous, galvanized, nonferrous, cast/ductile iron surfaces in industrial exposure, resistant to mild corrosion

	and chemical fumes, has good color and gloss retention

2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
Galvanized Steel and Non-Ferrous: SSPC-SP16 brush-off blast cleaning of coated and uncoated galvanized steel and non-ferrous metals to achieve a uniform anchor profile of 1.0-2.0 mils. Ductile and Cast Iron: Prepare all surfaces as per NAPF 500-03 - Uniformly abrasive blast the entire exterior surface using abrasive to an NAPF 500-03-04 with a minimum angular anchor profile of 1.5 mils.	Primer: Tnemec Series 69 Hi-Build Epoxoline II Finish: Tnemec Series 69 Hi-Build Epoxoline II	Primer: 3-5 DFT Finish: 3 – 5 DFT
	Primer: Sherwin Williams Macropoxy 646 Fast Cure Epoxy Finish: Sherwin Williams Macropoxy 646 Fast Cure Epoxy	
	Primer: Carboline Carboguard 60 Finish: Carboline Carboguard 60	

3. Application
   a. Exposed galvanized and cast/ductile iron surfaces located inside of structures requiring painting and the following specific surfaces unless noted otherwise:
      1) All exposed galvanized pipe
      2) All exposed cast/ductile iron pipe
   b. Do not paint galvanized steel mechanical pipe and equipment supports unless noted otherwise.

2.4 SPECIAL COATING SYSTEMS

A. System 200 - PVC Tape – NOT USED

B. System 201 – Water Retardant, Concrete and Masonry – NOT USED

C. System 202 – Polyethylene Encasement: Application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C. Provide polyethylene encasement where indicated on the Contract Drawings or per Section 30 05 05 – Ductile Iron Pipe.

D. System 203 - Cement Mortar Coating – NOT USED

E. System 204 – Ductile or Cast-Iron, Valves and Gates - Immersion in Water and Wastewater – NOT USED

F. System 205 – Anti-Graffiti Coating, Concrete and Masonry – NOT USED

2.5 CONCRETE FINISHES

A. Exterior Above Grade Concrete: Concrete surfaces exposed to view outside the building and including 6 inches below finished grade on the building or structure should be finished with a “Class B” finish. Products for the “Class B” finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.

B. Interior Exposed Above Floor Concrete: Interior above grade concrete shall be finished with a “Class B” finish. Products for the “Class B” finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.

C. Interior Concrete Floors: Interior concrete floors shall be finished with a “Trowel” finish. Products for the “Trowel” finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.

D. Exterior Concrete Flat Surfaces: Exterior concrete flat surfaces shall be finished with a “Broom” finish. Products for the “Broom” finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.

PART 3 EXECUTION

3.1 GENERAL

A. The intention of this specification is for all new, interior and exterior, masonry, concrete, and metal, whether atmospheric or submerged exposure surfaces to be painted whether specifically mentioned or not, except as modified herein. Concealed structural steel surfaces shall receive a prime coat only unless modified herein.

B. Surface preparation and coating application shall be in accordance with these specifications and the coating manufacturer’s written product data sheets and written recommendations of the manufacturer’s technical representative. Where conflict occurs between the manufacturer’s recommendations and these specifications, the more stringent of the two shall apply unless approved by ENGINEER.

C. For immersion coatings, obtain full cure for completed system before immersing or allowing exposure to water of condensation for more than 12 hours.

3.2 REGULATORY REQUIREMENTS

A. Meet federal, state, and local requirements limiting the emission of volatile organic compounds and worker exposures.

B. Protect workers and comply with applicable federal, state, and local air pollution and environmental regulations for surface preparation, blast cleaning, disposition of spent aggregate and debris, coating application, and dust prevention including but not limited to the following Acts, Regulations, Standards, and Guidelines:

1. Clean Air Act

2. National Ambient Air Quality Standard
3. Resource Conservation and Recovery Act (RCRA)
4. SSPC Guide 6

C. Comply with applicable federal, state, and local regulations for confined space entry.

D. Provide and operate equipment that meets explosion proof requirements.

3.3 ENVIRONMENTAL CONDITIONS

A. Do not apply paint in extreme heat, temperatures below 40 degrees F, nor in dust, smoke-laden atmosphere, damp or humid weather. The Applicator shall adhere to the manufacturer's recommendations regarding environmental conditions. The Applicator shall monitor humidity, air temperature, and surface temperature with properly calibrated instruments.

B. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent, nor whenever surface temperature is less than 5 degrees F above dew point of ambient air. Strictly adhere to manufacturer's recommendations.

C. Surface preparation power tools and blast equipment shall contain dust collection devices that will prevent discharge of dust particles into the atmosphere around electrical or mechanical equipment unless otherwise permitted by ENGINEER.

D. Where weather conditions or project requirement dictate, the Applicator shall provide and operate dehumidification equipment to maintain environmental conditions suitable for abrasive blasting and coating application as specified.

3.4 WORKMANSHIP

A. Skilled craftsmen and experienced supervision shall be used on coating work.

B. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure thorough surface preparation. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given so that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures.

C. Damage to other surfaces resulting from the work shall be cleaned, repaired, and refinished to original condition.

3.5 STORAGE, MIXING, AND THINNING OF MATERIALS

A. Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for other procedures relative to coating shall be strictly observed.

B. Coating materials shall be used within the manufacturer's recommended shelf life.

C. Coating materials shall be stored under the conditions recommended by the Product Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings from different manufacturers shall not be mixed together.

3.6 SURFACE PREPARATION

A. All surfaces which receive paint or other coatings shall be prepared in accordance with the recommendations of the manufacturer of the material being used. The Applicator shall examine surfaces to be coated and shall correct surface defects before application of any coating material. Marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any field coating application.

B. Perform sandblasting for piping and any other items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed. Materials, equipment, and procedures shall meet requirements of the Society for Protective Coatings (formerly the Steel Structures Painting Council).

3.7 PROTECTION OF MATERIALS NOT TO BE PAINTED

A. Surfaces that are not to receive coatings shall be protected during surface preparation, cleaning, and coating operations.

B. Remove, mask or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.

C. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

D. Protect working parts or mechanical and electrical equipment and motors from damage.

E. Care shall be exercised not to damage adjacent work during blasting operations. Spraying shall be conducted under carefully controlled conditions. CONTRACTOR shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blasting or coating operations.

3.8 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of the the Society for Protective Coatings shall form a part of this specification:

1. Solvent Cleaning (SSPC SP1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.
2. Hand Tool Cleaning (SSPC SP2): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.
3. Power Tool Cleaning (SSPC SP3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.
4. White Metal Blast Cleaning (SSPC SP5): Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.
5. Commercial Blast Cleaning (SSPC SP6): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that

staining shall be limited to no more than 33 percent of each square inch of surface area.

6. Brush-Off Blast Cleaning (SSPC SP7): Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint.
7. Near-White Blast Cleaning (SSPC SP10): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.
8. Surface Preparation of Concrete (SSPC-SP13): Removal of protrusions, laitance and efflorescence, existing coatings, form-release agents, and surface contamination by detergent or steam cleaning, abrasive blasting, water jetting, or impact or power tool methods as appropriate for the condition of the surface and the requirements of the coating system.
9. Surface Preparation (SSPC-SP16): Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

3.9 FERROUS METAL SURFACE PREPARATION (UNGALVANIZED)

A. The minimum abrasive blasting surface preparation shall be as indicated in the coating system schedules included at the end of this Section. Where there is a conflict between these requirements and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.

B. Oil, grease, welding fluxes, and other surface contaminants shall be removed by solvent cleaning per SSPC SP1 - Solvent Cleaning prior to blast cleaning.

C. Round or chamfer all sharp edges and grind smooth burrs and surface defects and weld splatter prior to blast cleaning.

D. Surfaces shall be cleaned of dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming, or another approved method prior to painting.

E. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.

F. Damaged or defective coating shall be removed by the blast cleaning to meet the clean surface requirements before recoating.

G. If the required abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC SP2 or SSPC SP3 may be used as per manufacturers recommendations.

H. Shop-applied coatings of unknown composition shall be completely removed before the indicated coatings are applied. Valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC SP1 before the abrasive blast cleaning has been started.

I. Shop primed equipment shall be solvent-cleaned in the field before finish coats are applied.

J. Exposed ductile iron pipe shall be given a shop coat of rust-inhibitive primer conforming to these specifications. Abrasive blasting of the asphaltic coating on ductile iron pipe will not be allowed.

3.10 FERROUS METAL SURFACE PREPARATION (GALVANIZED)

A. Galvanized ferrous metal shall be alkaline cleaned per SSPC SP1 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system, followed by blast cleaning per SSPC SP16.

B. Pretreatment coatings of surfaces shall be in accordance with the printed recommendations of the coating manufacturer.

3.11 SHOP COATING REQUIREMENTS

A. Unless otherwise indicated, items of equipment or parts of equipment which are not submerged in service shall be shop-primed and then finish-coated in the field after installation with the indicated or selected color. The methods, materials, application equipment, and other details of shop painting shall comply with this Section. If the shop primer requires topcoating within a specific period of time, the equipment shall be finish coated in the shop and then be touched up after installation.

B. Items of equipment or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have surface preparation and coating performed in the field.

C. For certain pieces of equipment, it may be undesirable or impractical to apply finish coatings in the field. Such equipment shall be primed and finish coated in the shop and touched up in the field with the identical material after installation. CONTRACTOR shall require the manufacturer of each such piece of equipment to certify as part of its Shop Drawings that the surface preparation is in accordance with these specifications. The coating material data sheet shall be submitted with the Shop Drawings for the equipment.

D. For certain small pieces of equipment, the manufacturer may have a standard coating system that is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the Shop Drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.

E. Shop-painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 2 months before being topcoated, or less time if recommended by the coating manufacturer.

F. CONTRACTOR shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment Shop Drawings.

G. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturer's printed instructions.

3.12 APPLICATION

A. General

1. Schedule inspection with ENGINEER in advance for cleaned surfaces and all coats prior to each succeeding coat.
2. Apply coatings in accordance with the paint manufacturer's recommendations and these specifications, whichever is more stringent. Allow sufficient time between coats to assure thorough drying of previously applied paint.
3. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same day.
4. Special attention shall be given to materials that will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.
5. Finish coats, including touch-up and damage repair coats shall be applied in a manner that will present a uniform texture and color matched appearance.
6. Non-buried steel piping shall be abrasive blast cleaned and primed before installation.
7. Finish coats shall be applied after concrete, masonry, and equipment installation is complete, and the working areas are clean and dust free.

3.13 CURING OF COATINGS

A. CONTRACTOR shall maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the most stringent, prior to placing the completed coating system into service.

B. In the case of enclosed areas, forced air ventilation, using heated air, if necessary, may be required until the coatings have fully cured.

3.14 SHOP AND FIELD OBSERVATION AND TESTING

A. CONTRACTOR shall give ENGINEER a minimum of 3 Days advance notice of the start of any field surface preparation or coating application, and a minimum of 7 Days advance notice of the start of any surface preparation activity in the shop.

B. Observation by ENGINEER, or the waiver of inspection of any particular portion of the work, shall not relieve CONTRACTOR of its responsibility to perform the work in accordance with these Specifications.

C. CONTRACTOR shall furnish inspection devices in good working condition for the detection of holidays and measurement of dry film thicknesses of coatings. Dry-film thickness gauges shall be made available for ENGINEER's use while coating is being done, until final acceptance of such coatings. CONTRACTOR shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of ENGINEER.

D. CONTRACTOR shall test for continuity (holiday test) all coated surfaces inside reservoirs, other surfaces that will be submerged in water or other liquids, surfaces that are enclosed in a vapor space in such structures, and surfaces coated with any of the submerged and severe service coating systems. Areas that contain discontinuities shall be marked and

repaired or recoated in accordance with the coating manufacturers' printed instructions and then be retested.

1. Coatings with thickness exceeding 20-mils total DFT: Pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the required coating thickness.
2. Coatings with thickness of 20-mils or less total DFT: Tinker & Rasor Model M1 nondestructive type holiday detector, K-D Bird Dog, or equal shall be used. The unit shall operate at less than 75 volts. For thicknesses between 10- and 20-mils, a nonsudsing type wetting agent, such as Kodak Photo-Flo or equal, shall be added to the water prior to wetting the detector sponge.

E. On ferrous and non-ferrous the dry film coating thickness shall be measured in accordance with the SSPC PA 2 using a magnetic type dry film thickness gauge such as Mikrotest Model FM, Elcometer Model 111/1EZ, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.

F. Evaluation of blast cleaned surface preparation will be based upon comparison of the blasted surfaces with the standard samples available from SSPC and NACE, such as using NACE standards TM-01-70 and TM-01-75.

G. Visually inspect concrete, nonferrous metal, plastic, drywall, and wood surfaces to ensure proper and complete coverage has been attained.

3.15 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at the end of each day.

B. Upon completion of the work, remove staging, scaffolding, and containers from the site or destroy in a legal manner.

C. Completely remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

D. Damages due to overspray on buildings, vehicles, trees, or other surfaces not specified to be painted would be the responsibility of CONTRACTOR.

3.16 MANUFACTURER' SERVICES

A. Furnish paint manufacturer's representative to visit jobsite at intervals during surface preparation and painting as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions and these specifications, and as may be necessary to resolve field problems attributable to, or associated with, manufacturer's products furnished under this Contract.

- END OF SECTION -

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SECTION 26 05 19
CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 GENERAL

A. Furnish and install conductors and cables as required, and as shown on the Drawings. Materials employed shall be as indicated on the Drawings and specified herein.

1.2 SUBMITTALS

A. Submit product literature including manufacturer part number, model number, material, size, and specifications. Material shall not be installed until the Engineer has reviewed the submittal data.

B. Shop Drawings shall be submitted for review and acceptance showing routing, conduit size, and number and size of wires in each conduit before installation of conduit and any related work. Show proposed routing of conduits buried under floor slabs-on-grade, conduit and rebar embedded in floor slabs, columns, etc. Identify conduit by tag number of equipment served and by conduit schedule number.

1.3 QUALITY ASSURANCE

A. MANUFACTURERS: Firms regularly engaged in manufacture of conduits and raceway systems of type and sizes required, whose products have been in satisfactory use in similar service for not less than (3) years.

B. STANDARDS: Comply with applicable portions of the NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL listed and labeled. Comply with NEC requirements as applicable to construction of raceway systems.

1.4 APPLICABLE SECTIONS

A. Section 26 05 00 Electrical General Requirements.

PART 2 PRODUCTS

2.1 COMPONENTS

A. 600 Voltage Conductors:

1. Copper with AWG sizes as shown or required:
   a. Minimum size shall be No. 12 except where specified otherwise.
   b. Conductors shall be stranded.

1) Insulation:
   a) Conductor Size No. 2 And Smaller: 600V type THWN or XHHW (75° C). All conductors run in underground conduits shall be XHHW.
   b) Conductor Size No. 1 And Larger: 600V Type XHHW-2 (90° C).
2) Colors:
   a) 120/240 V System
      (1) Black: Line 1.
      (2) Red: Line 2.
      (3) Green: Ground.
      (4) White: Neutral.
   b) 208Y / 120 V System:
      (1) Black: Phase A.
      (2) Red: Phase B.
      (3) Blue: Phase C.
      (4) Green: Ground.
      (5) White: Neutral.
   c) 480Y / 277 Volt System:
      (1) Brown: Phase A.
      (2) Orange: Phase B.
      (3) Yellow: Phase C.
      (4) Neutral: Gray.
      (5) Ground: Green.
   d) Conductors size No. 10 and smaller shall be colored full length. Tagging or other methods for coding of conductors size No. 10 and smaller not allowed.
   e) For feeder conductors larger than No. 10 at pull boxes, gutters, and panels, use taped band or color tag color-coded as specified above.

B. Instrumentation Cables:

1. Instrument cable shall be Type TC, and have the number of individually shielded twisted pairs indicated on the Drawings and shall be insulated for not less than 600 volts. Unless otherwise indicated, conductor size shall be No. 18 AWG minimum. Shielded, grounded instrumentation cable shall be used for all analog and low voltage digital signals.
2. The jacket shall be flame retardant with 90 degrees C temperature rating. The cable shield shall be a minimum of 2.3 mil aluminum or copper tape overlapped to provide 100 percent coverage and a tinned copper drain wire.
3. The conductors shall be bare soft annealed copper, Class B, 7 strand minimum concentric lay with 15 mils nominal thickness, nylon jacket, 4 mil nominal thickness, 90 degrees C temperature rating. One conductor within each pair shall be numerically identified.
4. Pairs shall be assembled with a nominal 2 inch lay and shall then be group shielded with a minimum of 1.3 mil aluminum or copper tape overlapped to provide 100 percent coverage. All group shields shall be completely isolated from each other.

C. Control Wires:

1. Copper with AWG sizes as shown or required:
   a. Minimum size shall be No. 14 except where specified otherwise.
   b. Conductors shall be stranded.

1) Insulation:
   a) 600V type THWN or XHHW (75° C). All conductors run in underground conduits shall be XHHW.

2. Control wires may be run in same conduits as instrumentation cables.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:

1. Conductors and cables shall be continuous from source to equipment.
2. Do not use direct burial cable.
3. Instrumentation and control wires shall be run in conduits separate from power conduits.

B. 600 Voltage Conductors:

1. Install conductors in raceway except where specifically indicated otherwise. Run conductors of different voltage systems in separate conduits. All raceways shall include an equipment ground conductor.
2. Route circuits at own discretion, however, circuiting shall be as indicated or required. Group circuit homeruns to panels as shown on Drawings. No other groupings of circuits will be allowed.
3. Neutrals:
   a. On three phase, 4 wire systems: Do not use common neutral for more than one three phase circuit.
   b. On single phase, 3 wire systems: Do not use common neutral for more than one circuit per phase.
   c. Run separate neutrals for each circuit where specifically noted on Drawings.
   d. Where common neutral is run for two or three home run circuits, connect phase conductors to breakers in panel which are attached to separate phase legs so neutral conductors will carry only unbalanced current. Neutral shall be sized at 200% of full load.
4. Pulling Conductors:
   a. Do not pull conductors into conduit until raceway system is complete and enclosures, cabinets, and boxes are free of foreign matter and moisture.
   b. Install conductors in accordance with the manufacture’s requirements.
   c. Use only listed non-hardening wire pulling lubricants.
5. Provide positive supports for conductors in vertical raceways at following spacing minimum, unless shorter is recommended by manufacturer.
   a. No. 18 to 1/0 100 feet.
   b. No. 2/0 to 4/0 80 feet.
   c. 250MCM to 350MCM 60 feet.
   d. 350MCM to 500MCM 50 feet.

C. Feeder and branch circuits shall be isolated from each other, and from instrumentation and control circuits. Instrumentation cables shall be installed in separate raceways from other cables and wiring. This includes portions running through manholes. Instrumentation cable shall be continuous between instruments or between field devices and instrument enclosures. There shall be no intermediate splices or terminal boards, unless otherwise shown on the Drawings.

D. Maintain electrical continuity of the shield when splicing twisted shielded pair conductors. Drain wires shall be terminated inside enclosures at grounded terminal blocks. Only one end of each instrument loop cable drain wire shall be grounded. Ground drain wire of shielded conductors at one end only.

E. Terminate instrumentation and control wiring, including spare wires, at control panels and motor control centers on terminal boards mounted inside the equipment.

1. CONTRACTOR shall supply terminal boards as required.
2. Do not field wire directly to devices.

F. Low Voltage Cables In Office Spaces (70 Volts or Less):

1. In inaccessible, concealed spaces, run cables in raceway. In accessible, unfinished areas, cables may be run exposed without raceway.
2. Run exposed cables parallel to or at right angles to building structure lines. Do not run exposed cables on floors or in such a way that they obstruct access to, operation of, or servicing of equipment. Keep cables 6 inches minimum from hot water pipes.
   a. Support cables every 3 feet with permanent clips, straps, staples, or tie wraps approved for application and which will not cause cables to be pinched or deformed.
   b. Securely attach clips and straps with nails or screws. Do not use wire or tape to support cables.
3. Bundle only cables of same systems together.

- END OF SECTION -

SECTION 26 05 22
WIRING DEVICES

PART 1 GENERAL

1.1 GENERAL

A. Furnish and install wiring devices as required, and as shown on the Drawings. Materials employed shall be as indicated on the Drawings and specified herein.

1.2 SUBMITTALS

A. Submit product literature including manufacturer, model or part number, materials of construction, size, ratings, and listings as a minimum.

1.3 QUALITY ASSURANCE

A. NECA - Standard of Installation.

B. NEMA WD 1 - General Requirements for Wiring Devices.

C. NEMA WD 6 - Wiring Device -Dimensional Requirements.

D. NFPA 70 - National Electrical Code.

E. UL - Underwriters Laboratories, Inc.

PART 2 PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:

1. Hubbell, Model HBL-1221, 1223, 1224 series.
2. Arrow Hart, Model 1991.

B. Description: NEMA WD 1, Heavy-Duty Specification Grade AC only general-use snap switch.

C. Body and Handle: Gray plastic with toggle handle.

D. Indicator Light: Lighted handle type switch red color handle.

E. Locator Light: Lighted handle type switch; red color handle.

F. Ratings:

1. Voltage: 120-277 volts, AC.
2. Current: 20 amperes.

2.2 RECEPTACLES

A. Manufacturers:

1. Hubbell, Model HBL 5362-SP.
2. Arrow Hart, Model 5362-CR.

B. Description: NEMA WD 1, Heavy-duty specification grade general use receptacle.

C. Device Body: Gray plastic.

D. Configuration: NEMA WD 6, type as specified and indicated.

E. Convenience Receptacle: Type 5-20.

F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.3 WALL PLATES

A. Decorative Cover Plate: Brushed stainless steel in electrical/control/blower rooms.

B. Process Room/Exterior Cover Plate: Gasketed cast metal with hinged gasketed device cover. Lever type switch cover. Classified hazardous as required for process areas per drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that outlet or device boxes are installed at proper height.

B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install in accordance with NECA "Standard of Installation."

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install receptacles with grounding pole on bottom.

E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

F. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

G. Connect wiring devices by wrapping conductor around screw terminal.

H. Use jumbo size plates for outlets installed in masonry walls.

I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Install wall switch 48 inches above finished floor.

B. Install convenience receptacle 18 inches above finished floor unless otherwise indicated.

C. Install convenience receptacle 6 inches above back-splash of counter.

D. Install dimmer 48 inches above finished floor.

E. Install telephone jack 18 inches above finished floor.

F. Install telephone jack for side-reach wall telephone to position top of telephone at 54 inches above finished floor.

G. Install telephone jack for forward-reach wall telephone to position top of telephone at 48 inches above finished floor.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

F. Verify that each telephone jack is properly connected and circuit is operational.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish

- END OF SECTION -

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SECTION 26 05 26
GROUNDING AND BONDING

PART 1 GENERAL

1.1 GENERAL

A. Furnish all labor, materials, equipment, appliances, and perform all operations in connection with, and complete in strict accordance with, this section of specifications and the applicable drawings and subject to the terms and conditions of the contract for the following work:

1. Grounding electrodes and conductors.
2. Equipment grounding conductors.

1.2 APPLICABLE SECTIONS

A. The General Conditions, Supplementary Conditions, alternates and Addenda, applicable drawings and the technical specification including but not limited to the following:

1. Section 26 05 00 Electrical General Requirements.

1.3 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 26 05 00 Electrical General Requirements

1.4 REFERENCES

A. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).

B. NFPA 70 - National Electrical Code.

1.5 GROUNDING SYSTEM DESCRIPTION

A. Metal underground water pipe.

B. Metal frame of the building.

C. Concrete-encased electrode.

D. Rod electrode.

E. Plate electrode.

F. Active electrode.

1.6 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms maximum.

1.7 SUBMITTALS FOR REVIEW

A. Product Data: Provide for grounding and bonding equipment.

B. All submittals shall include a list of all items being submitted by description, manufacturer and catalog number.

1.8 SUBMITTALS FOR CLOSEOUT

A. Section 26 05 05 - Operation and Maintenance Manuals.

B. Project Record Documents: Record actual locations of components and grounding electrodes.

C. Certificate of Compliance: Indicate approval of installation by the authority having jurisdiction.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.

1.10 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Material: Copper Clad Steel.

B. Diameter: 5/8 inch.

C. Length: 10 feet (3000 mm).

2.2 CONNECTORS

A. Manufacturers:

1. T&B
2. Burndy - Hi-Ground
3. ERICO® - Cadweld®

B. Material: Irreversible Crimp Style or Exothermic Weld.

2.3 WIRE

A. Material: Stranded copper, tinned.

B. Grounding Electrode Conductor: Size as indicated in the Drawings, or if modified or not indicated, size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Install electrodes at locations indicated and in accordance with manufacturer's instructions. Install additional rod electrodes as required to achieve specified resistance to ground.

B. Provide grounding electrode conductor (UFER) and connect to reinforcing steel in foundation footing. Bond steel together.

C. Provide bonding to meet Regulatory Requirements.

3.3 FIELD QUALITY CONTROL

A. Perform inspections and tests listed in NFPA ATS, Section 7.13.

- END OF SECTION -

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SECTION 26 05 30
CONDUIT

PART 1 GENERAL

1.1 GENERAL

A. Furnish and install conduits and raceway systems as required, and as shown on the Drawings. Materials employed shall be as indicated on the Drawings and specified herein.

1.2 SUBMITTALS

A. Submit product literature including manufacturer part number, model number, material, size, and specifications. Material shall not be installed until the Engineer has reviewed the submittal data.

B. Shop Drawings shall be submitted for review and acceptance showing routing, conduit size, and number and size of wires in each conduit before installation of conduit and any related work. Show proposed routing of conduits buried under floor slabs-on-grade, conduit and rebar embedded in floor slabs, columns, etc. Identify conduit by tag number of equipment served and by conduit schedule number.

C. Proposed location and details of construction for openings in slabs and walls for conduit runs.

1.3 QUALITY ASSURANCE

A. MANUFACTURERS: Firms regularly engaged in manufacture of conduits and raceway systems of type and sizes required, whose products have been in satisfactory use in similar service for not less than (3) years.

B. STANDARDS: Comply with applicable portions of the NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL listed and labeled. Comply with NEC requirements as applicable to construction of raceway systems.

1.4 PROJECT/SITE CONDITIONS

A. GENERAL

1. Unless otherwise specified, equipment and materials shall be sized and derated for ambient site conditions, but in no case less than an ambient temperature of 40 degrees C at an elevation ranging from sea level to 4,300 feet without exceeding the manufacturer’s stated tolerances.

B. AREA CLASSIFICATIONS

1. For the purpose of delineating the basic electrical construction materials and installation requirements for this project, areas of the project have been classified on the contract drawings as defined below. Electrical work within these areas shall

conform to the requirements described below as well as the referenced code requirements.

a. General Purpose (NEMA 1): Areas requiring general purpose (NEMA 1) construction are indoor areas typically architecturally finished, always dry, and occupied by plant personnel.
b. Corrosive Process Areas (NEMA 4X): Areas requiring corrosion resistant (NEMA 4X) construction. Corrosive process areas typically contain pumping or piping systems and are subject to spills and washdown. Corrosive process areas shall also include those areas containing corrosive chemicals.
c. Outdoor Areas (NEMA 3R): Areas outdoors require weather resistant (NEMA 3R) rating.
d. Hazardous Areas (NEMA 7): Unless otherwise indicated on the contract drawings, areas requiring hazardous location (NEMA 7) construction are classified as Class 1, Division 2 or Class1, Division 1 hazardous locations per Articles 500 and 501 of the National Electrical Code. See classification drawings.
e. Process Areas (NEMA 12): Areas requiring drip-proof (NEMA 12) construction are indoor process and support system areas and are not typically subject to spills, direct washdown, or corrosive chemicals under normal operating conditions, but may experience occasional or unintended wetness.

1.5 CONSTRUCTION MATERIALS:

A. Construction materials required for each area classification are listed in table A below. Refer to the individual specification section for each component for material composition and installation practices.

	Area Classification				
Component	NEMA 1	NEMA 3R[1] Outdoor	NEMA 4X[1] Indoor Corrosive	NEMA 12[1]	NEMA 7 Classified Explosion Proof/Process Area
Conduit (exposed)	GRS	RA PGRS	RA PGRS	RA PGRS	PGRS
Conduit (concealed)[4]	EMT[3]	PGRS GRS	RA	GRS	GRS
Flexible conduit[5]	LFS	LFS	LFN	LFN	Classified
Support systems	Galvanized Steel	Aluminum	Stainless steel	Aluminum	Stainless steel
Fastening hardware and hanger rods	Cadmium plated steel	Stainless steel	Stainless steel	Cadmium plated steel	Stainless steel
Control Stations[2,6]	Painted Steel	Non-Metallic	Non-Metallic	Painted Steel	Classified

Enclosures[2,6]	Painted Steel	Non-Metallic	Non-Metallic	Painted Steel	Classified
Receptacles[2] Surface Recessed	General General	WP[8] WP[8]	WP[8] N/A	WP[8] WP[8]	Classified N/A
Switches[2] Surface Recessed	General General	WP[8] WP[8]	WP[8] N/A	WP[8] WP[8]	Classified N/A

Notes:

1. Enclosures, device boxes, control stations and raceway systems shall be mounted with ¼-inch (minimum) space between the electrical system and supporting structure.
2. Conduit terminations to control stations, enclosures, and device boxes in NEMA 3R, 4X, 7 and 12 areas shall be made through threaded hubs.
3. Rigid conduit concealed in framed walls, block walls and ceiling spaces shall be electrical metallic tubing, type EMT.
4. Conduit ductbank or beneath slab on grade shall be rigid PVC-40 conduit, without pullboxes, and with waterproof conduit splices beneath grade to limit water penetration.
5. Flexible conduit shall be utilized for final connections to equipment.
6. Control station and enclosure sealing ratings shall meet or exceed the rating designated by the area classification.
7. Exposed conduit systems in areas containing equipment handling Ferric Chloride shall be PGRS.
8. Use gasketed lever type switches and up-in use red dot steel receptacle covers.

Legend:

EMT	Electrical Metallic Tubing
GRS	Galvanized Rigid Steel
LFS	Liquid Tight Flexible Steel
LFN	Liquid Tight Flexible Non-Metallic
PGRS	PVC Coated Galvanized Rigid Steel
PVC4	PVC Schedule 40
PVC8	PVC Schedule 80
RA	Rigid Aluminum
WP	Weatherproof – Use cast device boxes with threaded hubs
XP	Explosion proof – Approved conduit systems per classification listing
N/A	Non applicable

PART 2 PRODUCTS

2.1 CONDUIT AND TUBING

A. GENERAL

1. Provide conduit and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4".

B. Electrical Metallic Tubing (EMT)

1. Per UL "Standard for Electrical Metallic Tubing" No. 797. Galvanized mild steel with interior coat of enamel.
2. Fitting shall be steel, compression type. Cast type or indenter type fittings are not acceptable.
3. Approved for concealed interior locations of the Electrical Room.

C. Galvanized Rigid Metal Conduit (GRC): FS WW-C-0581 and ANSI C80.1

1. Per USAS C80.1, zinc-coated by hot-dip galvanizing or sherardizing with additional enamel or lacquer coating.
2. Couplings shall be threaded type of same material and finish as conduit. Connectors shall be Myers hubs or equal of same material and finish as conduit.
3. Approved Locations: Interior where exposed, where not exposed to moisture or corrosive atmosphere.

D. High Density Polyethylene Plastic Pipe (HDPE), Or Polyvinyl Chloride (PVC) Schedule 40, Based on Outside Diameter:

1. Conduit suitable for direct burial. 1” minimum size.
2. Fittings shall be threaded, glued, or heat welded type of same material as conduit. No splices are allowed underground in locations with high water table.
3. Approved for underground direct burial, May be used where buried in earth under floor slabs.
4. Minimum depth of bury under slab shall be 18 inches or of sufficient depth to allow for bending radius to rise out of the slab vertically. Shall have an exposed grounding electrode conductor in each trench.
5. Not approved for above grade installation nor for embedding in concrete slabs.
6. Exterior underground conduits, all elbows shall be PVC coated GRS or Fiberglass.
7. All buried conduit between VFDs and motors.

E. PVC Coated Galvanized Rigid Metal Conduit (PGRC): NEMA RN 1

1. Rigid galvanized conduit, prior to plastic coating, shall conform to ANSI Standard C80.1, UL 6, and CSA Standard C22.2 #45.
2. Nominal thickness of exterior PVC coating shall be 40 mils. A two-part red urethane coating of 2 mil thickness shall be applied to the interior of all conduits and fittings.
3. All hollow conduit fittings which serve as part of the raceway system shall be coated with exterior PVC coating and red interior urethane coating as described above.
4. Coated conduit shall conform to NEMA Standard No. RN1-1989. Shall be "Plastic-Bond Red" as manufactured by Robroy Industries, Inc.
5. Approved Locations: Shall be used in all locations where conduits are buried, in contact with earth, and in wet and corrosive areas, and as noted on the drawings. All risers through concrete floors, all embedded conduit, and all elbows of ductbanks underground.

F. Liquidtight Flexible Metal Conduit: UL 360

1. Galvanized steel with an extruded liquidtight PVC cover that is moisture and oil-proof, and UV resistant.

2. Fittings shall be liquidtight compression type, listed for grounding. Provide fittings with external bonding jumper where required for bonding.
3. Approved for flexible connections to equipment subject to vibration such as motors, fan, pumps, dry transformers, etc., 36-inch maximum, 18" minimum length for each connection.

G. Flexible Metal Conduit: UL 1

1. Galvanized steel.
2. Approved for flexible connections to equipment in unclassified areas of the Administration Building.

H. Ridged Aluminum Conduit

1. Couplings shall be threaded type of same material and finish as conduit. Connectors shall be Myers hubs or equal of same material and finish as conduit. Approved Locations: Interior where exposed, on the exterior exposed to moisture or corrosive atmosphere. Approved for above grade installation. May be used within the process area of the plant.

I. Conduit Bodies:

1. Form 7 malleable iron with hot dip galvanized finish, PVC coated in wet or process areas of plant.
2. Gasketed cast iron, zinc plated cover with stainless steel screws.

PART 3 EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS

A. General Requirements: Unless otherwise indicated, wiring shall consist of insulated conductors installed in conduits or raceways.

3.2 CONDUIT AND TUBING SYSTEMS

A. Conduit and tubing systems shall be installed as indicated. Conduit sizes are based on the use of insulated, copper conductors. Minimum size of raceways shall be as noted. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. PVC coated rigid metal conduit will be used in damp, wet or corrosive locations and the conduit or tubing system will be provided with the appropriate boxes, covers, clamps, screws or other appropriate type of fittings. Any exposed threads or metal shall be touched up with 3 coats of touch up material provided with conduit. Raceways shall be kept 6" away from parallel runs of any mechanical piping. Raceways shall be concealed where possible. Raceways crossing structural expansion joints shall be provided with suitable expansion fittings and will provide continuity for grounding.

3.3 BELOW SLAB-ON-GRADE OR IN THE GROUND

A. All electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing through slabs-on-grade shall be PVC coated rigid metal conduit. PVC conduits

shall be installed below slab-on-grade or in the earth. All underground bends over 22º and risers through concrete slab shall be PVC coated GRC.

3.4 INSTALLED IN SLABS INCLUDING SLABS ON GRADE

A. Conduit shall not be embedded in concrete slabs except as specifically detailed.

3.5 EXPOSED RACEWAYS

A. Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways under raised floors and above ceilings shall be considered as exposed installations.

3.6 CHANGES IN DIRECTION OF RUNS

A. Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field made bends and offsets shall be made with an approved hickey or conduit bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp or wet locations shall be avoided where possible. Care shall be taken to prevent the lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment during the course of construction. Clogged raceways shall be entirely freed from obstructions or shall be replaced.

3.7 SUPPORTS

A. Metallic conduits and tubing shall be securely and rigidly fastened in place at intervals of not more than 10' and within 3' of boxes, cabinets, enclosures, and fittings, with U-channel support systems, one hole conduit straps with clamp backs, and conduit hangers. All supports mounted in exterior, process, or exposed areas subject to corrosive atmosphere shall be stainless steel. Supports in other areas shall be hot dipped galvanized. C-clamps or beam clamps shall have strap or rod type retainers. Rigid plastic conduits (if permitted as wiring method) shall be supported as indicated above, except that they shall be supported at 3’-0” maximum on centers and as indicated in the NEC (NFPA 70). Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structures, but no load shall be applied to joist bridging.

B. Fastenings shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a power charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or supports shall not be welded to steel structures. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams or to a depth of more than 3/4" in concrete joints shall avoid cutting the main reinforcement bars. Holes not used shall be filled. In partitions of light steel construction, sheet metal screws shall be used. Conduits shall not be supported using wire or nylon ties.

C. Raceways shall be installed as a complete system and shall be independently supported from the structure. Upper raceways shall not be supported of lower raceways. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts and shall not be fastened to hung ceiling supports.

D. Support Installations:

1. U-channel supports generally are not detailed but must be adequate to support combined weights of conduit and conductors.
2. Clamps: Galvanized malleable iron one-hole straps with clamp backs, beam clamps or other approved device with necessary bolts, expansion shields. Perforated metal straps shall not be used.
3. Adjustable U-channel Supports: Used to support horizontal runs only, use trapeze hangers for parallel runs of conducts.
4. Surface mounted raceway bases shall be anchored to ceiling members or block walls on 5'-0" centers maximum spacing and at all junction and device boxes and at angle fittings. Anchors shall be: Expansion shields on concrete or solid masonry, toggle bolts on hollow masonry units or on suspended ceilings.

3.8 INSTALLATION OF RACEWAYS AND FITTINGS:

A. General

1. All Conduit: In accordance with requirement of National Electrical Code and applicable local codes.
2. Steel Conduit: In accordance with recommendations of American Iron and Steel Institute "Design Manual on Steel Electrical Raceways," latest edition.

B. Electrical Continuity

1. All metallic conduit systems shall be electrically continuous throughout.

C. Moisture

1. All conduit systems shall be essentially moisture tight.

D. Alignment of Exposed Conduit

1. Parallel with or at right angles to lines of structure.

E. Field Cuts and Threads

1. Cuts shall be square, threads clean and sharp. Remove sharp or rough edges by reaming burrs. Before couplings or fittings are attached, apply one coat of red lead or zinc chromate to male threads of rigid steel conduit. Apply coat of red lead, zinc chromate or special compound recommended by manufacturer of conduit where conduit protective coating is damaged.

F. Bends

1. Uniform, whether job-fabricated or made with standard fittings or boxes. Do not dent or flatten conduit.
2. Exposed Conduit: Symmetrical insofar as practicable.

G. Location

1. Routing: Generally shown in schematic fashion, unless dimensioned or noted to contrary. Contractor shall determine actual routing as approved.

2. Conduit Not Shown: Contractor shall route as required to connect equipment as specified.
3. Vertical Risers, Equipment and Device Locations: Approximately as shown. Contractor shall coordinate installation of conduit, in locations indicated, with structure and equipment.
4. Conduit in Relation to Steam or Hot Water Lines or Other Hot Surfaces: Locate minimum of 6" away. If such separation is impracticable, protect from heat as approved.

H. Buried Conduit

1. Depth of Burial: Minimum of 24" below finished grade with warning tape 12" above conduit.

I. Wall Penetrations: Required for passage of conduits installed by CONTRACTOR through walls, or partitions.

1. Penetrations Through Exterior Building Walls: Cast in sleeve/Core drill wall and provided conduit entrance seals as detailed. All penetrations shall be with rigid steel conduit PVC coated within the plant process areas.
2. Openings Required Through Existing Partitions: Shall be provided at CONTRACTOR's expense. Holes through masonry construction shall be cast/ drilled with suitable coring machine. Perform work neatly. Patches shall match original material in composition and appearance.
3. Provide fire seals where a fire rated partition or wall is penetrated.

J. Expansion Fittings

1. Install in all conduit runs crossing structural expansion joint or in straight runs 75 feet or more in length.

K. Conduit Ends

1. Cap spare conduits.
2. Open Conduit Ends Terminating in Switchboards, Cabinets or Similar Locations Where Exposed to Entrance of Foreign Material: Install insulating grounding bushing. Plug space around cables with sealing compound.
3. Cap or plug conduit ends to prevent entrance of foreign material during construction.

L. Conduit Connections

1. Cabinets, Enclosures, and Boxes: Double lock nuts and insulating bushings for rigid conduits in unclassified areas, NEMA 1. Hubs for rigid conduits in damp, wet, exterior, or corrosive areas, NEMA 12, 3R, 4, 4X. Bushings, insulating type, bell ends, or insulated throat fittings shall be installed on the ends of all conduits. Grounding type fittings and bushings shall be utilized as required for bonding.
2. Metallic Conduit Terminating in Non-Metallic Manholes or Pull Boxes: Insulated grounding bushing with lay-in ground lugs.
3. Flexible conduit for connection to movable equipment shall be liquidtight, utilizing listed liquidtight fittings.

M. Cleaning

1. Clean and swab inside of conduits by mechanical means to remove foreign materials and moisture before conductors are installed.

N. Spare Conduits

1. Install nylon pull line for future installation of cables. Cap all conduits and mark where end is located on Record Drawings with dimensions.

- END OF SECTION -

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SECTION 26 05 32
CONDUIT DUCTBANKS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install conduit ductbanks as required, and as shown on the Drawings. Materials employed shall be as indicated on the Drawings and specified herein. All exterior conduit shall be buried underground and embedded in sand as detailed.

1.2 SUBMITTALS

A. Submit product literature including manufacturer part number, model number, material, size, and specifications. Material shall not be installed until the Engineer has reviewed the submittal data.

B. Shop Drawings shall be submitted for review and acceptance showing routing, conduit size, and number and size of wires in each conduit before installation of conduit and any related work. Show proposed routing of conduits buried under floor slabs-on-grade, conduit and rebar embedded in floor slabs, columns, etc. Identify conduit by tag number of equipment served and by conduit schedule number.

1.3 QUALITY ASSURANCE

A. MATERIAL MANUFACTURERS: Firms regularly engaged in manufacture of duct system components of type and sizes required, whose products have been in satisfactory use in similar service for not less than (3) years.

B. STANDARDS: Comply with applicable portions of the NEMA standards pertaining to underground ducts. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL listed and labeled. Comply with NEC requirements as applicable to construction of raceway systems.

1.4 APPLICABLE SECTIONS

A. Section 31 22 00 - Earthworks

B. Section 26 05 00 - Electrical General Requirements.

C. Section 26 05 19 – Conductors and Cables.

PART 2 - PRODUCTS

2.1 DUCTS

A. Ducts shall be round-bore, size as indicated, Nonmetallic Conduit, PVC-40.

B. Duct elbows, bends, and off-sets shall be per the manufacturer’s requirements. Metal or PVC conduits underground are not allowed.

PART 3 - EXECUTION

3.1 CONDUIT BANKS

A. Each ductbank shall be completely encased in sand. Thickness of sand over, under and around ductbank shall be not less than 3 inches as detailed. All ductbanks shall include a grounding electrode conductor as detailed.

B. Unless noted otherwise, the top of the sand envelope shall be not less than 2'-6" below finished grade or paving.

C. Ducts shall be installed to provide a water-tight, continuous length duct. If required, joints in duct shall be as per the manufacturer's requirements, and staggered at least 6 inches.

D. Saddles shall be used for support as indicated on the drawings. Hold down anchors shall be provided as indicated and required to prevent duct from floating on wet concrete.

E. During construction, ends of ducts shall be plugged to prevent debris from entering into ducts. Particular care shall be taken to keep ducts clean of concrete or any other substance during the course of construction.

F. After each duct line has been completed, a mandrel not less than 12 inches long, having a cross section approximately 1/2" less than the inside cross section of the duct, shall be pulled through to clean out the duct of earth, sand or gravel.

G. Trenching, backfilling and surface repair shall be done in accordance with Division 2 of these specifications. Hand dug or vacuum truck dug trenches are required where risk of contact with other underground utilities are present.

H. Ductbanks shall be straight without bends or off-sets if at all possible.

I. Over each ductbank at approximately 12 inches below grade, provide a detectable continuous red plastic warning tape to alert future excavators of the presence of the ductbank.

J. Provide nylon pull line in all ducts.

- END OF SECTION -

SECTION 26 42 14
GALVANIC CATHODIC PROTECTION SYSTEMS

PART 1 GENERAL

1.1 WORK INCLUDED:

A. This section covers the work necessary to furnish and install a galvanic anode cathodic protection system, including test stations, electrical isolation, and pipe joint bonds for electrical continuity, complete, on steel and ductile iron pipelines.

B. Additional work shall include installation of galvanic anodes on buried metallic fittings, pipe, and appurtenances used with non-metallic (PVC or HDPE) pipe, complete.

C. CONTRACTOR to have a third-party Corrosion Expert perform CONTRACTOR required quality control testing as defined this section.

1.2 RELATED WORK

A. Related work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 09 90 00 Painting and Finishes
3. Section 40 05 13.13 Steel Process Piping

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. NACE International (NACE)

1. NACE SP-0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems
2. NACE SP-0177 Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems

1.4 QUALIFICATIONS

A. All CONTRACTOR specified testing shall be performed by a third-party Corrosion Expert who holds a current NACE accreditation as a Cathodic Protection Specialist (CP-4) or Cathodic Protection Technologist (CP-3), and/or a registered professional engineer.

B. CONTRACTOR performed quality control testing shall include the following tests, which shall be performed as defined in this section.

1. Quality Control Testing, Joint Bond Resistance test
2. Quality Control Testing, Insulating Joint Testing
3. Quality Control Testing, Concrete isolation testing

C. Connection of galvanic anodes, energizing and testing of cathodic protection system, and other tests as defined under “System Tests and Inspections” shall be performed by ENGINEER unless specifically stated otherwise this section.

D. Buried pipe appurtenance galvanic anodes shall be connected to the pipe by CONTRACTOR as work proceeds.

1.5 DEFINITIONS

A. Electrically Continuous Pipeline: A pipeline which has a linear electrical resistance equal to or less than the sum of the resistance of the pipe plus the maximum allowable joint bond resistance for each bonded pipe joint as specified in this section.

B. Electrical Isolation: The condition of being electrically isolated from other metallic structures (including, but not limited to, piping, reinforcement, casings) and the environment as defined in NACE Recommended Practice SP0169.

1.6 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: Catalog cut sheets, product data sheets, and other information for products proposed for use in the Work.

C. Quality Assurance Submittals:

1. Manufacturers' Certificates of Compliance.
2. Field Test Reports.
3. Qualifications of NACE Accredited Testing Personnel.

PART 2 PRODUCTS

2.1 GENERAL

A. Like items of materials provided hereunder shall be the end product of one manufacturer to achieve standardization for appearance, maintenance, and replacement.

B. Materials and workmanship as specified in this section shall be installed concurrently with pipe installation. Coordinate all work specified herein with related sections.

2.2 SUPPLIERS

A. Alternate suppliers will be considered, subject to the approval of ENGINEER. The address given below is that of the general office. Contact these offices for information regarding the location of their representative nearest the project site.

1. Corrpro, Inc., Chicago, IL www.corrpro.com
2. Farwest Corrosion Control, Gardena, CA www.farwestcorrosion.com
3. Hoff Company, Inc. , Denver, CO www.pipelinesupplies.com
4. MESA Products, Tulsa, OK www.mesaproducts.com
5. Northtown Products, Huntington Beach, CA www.northtownproducts.com

2.3 JOINT BONDS

A. General:

1. All joint bonds provided either by pipe manufacturer or CONTRACTOR shall meet the following minimum requirements:
   a. All connections on a joint bond shall be welded or soldered.
   b. Mechanical or compression type connections will not be permitted.
   c. Bonds and welds shall exhibit sufficient strength or flexibility to allow thermal movement of the pipe after pipe backfill without cracking or breakage.
   d. Bond connections to pipe shall be with an ENGINEER approved thermite welding method.
2. All installed bonds shall be insulated or coated copper with all exposed copper, steel, or iron surfaces field coated as specified in this section.

B. Ductile or Cast-Iron Pipe, External Bonds:

1. Single-conductor, No. 2 AWG stranded copper wire with 600-volt HMWPE insulation, 18 inches long, with formed copper sleeve on each end of the wire.
2. Quantity of joint bonds per pipe joint by pipe diameter shall be as defined below:

Bond Type	Two Bonds	Three Bonds	Four Bonds
#2 AWG Wire	16” or less	42” or less	Over 42”

3. Connection of wire joint bonds to pipe shall be with the thermite weld method using molds and cartridges as recommended by the welder manufacturer for bond type used.
4. Bonds shall be manufactured by Erico Products, Continental Industries, or approved equal. Third party manufactured bonds shall be approved by the Engineer for conformance with the requirements of this specification and proper thermite welding.

C. Coated Steel Pipe, External Bonds:

1. Rolled joint or Carnegie joint bonds shall be one of the following types at CONTRACTOR’s option:
   a. Wire Bond: Single-conductor, No. 2 AWG stranded copper wire with 600-volt HMWPE or THWN insulation, 18 inches long, with a formed copper sleeve on each end of the wire.
   b. Strap Bond:
      1) Solid copper strap, 1-1/4-inch wide by 1/16-inch thick, equivalent to 1/0 AWG wire, with two punched holes for thermite welding to the pipe. Strap holes shall be sized for the thermite weld mold and shall provide for physical centering of the mold over the hole.
      2) The strap bond shall be 12-inches long with dielectric coating applied to the center 8-inches of the strap bond. Strap bonds provided without a dielectric coating shall be coated prior to installation with filler mastic as specified for heat shrink sleeves in Section 09 98 10 - Pipeline Coating and Lining.
      3) Strap bonds shall be manufactured by Erico Products, Continental Industries, Hoff Company, or approved equal. Third party manufactured

strap bonds shall be approved by ENGINEER for conformance with the requirements of this specification and proper thermite welding.

c. Use of manufactured steel bonding clips will not be permitted with heat shrink sleeve coated joints.

D. Flange joints:

1. Flanged joint bonds shall be one of the following types at CONTRACTOR's option:
   a. Exposed or Buried Joints:
      1) Steel rod, 5/8-inch diameter, length as required, arc welded to flange.
      2) Steel rod bonds will not be allowed where welding to the flange is not approved by ENGINEER.
   b. Buried Joints:
      1) Single-conductor, No. 2 AWG stranded copper wire with 600-volt HMWPE insulation, 18 inches long, with a formed copper sleeve on each end of the wire.
      2) Required bond where welding to the flange is not allowed by Engineer.
2. Quantity of joint bonds per pipe joint shall be as defined below:

Bond Type	Two Bonds	Three Bonds	Four Bonds
Steel Rod	36" or less	72" or less	Over 72"
#2 AWG Wire	NA	30" or less	Under 60"

3. Connection of wire joint bonds to pipe shall be with the thermite weld method using molds and cartridges as recommended by the welder manufacturer for bond type used.
4. Coat steel rod bonds with fast curing epoxy after welding to joint as specified in this Section, except when pipe is specified to be coated in accordance with Section 09 90 00 – Painting and Finishes.

E. Sleeve Coupling, Flanged Coupling Adapter, and Other Non-standard Joints:

1. Ductile Iron Pipe:
   a. Bond: No. 2 AWG wires, 24 inches long, HMWPE insulation, with two 12-inch long THHN insulated No. 12 AWG wire pigtails,
   b. Manufacturer: Erico Products Inc. (Cadweld), Cleveland, OH, Hoff Company, Denver, Colorado, or equal.
2. Steel Pipe:
   a. Solid copper strap, 1-1/4-inch wide by 1/16-inch thick, equivalent to 1/0 AWG wire, with five punched holes for thermite welding to the coupling follower rings, middle, ring, and pipe. Strap bond shall be fabricated for the length of the coupling with sufficient additional length for 1 inch of joint movement. Strap holes shall be sized for the thermite weld mold and shall provide for physical centering of the mold over the hole.
   b. Strap bond shall be manufactured by Erico Products, Continental Industries, Hoff Company, or approved equal. Third party manufactured copper strap bonds shall be approved by ENGINEER for conformance with the requirements of this specification and proper thermite welding.
3. Bond Quantity per Joint: Provide the quantity of bonds per pipe diameter as defined below:

Bond Type	Two Bonds	Three Bonds	Four Bonds
Copper Strap	NA	54” or less	Over 54”
No. 2 Wire Bond	NA	54” or less	Over 54”

4. Connection of wire or copper strap joint bonds to pipe shall be with the thermite weld method using molds and cartridges as recommended by the welder manufacturer for the bond type used.

2.4 BURIED APPURTENANCE GALVANIC ANODES

A. See Contract Drawings for type, size and quantity of anodes required for metallic fittings, pipe, and pipe appurtenances used in conjunction with non-metallic pipe.

B. All metallic fittings on non-metallic pipe shall be cathodic protected with one or more galvanic anodes as shown on the Contract Drawings.

C. CONTRACTOR shall connect anodes directly to the pipe appurtenances as work proceeds. Anode installation shall be visually verified by ENGINEER as work proceeds.

D. Buried pipe appurtenances do not require a test station.

2.5 PREPACKAGED GALVANIC ANODES

A. High-Potential Magnesium Alloy:

1. Composition:
   a. Aluminum: 0.01 percent maximum.
   b. Manganese: 0.5 to 1.3 percent.
   c. Zinc: 0.0
   d. Silicon: 0.0
   e. Copper: 0.02 percent maximum.
   f. Nickel: 0.001 percent maximum.
   g. Iron: 0.03 percent maximum.
   h. Total Others: 0.05 percent each or 0.3 percent maximum.
   i. Magnesium: Remainder.
2. Dimensions:
   a. Length: 30 inches minimum.
   b. Bare Weight: 32 pounds minimum.
3. Manufacturers and Products, or approved equal:
   a. Dow; Galvomag.
   b. Amax; Maxmag.

B. Anode Wire: Furnish each anode with No. 12 AWG solid copper wire with THWN insulation, 10 feet long.

C. Wire-to-Anode Connection: Manufacturer's standard. The anode connection shall be stronger than the wire.

D. Backfill:

1. Composition:
   a. Ground Hydrated Gypsum: 75 percent.
   b. Powdered Wyoming Bentonite: 20 percent.
   c. Anhydrous Sodium Sulfate: 5 percent.
2. Grain Size: 100 percent passing through a 20-mesh screen and 50 percent retained by a 100-mesh screen.
3. Mixture: Thoroughly mixed and firmly packaged around the galvanic anode within the cloth bag or cardboard tube by means of adequate vibration.
4. The quantity of backfill shall be sufficient to cover surfaces of the anode to a depth of 1-inch.

2.6 CATHODIC PROTECTION TEST STATIONS

A. Post Style, Steel Conduit:

1. Test Box:
   a. Cast aluminum with thread hub suitable for mounting to a 2-inch x 3-inch street reducer.
   b. Manufacturer and Product, or approved equal:
      1) Type A Stations: Gerome Manufacturing, Testox 2000 series (rectangle) with 2- inch or 3-inch threaded hub.
2. Street Reducer:
   a. Hot dipped galvanized 2-inch x 3-inch reducer and close nipple.
   b. Reducing bushings will not be permitted.
   c. Test stations provided with 3-inch threaded hub shall be directly mounted on steel conduit.
3. Terminal Block:
   a. Plastic or glass-reinforced laminated, 1/4-inch thick with eleven terminals for Type A stations.
   b. Terminal heads shall have special heads to keep them from turning or shall be easily accessible from both sides of the terminal block without requiring its removal.
   c. Terminal studs, washers, and nuts shall be stainless steel.
4. Mounting Structure:
   a. Rigid hot dipped galvanized steel conduit 3-inches diameter, threaded at one end (minimum), length as required for installation requirements.
   b. PVC long radius sweep elbow, 1-inch diameter, for wire protection as shown on the Contract Drawings.

2.7 WIRE

A. Pipe and Test Lead Wires:

1. No. 10 or 12 AWG wire, single-conductor, stranded copper with 600-volt, TW, THWN, or HMWPE insulation. Color coded insulation as specified.
2. Insulation Color: Color shall indicate the function of each test wire and shall be as follows:
   a. Pipe: White
   b. Anode: Black
   c. Insulating Joints: White or Green as shown on Contract Drawings

d. Reference Electrode: Yellow

2.8 CONDUIT, LOCKNUTS, AND STRAPS

A. Outdoors, Exposed Conduit

1. Rigid conduit shall be rigid galvanized steel.
2. Fittings, junction boxes, pull boxes, and outlet bodies shall be hot-dipped galvanized iron.
3. Locknuts, conduit clamps, and other miscellaneous hardware shall be hot dipped galvanized steel. Galvanized items shall be hot-dipped galvanized in accordance with ASTM A153.
4. Conduit clamps shall be two-piece, malleable iron, one hole, strap and clamp back spacer, O. Z. Gedney 14-100G and 143G or similar, for mounting to surfaces with either lag bolts or concrete wedge anchors, as shown in the Contract Drawings.

B. Buried Conduit:

1. Conduit shall be rigid electrical grade schedule 40 gray PVC.
2. Locknuts, two-hole straps, and other miscellaneous hardware shall be galvanized steel. Galvanized items shall be hot-dipped galvanized in accordance with ASTM A153.

2.9 THERMITE WELD MATERIALS

A. General:

1. Thermite weld materials consist of wire sleeves, welders, and weld cartridges according to the weld manufacturer's recommendations for each wire size and pipe or fitting size and material.
2. Welding materials and equipment shall be the product of a single manufacturer. Interchanging materials of different manufacturers is not acceptable.

B. Molds: Graphite, as recommended by the manufacturer for pipe and wire size.

C. Adapter Sleeves:

1. For No. 12 AWG and No. 2 AWG wires.
2. Prefabricated factory sleeve joint bonds or bond wires with formed sleeves made in the field are acceptable. Attach field-formed joint bonds sleeves with the appropriate size and type of hammer die furnished by the thermite weld manufacturer.
3. Extend wire conductor 1/8 inch beyond the end of the adapter sleeve.

D. Cartridges:

1. Steel: 32 grams, maximum.
2. Cast and Ductile Iron: 45 grams, maximum, XF-19 Alloy

E. Welders and Cartridges: For attaching copper wire to pipe material:

Pipe Material	Weld Type	Cartridge Size, Max.
No. 6 AWG Wire & Smaller		
Steel	HA, VS, HC	15 gm
Ductile or Cast Iron	HB, VH, HE	25 gm
No. 4 AWG Wire & Smaller		
Steel	HA, VS, HC	25 gm
Ductile or Cast Iron	HB, VH, HE	32 gm
No. 2 Wire Joint Bonds		
Steel	FS	32 gm
Ductile or Cast Iron	FC	45 gm

F. Welding Materials Manufacturers or approved equal:

1. Erico Products Inc. (Cadweld), Cleveland, OH.
2. Continental Industries, Inc. (Thermo-Weld), Tulsa, OK.

2.10 COATING REPAIR MATERIAL FOR PIPE AND FITTINGS

A. General:

1. Complete coating repairs in accordance with recommendations of the pipe or fitting manufacturer.

B. Coating Requirements:

1. Steel Pipes:
   a. Coal tar based coatings: Koppers Bitumastic 50 or Denso or Tapecoat wax tape coatings; or equal, 20 mils dry film thickness, minimum.
   b. Polyurethane or Epoxy Coatings: Fast cure epoxy, 20 mils dry film thickness, minimum
   c. Tape Wrap or Extruded Polyethylene Coating: Thermite Weld Cap, Canusa CRP Patch, or Raychem PERP patch, or equal
2. Ductile iron Pipe:
   a. Fast cure epoxy
   b. Thermite weld cap

C. Coating Materials:

1. Thermite Weld Caps:
   a. Royston Laboratories Handi-Cap IP, prefabricated primerless thermite weld cap and coating system.

b. Provide primer unless specifically stated in product data sheet that no primer is required.

2. Fast Cure Epoxy Coating:
   a. 100 percent solids, fast curing epoxy suitable for submerged or buried conditions.
   b. Acceptable products or equal:
      1) Denso Protal 7125 (low temperature) or Protal 7300
      2) Tapecoat TC 7010
      3) 3M ScotchKote 323

2.11 INSULATING JOINTS

A. General: Insulating joints shall be dielectric unions or flanges. The complete assembly shall have an ANSI rating equal to or higher than that of the joint and pipeline. All materials shall be resistant for the intended exposure, operating temperatures, and products in the pipeline.

B. Insulating Flanges:

1. Gaskets:
   a. Full-face, fiberglass (G10) with O-ring seal gasket. Buried insulating flanges shall be full face gaskets only.
   b. Complete assembly shall have an ANSI rating equal to the flanged joint.
   c. Gasket materials shall be resistant to intended chemical exposure, operating temperatures, and pressures in the pipeline.
2. Insulating Sleeves: Full-length Mylar or fiberglass reinforced epoxy (NEMA G-10 grade).
3. Insulating Washers: Fiberglas reinforced epoxy (NEMA G-10 grade).
4. Steel Washers: Plated, hot-rolled steel, 1/8-inch thick.
5. Manufacturer or approved equal:
   a. GPT industries, Houston, TX.
   b. Advanced Products and Systems, Scott, LA
   c. Central Plastics Co., Shawnee, OK.

C. Insulating Unions: O-ring sealed with molded and bonded insulating bushing to union body, as manufactured by **Central Plastics Company, Shawnee, OK**; or approved equal.

2.12 CONCRETE

A. ASTM C94-90, Option A

B. Cement: ASTM C150-89, type II with minimum cement content of 6.5 bags (611 pounds) per cubic yard.

C. Coarse Aggregate Size: 3/4 inches

D. Minimum Compressive Strength: 4,000 psi at 28 days with maximum water-cement ratio of 0.45.

E. Air Entrainment:

1. ASTM C260, nontoxic after 30 days and containing no chlorides.
2. Not less than 5 nor more than 7.5 percent entrained air at the project site.

2.13 OTHER MISCELLANEOUS MATERIALS

A. Test Station Wire Terminations: One-piece, tin-plated crimp-on ring tongue connector as manufactured by Burndy Co. or Thomas and Betts.

B. Shunts: Shunts shall be 0.01-ohm Holloway Type RS.

PART 3 EXECUTION

3.1 GENERAL

A. The installation of the facilities herein specified and described shall conform to the latest applicable NEC rules.

B. The workmanship shall be of the highest grade and shall be in strict accordance with material manufacturer's instructions. Equipment or materials damaged in shipment or in the course of installation shall be replaced.

C. CONTRACTOR shall examine all Contract Drawings and coordinate his work so as to avoid conflicts, errors, delays, and unnecessary interference with the construction of the facilities and to avoid duplication of the work such as excavation, filling, etc. In the event of any conflicts in the Specifications, ENGINEER shall be consulted.

3.2 STORAGE AND HANDLING

A. Store all prepackaged anodes off the ground and keep them dry at all times. Protect against weather, condensation, and mechanical damage.

B. Immediately remove from the project site all wet or mechanically damaged anodes.

C. Galvanic anodes shall not be lifted or held by the lead wire.

3.3 PIPE JOINT BONDING, NEW PIPE

A. To form an electrically continuous pipeline and associated appurtenances, all metallic pipe joints shall be electrically bonded; including buried, vault, and manhole pipe, fittings, fire hydrants, and restrained joints; except joints that are threaded, welded, or insulated.

B. Install the quantity of joint bonds at each joint required to be bonded as specified this section or shown on the Drawings. Should the specifications and drawings conflict, the larger quantity shall apply.

C. Electrical connection of bonds to pipe and fittings shall be by thermite or arc welding process. Bolted, compression, or mechanical connections will not be permitted.

D. CONTRACTOR shall test each bonded joint for electrical resistance as specified under CONTRACTOR QUALITY CONTROL TESTING, this section.

3.4 TEST STATION INSTALLATION

A. General:

1. Test station location, type, and style shall be as shown on the Contract Drawings.

2. CONTRACTOR may relocate test station up to ±25 feet for site conditions without ENGINEER approval. Relocation greater than ±25 feet must be approved by ENGINEER.
3. CONTRACTOR to maintain records showing actual pipeline stationing of test station wire connections to the pipe.
4. Test stations shall be generally located as follows:
   a. Install a Type I test station at all buried insulated joints.
5. Locate post-mounted test stations directly over the pipe and, where possible, at protected locations such as fences, manholes, power poles, or edges of cultivated land.

B. Style:

1. Test station style shall be as shown on the Contract Drawings and as follows:
2. Post mount style test stations shall be steel style as shown on the Contract Drawings.

C. Installation:

1. Post mounted test station:
   a. Height shall be 36 and 42 inches above finish grade.
   b. In areas with livestock, test station height shall be between 48 and 60-inches.
   c. Post shall be concrete encased as shown on the Contract Drawings.

D. Test Wires:

1. Wires shall be attached to the pipe as specified under WIRE CONNECTIONS, this section.
2. Wire connections shall be an individual connection with not less than 6-inches separation from other connections. Common connections will not be allowed. Where a steel tab is welded to pipe for test wire connections, a separate tab shall be provided for each wire connection.
3. Wires shall be buried a minimum of 24 inches below finished grade, except in undeveloped or cultivated areas where test wires shall be a minimum of 30-inches below finished grade.
4. Wires shall be direct buried except where test station offset is required. Offset wires shall be installed in PVC coated rigid steel conduit from the centerline of the pipeline to 6-inches from test station. Rigid conduit shall not be connected to the test station.
5. Provide 12-inch diameter loop in wires at the pipeline connection, at each end of rigid conduit when required, and below post mounted test stations to prevent wires from being stressed or broken.
6. Make wire connections to test station terminals with crimp-on ring tongue terminals, except where solid wire is specified.

3.5 THERMITE WELD WIRE CONNECTIONS

A. Use thermite weld method for electrical connection of copper wire to steel, ductile iron, and cast iron surfaces. Observe proper safety precautions, welding procedures, thermite weld material selection, and surface preparation as recommended by the material manufacturer. Assure that pipe or fitting wall thickness is of sufficient thickness that the thermite weld process will not damage the pipe or fitting wall's integrity or damage the lining in any way.

B. Before the connection is made, the surface shall be cleaned to bare metal by making a 2-inch by 2-inch window in the coating, and then filing or grinding the surface with a vitrified wheel to produce a bright metal finish. Wire sleeves shall be installed on the ends of the wire before welding to the metal surface.

C. After the weld connection is cooled, remove slag, visually inspect, and physically test wire connection by hitting with a hammer. Remove and replace any defective connections.

D. Make wire connections to concrete cylinder pipe by thermite welding to the shop welded steel plates provided on the pipe for this purpose.

E. Coat each completed wire connection as specified, this section. If lining is damaged by welding, repaired in accordance with the lining applicator's recommendations.

3.6 TRENCHING AND BACKFILL

A. General

1. Complete excavations and trenching regardless of the type, nature, or condition of materials encountered, and as required to accomplish specified construction to lines and grades shown.
2. CONTRACTOR shall complete all utility notifications prior to performing trenching and excavations work.
3. Take care to avoid damage to existing structures and utilities during excavating and trenching process. CONTRACTOR may modify location, where approved by the ENGINEER, to minimize possible damage to existing structures. Trench shall be of uniform depth and width, level, smooth, and free of sharp objects.
4. Trench Depths:
5. Trench depths vary for conditions and requirements. Trench depths provided are minimum requirements. CONTRACTOR to meet minimum requirements or that required by local utilities, ordinances, or regulations, whichever is more stringent.
6. Minimum depths for cathodic protection or corrosion monitoring work shall be as defined herein or shown on the Drawings. If in conflict, the more stringent shall apply.
7. Pipeline Test wires, undeveloped 24-inches (direct bury)
8. Pipeline Test wires, roadways 30-inches (conduit)
9. All other 30-inches
10. Safety
11. Slope, shore, or brace excavations and trenches in accordance with OSHA regulations as necessary to prevent caving during excavation in unstable material, or to protect adjacent structures, property, workers, and the public.
12. CONTRACTOR shall have sole responsibility for ensuring safety of trenches and conformance to OSHA trench safety requirements.
13. Backfill and Compaction
14. Backfill trench with excavated backfill materials, unless otherwise specified.
15. Compaction requirements shall be as specified for the pipeline or 90 percent compaction, whichever is more stringent. Backfill within 5 feet of roadways, paved areas, or other traffic areas shall be compacted to 95 percent.
16. Do not use backfill material of frozen or consolidated debris. Leave the trench with the excess backfill material neatly mounded, but not more than 4 inches above the existing ground level, for the entire width of the trench in undeveloped areas.
17. Replace topsoil in developed, landscaped, or cultivated areas.

3.7 WIRE INSULATION REPAIR

A. Underground splicing of wire will not be permitted, except where specifically shown on the drawings and approved by ENGINEER.

B. Splices or insulation damage to test station wires shall be spirally wrapped with two coats of high-voltage self-vulcanizing rubber splice tape and two layers of vinyl electrical tape.

3.8 INSULATED JOINTS

A. Install insulated joints to electrically isolate the pipeline from other pipes or structures where shown on the Contract Drawings.

B. Install insulated joints as shown on the Contract Drawings.

C. Align and install insulating joints according to the manufacturer's recommendations to avoid damaging insulating materials.

D. CONTRACTOR shall test each insulated joint for electrical insulation as specified this section. Defective insulating joints shall be repaired by the CONTRACTOR at his sole expense. All damaged or defective insulation parts shall be replaced.

3.9 QUALITY CONTROL TESTING

A. General:

1. CONTRACTOR shall correct all construction defects identified during testing.
2. Provide ENGINEER with 7 days advance notice of completion for ENGINEER acceptance testing.
3. CONTRACTOR required testing as defined herein shall be performed by a Corrosion Expert, with qualifications as specified this section, whom is an employee or subcontractor to CONTRACTOR.

B. Joint Bond Resistance Test:

1. General
   a. CONTRACTOR shall test completed joint bonds for electrical continuity using a digital low resistance ohmmeter.
   b. Joint bond quality control test shall be performed on all bonded joints after the bonds are installed but before backfilling of the pipe.
   c. Furnish all equipment and materials as required for test.
2. Digital Low Resistance Ohmmeter Test Method:
   a. Required Equipment And Materials:
      1) One Biddle Model 247001 digital low resistance ohmmeter.
      2) One set of duplex helical current and potential handspikes, Biddle Model No. 241001, cable length as required.
   b. Test Procedure:
      1) Measure the resistance of joint bonds with the low resistance ohmmeter in accordance with the manufacturer's written instructions.
      2) Use the helical handspikes to contact the pipe on each side of the joint, without touching the thermite weld or the bond. The contact area shall be

cleaned to bright metal by filing or grinding and without any surface rusting or oxidation.

3) Record the measured joint bond resistance on the test form described herein.

4) Repair any damaged pipe coating in accordance with WIRE CONNECTIONS, this section.

3. Joint Bond Acceptance:
   a. Joint bond resistance shall be less than or equal to the maximum allowable bond resistance values shown below.

Joint Type	Max. Allowable Resistance (micro-ohms)		
	Two Bonds/Joint	Three Bonds/Joint	Four Bonds/Joint
No. 2 AWG wire Bonds	185	123	93

   b. For bond quantities greater than shown above obtain maximum allowable bond resistance from the ENGINEER.
   c. The CONTRACTOR shall remove and replace all joint bonds on a joint that exceeds the maximum allowable resistance. Replacement joint bonds shall be retested for compliance with the specified bond resistance.
   d. Any defective joint bond discovered during SYSTEM TESTS AND INSPECTION shall be located, excavated, repaired, and backfilled by the CONTRACTOR.
4. Test Records: Records shall be made of each bonded pipeline during the test and submitted to the ENGINEER. These records shall include:
   a. Description and location of the pipeline tested.
   b. Starting location and direction of test.
   c. Date of test.
   d. Joint type.
   e. Measured joint bond resistance

C. Insulated Joint Isolation Test:

1. CONTRACTOR shall provide a Cathodic Protection Specialist to test each insulating joint after assembly with a GAS Electronics Model 601 insulator tester or equivalent instrument in accordance with the manufacturer's written instructions.
2. The Cathodic Protection Specialist shall conduct additional insulating joint testing as required to insure that insulating flanges are not electrically shorted by other equipment or incidental contact with concrete reinforcement.
3. Conduct test before burial and coating of buried insulating flanges.
4. CONTRACTOR to replace damaged or defective insulation parts identified during testing.
5. Electrical Isolation is defined as a condition of being electrically isolated from other metallic structures (including, but not limited to, other piping, concrete reinforcement, casings, and other structures not intended to be cathodically protected) and the environment as defined in NACE Recommended Practice RP0169-83.
6. CONTRACTOR shall submit a report prepared by the Corrosion Specialist certifying insulating joint testing isolation and any corrective action required.

D. Concrete Reinforcement Isolation Test:

1. Pipe penetrations as listed below shall be tested for electrical isolation from electrical grounding and concrete reinforcement by a Corrosion Expert.
2. Contractor to perform concrete reinforcement isolation tests where concrete reinforcement isolation is required on the Contract Drawings and the following specific locations:
   a. Pipes through vault walls
3. Electrical isolation test method and evaluation criterion to be utilized by Corrosion Expert is to be submitted in writing for approval by ENGINEER prior to beginning field testing.
4. Testing shall be conducted prior to concrete placement and shall be monitored during concrete placement to ensure no electrical shorts between the pipe and tank occur.
5. Corrosion Expert shall prepare a report certifying the concrete reinforcement is properly isolated and describe test method used to verify electrical isolation upon completion of the isolation test.
6. Electrical shorted detected and identified during ENGINEER performed SYSTEM TESTS AND INSPECTIONS, shall be located and repaired by the Contractor at Contractor's sole expense.
7. CONTRACTOR shall submit a written report prepared by the Corrosion Expert certifying concrete reinforcement isolation, testing method(s), test data, and any corrective action required.

3.10 SYSTEM TESTS AND INSPECTION

A. General

1. CONTRACTOR shall correct all construction defects identified during testing.
2. Provide ENGINEER with one week advance notice before beginning tests.

B. Electrical Continuity Testing:

1. Preliminary Continuity Test by ENGINEER.
   a. After the pipeline construction is completed and all test stations have been installed, ENGINEER shall test all pipelines with joint bonds for electrical continuity using the four-wire lineal pipe resistance test method.
   b. Test will be conducted with a minimum test current of 15 amperes using a portable rectifier or dc welder.
   c. An electrically continuous pipeline will be defined as a pipe or section of pipe that has a linear electrical resistance equal to or less than the sum of the resistance of the pipe plus the maximum allowable joint bond resistance for each joint as specified in this section.
   d. CONTRACTOR shall locate electrically discontinuous joints at his sole expense as specified herein.
   e. Each discontinuous section of pipe shall be retested by ENGINEER after all continuity repairs are completed to demonstrate that the pipeline is electrically continuous. ENGINEER retesting costs shall be at CONTRACTOR's expense.
2. Electrical Discontinuity Location:
   a. CONTRACTOR shall be solely responsible for location and repair of all discontinuous or high resistance joints bonds using a test method determined by CONTRACTOR. Regardless of test method used to locate discontinuous joints, final acceptance of discontinuous sections shall be determined by the lineal pipe resistance method.

b. After all discontinuous or high resistance joint bonds are repaired, the repaired section shall have a resistance less than or equal to the calculated allowable lineal pipe resistance as determined by the initial final continuity testing.
c. Existing joint bonds damaged during excavation of the pipe for repairs or temporary wire connections shall be repaired by CONTRACTOR.
d. Existing test stations shall be protected from damage. When damage occurs CONTRACTOR shall complete repairs while the excavation is open. Undisclosed test station damage that requires repairs to be made after backfilling the excavation will be repaired at CONTRACTOR sole expense.

C. Cathodic Protection System Energizing and Testing:

1. After the installation of the cathodic protection system is completed, ENGINEER shall energize and adjust the system and ensure proper installation of the cathodic protection system.
2. Test data obtained shall be tabulated and submit in a report of the system operation, test methods, and protection levels. Test data from all testing performed shall be submitted in tabular and electronic form.
3. Energizing and Testing procedures shall, as a minimum, include the following:
   a. Static pipe-to-soil potentials at each test station on each wire in the test station.
   b. Test station wire continuity at each test station
   c. Final electrical continuity of pipeline between each test station.
   d. 'ON' pipe-to-soil potentials at each test station
   e. Anode current output at each anode test station
   f. Interference potentials at all crossing metallic pipelines.
   g. Polarized 'ON' potentials after four weeks operation, minimum and three months, maximum.
   h. Verification of electrical isolation of the pipe at each mainline valve vault.
   i. GPS positions in latitude and longitude format using a WGS 84 datum for all test stations. Locations shall be identified by GPS location, test station type, and street address. Accuracy of GPS positional measurements shall be sub-meter or better.
4. As a minimum, data shall indicate location of test box with clear differentiation between readings. Report shall also include name of the Corrosion Specialist who performed the test, manufacturer and model of equipment used, and a description of procedure followed in taking the readings, including the rectifier settings.

- END OF SECTION -

SECTION 26 51 13

INTERIOR LUMINAIRES

PART 1 - GENERAL

1.01 SCOPE

A. Furnish all labor, materials, equipment, appliances and perform all operations in connection with, and complete in strict accordance with, this section of specifications and the applicable drawings and subject to the terms and conditions of the contract for the following work:

1. Interior luminaires and accessories.
2. Emergency lighting units.
3. Exit signs.
4. Ballasts.
5. Fluorescent lamp emergency power supply.
6. Lamps.
7. Luminaire accessories.

1.02 APPLICABLE SECTIONS

A. The General Conditions, Supplementary General Conditions, alternates and Addenda, applicable drawings and the technical specification including but not limited to the following;

B. Section 260500- Electrical General Requirements.

1.03 REFERENCES

A. ANSI C78.379 - Electric Lamps - Incandescent and Issued October 1993 High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.

B. ANSI C82.1 - Ballasts for Fluorescent Lamps -Specifications.

C. ANSI C82.4 - Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).

D. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

E. NFPA 70 - National Electrical Code.

F. NFPA 101 - Life Safety Code.

1.04 SUBMITTALS FOR REVIEW

A. Section 260500 - Electrical General Requirements

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

1.05 SUBMITTALS FOR CLOSEOUT

A. Section 260500 - Electrical General Requirements

B. Submit manufacturer's operation and maintenance instructions for each product.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Conform to requirements of NFPA 101.

C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.08 EXTRA PRODUCTS

A. Section 260500 - Contract Closeout.

B. Furnish 10% or a minimum of two of each lens type.

C. Furnish one case of replacement fluorescent lamps for each lamp type. Furnish two replacement lamps for each size HID lamp type and LED assembly.

D. Furnish 10% or a minimum of two of each ballast type or driver type.

PART 2 - PRODUCTS

2.01 LUMINAIRES

A. Furnish Products as scheduled. Refer to Section 260500 for substitutions and product options.

B. Lighting Fixtures: Shall be as shown in the Lighting Fixture Schedule on the Drawings.

2.04 LED LUMINAIRE WARRANTY

A. Provide a written 5-year on-site replacement warranty for material, fixture finish, and workmanship. On-site replacement includes transportation, removal, and installation of new products.

1. Include finish warranty to include failure and substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

2. Material warranty must include:

a. All drivers.

b. Replacement when more than 10 percent of LED sources in any lightbar or subassembly(s) are defective or non-starting.

B. Warranty period must begin on date of beneficial occupancy. Provide the Contracting Officer with signed warranty certificates prior to final payment.

2.05 PROVIDE LUMINAIRE USEFUL LIFE CERTIFICATE

Submit certification from the manufacturer indicating the expected useful life of the luminaires provided. The useful life must be directly correlated from the IES LM-80 test data using procedures outlined in IES TM-21. Thermal properties of the specific luminaire and local ambient operating temperature and conditions must be taken into consideration.

2.06 LUMINAIRES

UL 1598, NEMA C82.77, and UL 8750. Provide luminaires as indicated in luminaire schedule and NL plates or details on project plans. Provide luminaires complete with light sources of quantity, type, and wattage indicated. Provide all luminaires of the same type by the same manufacturer. Luminaires must be specifically designed for use with the driver, ballast or generator and light source provided.

2.07 LED LUMINAIRES

Provide luminaires complete with power supplies (drivers) and light sources. Provide design information including lumen output and design life in luminaire schedule on project plans for LED luminaires.

LED luminaires must meet the minimum requirements in the following table:

LUMINAIRE TYPE	MINIMUM LUMINAIRE EFFICACY (LE)	MINIMUM COLOR RENDERING INDEX (CRI)
LED TROFFER – 1 x 4300 x 1200 2 x 2600 x 600 2 x 4600 x 1200	90 LPW	80
LED Downlight	50 LPW	90
LED Track or Accent	40 LPW	80
LED Low Bay/High Bay	80 LPW	70
LED Linear Ambient	80 LPW	80

LED luminaires must also meet the following minimum requirements:

A. Luminaires must have a minimum 5-year manufacturer's warranty.

B. Luminaires must have a minimum L70 lumen maintenance value of 50,000 hours as calculated by IES TM-21, with data obtained per IES LM-80 requirements.

C. Luminaire drive current value must be identical to that provided by test data for luminaire in question.

D. Luminaires must be tested to IES LM-79 and IES LM-80 standards, with the results provided as required in the Submittals paragraph of this specification.

2.08 FLUORESCENT LUMINAIRES

Fluorescent luminaires are not acceptable.

2.09 HIGH INTENSITY DISCHARGE (HID) LUMINAIRES

HID Luminaires are not acceptable.

2.10 LUMINAIRES FOR HAZARDOUS LOCATIONS

In addition to requirements stated herein, provide LED luminaires for hazardous locations which conform to UL 844 or which have Factory Mutual certification for the class and division indicated.

2.11 LED DRIVERS

NEMA SSL 1, UL 8750. LED drivers must be electronic, UL Class 1, constant-current type and comply with the following requirements:

A. Output power (watts)and luminous flux (lumens) as shown in luminaire schedule for each luminaire type to meet minimum luminaire efficacy (LE) value provided.

B. Factor (PF) greater than or equal to 0.9 over the full dimming range when provided.

C. Current draw Total Harmonic Distortion (THD) of less than 20 percent.

D. Class A sound rating.

E. Operable at input voltage of 120-277 volts at 60 hertz.

F. Minimum 5-year manufacturer's warranty.

G. RoHS compliant.

H. Integral thermal protection that reduces or eliminates the output power if case temperature exceeds a value detrimental to the driver.

I. UL listed for dry or damp locations typical of interior installations.

J. Non-dimmable, or fully-dimmable to 1% using 0-10V, or 3 wire, control as indicated in luminaire schedule and on drawings.

2.16 LIGHT SOURCES

NEMA ANSLG C78.377, NEMA SSL 3. Provide type and wattage as indicated in luminaire schedule on project plans.

A. LED Light Sources
   1. Correlated Color Temperature (CCT) between 3000 and 5000 degrees K as indicated.
   2. Minimum Color Rendering Index (CRI) R9 value of 80.
   3. High power, white light output utilizing phosphor conversion (PC) process or mixed system of colored LEDs, typically red, green and blue (RGB).
   4. RoHS compliant.
   5. Provide light source color consistency by utilizing a binning tolerance within a 3 step McAdam ellipse.

2.17 CONTROLS

A. Dual Technology Wall Mounted Occupancy Sensors: Spaces indicated on drawings shall be equipped with a dual technology occupancy sensor DT-100L as manufacturer by Wattstopper or equal. The sensors shall be connected to a power supply as specified above. The sensor shall comply with the following specifications:

   1. Shall utilize PIR and Ultrasonic technologies with an adjustable integrated light level sensor for 2.5 to 430 foot-candles. The output shall be a single-pole, double-throw isolated relay.
   2. Shall utilize 40Khz +/- .006% ultrasonic frequency.
   3. Shall provide an adjustable time delay of 15 seconds to 15 minutes and an LED indicator for both technologies.
   4. Shall provide adjustable sensitivities, and shall be capable of installing two units per power pack.
   5. Shall be UL listed with a 5 year warranty.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

B. Support luminaires independent of ceiling grid, if layin type ceilings or concealed spline ceilings ore used.

C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

D. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

3.02 INSTALLATION OF LIGHTING FIXTURES

A. Install all lighting fixtures complete and ready for service, in accordance with the Fixture Schedule on the Drawings:

B. Wire all fixtures with fixture wiring of at least 150 degree C rating. Conductors in wiring channels of fixtures mounted in rows shall be the same size as the circuit

wiring supplying the rows.

C. Install all fixtures straight and true with reference to adjacent walls.

D. Install all lighting fixtures, including those mounted in continuous rows, so that the weight of the fixture is supported either directly or indirectly by a sound and safe structural member of the building, using adequate number and type of fasteners to ensure a safe installation. Screwed fastenings and toggles through ceiling or wall material are not acceptable. Provide suitable connectors or collars to connect adjoining fixtures in continuous rows.

E. Do not support fixtures from roof deck. Provide unistrut channels spanning space between roof joists to support fixtures and outlets.

F. Fixtures mounted in lay-in grid ceilings shall have safety support wires to structural roof members as detailed for seismic restraint.

G. All single outlets shall be properly centered in each room. Where two or more outlets occur, they shall be spaced uniformly and in straight lines with each other.

H. Provide plaster frames and support channels around ceiling openings for recessed fixtures. Securely fasten to ceiling structural members.

I. Terminate circuits for recessed fixtures in an extension outlet box adjacent to ceiling opening and connect to fixtures with flexible steel conduit.

3.03 Where lighting fixtures and other electrical items are shown in conflict with locations and structural members and mechanical or other equipment, provide all required supports and wiring to clear the encroachment.

3.04 ADJUSTING

A. Section 260500 Contract Closeout

3.05 CLEANING

A. Section 260500 - Contract Closeout: Cleaning installed work.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosures.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.06 DEMONSTRATION AND INSTRUCTIONS

A. Section 260500 - Contract Closeout - Starting of Systems: Demonstrating installed work.

B. Demonstrate luminaire operation for 12 hours.

3.07 PROTECTION OF FINISHED WORK

A. Re-lamp or repair/replace luminaires that have failed at substantial completion.

END OF SECTION

SECTION 31 05 19
GEOSYNTHETICS

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the manufacturing and installation of geosynthetics including non-woven filter fabric.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 31 22 00 Site Grading
3. Section 31 23 23 Excavation and Backfill for Structures

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text to by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. B16.1/ASTM D 751 Standard Test Methods for Coated Fabrics
2. ASTM D 1777 Standard Test Method for Thickness of Textile Materials
3. ASTM D 3786 Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method
4. ASTM D 4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles
5. ASTM D 4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
6. ASTM D 4751 Standard Test Method for Determining Apparent Opening Size of a Geotextile
7. ASTM D 4833 Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
8. ASTM D 5034 Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
9. ASTM D 5035 Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
10. ASTM D 5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Quality Control Certificates shall be provided at a minimum frequency of one (1) per every hundred thousand (100,000) square feet of geosynthetics produced consecutively, and which is supplied to the project. These certificates shall be supplied only for the individual rolls of geosynthetics sampled and tested by the Manufacturer or his representative. An

individual Quality Control Certificate shall be provided for each roll of geosynthetics provided to the project, which was not produced consecutively within the hundred thousand (100,000) square foot lot. Quality Control Certificates shall be submitted two (2) weeks prior to installation of geosynthetics and shall state that the geosynthetics meets the requirements of these specifications for:

1. Mass per Unit Area
2. Grab Tensile Strength
3. Mullen Burst Strength
4. Equivalent Opening Size

C. Geosynthetics shall not be accepted and/or incorporated into the project without the approved quality control documentation.

D. Certification stating that all geosynthetics is furnished by one manufacturer shall be submitted two (2) weeks prior to installation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage and handling of the geosynthetics shall be the responsibility of CONTRACTOR.

B. During shipment, handling and storage, the geosynthetics shall be protected from ultraviolet light exposure, precipitation, or other inundation, mud, dirt, dust, puncture, cutting or any other damage or deleterious conditions. To that effect, geosynthetics rolls shall be shipped and stored in relatively opaque and watertight wrappings. An opaque tarp shall be placed over all rolls where the outer wraps are removed or damaged and where the geotextile is exposed. CONTRACTOR shall be responsible for the replacement of damaged or unacceptable materials at no cost to OWNER.

C. Storage of Materials: A storage area shall be provided on site by OWNER. The storage of geosynthetic materials shall be the responsibility of CONTRACTOR until the completed installation is accepted by ENGINEER.

D. Damaged Geosynthetics: Damaged geosynthetic materials shall be repaired, if possible, in accordance with these specifications, or shall be replaced at no additional cost to OWNER.

PART 2 PRODUCTS

2.1 GEOSYNTHETICS (FILTER FABRIC)

A. The geosynthetics shall be 10-ounce (or heavier) non-woven filter fabric.

B. Geosynthetics shall be provided in rolls.

C. Each roll of geosynthetics shall be externally labeled or tagged to provide product identification sufficient for field determination as well as inventory and quality control purposes. Each roll shall be labeled with the name of manufacturer, roll number, physical dimensions (length and width) and the material type. Any roll of geosynthetics from which the labeling has been removed or has become illegible, shall not be used, but shall be removed from the site and replaced at the expense of CONTRACTOR.

D. The geosynthetics shall be sampled, tested, and certified by the manufacturer for the following properties:

MATERIAL PROPERTIES FOR NON-WOVEN GEOTEXTILE FILTER FABRIC		
Property	Specification	ASTM Test Method
Mass per Unit Area (min)	10.0 oz./S.Y.	D-5261
Grab Tensile Strength (min)	250 lbs.	D-4632
Elongation at Break	50 %	D-4632
Tear Strength (min)	100 lbs	D-4533
Apparent Opening Size (maximum U.S. Sieve size)	100 mesh	D-4751

E. Filter Fabric shall be **Mirafi 1100N by TenCate, 250NW by U.S. Fabrics**, or approved equal.

PART 3 EXECUTION

3.1 DEPLOYMENT

A. Prior to deployment, CONTRACTOR shall inspect each roll of geosynthetics to verify that the roll has a valid Quality Control Certificate and that has been previously approved by ENGINEER.

B. Adjacent rolls shall be joined by overlapping the edges a minimum of twelve (12) inches.

C. The overlap shall be glued, sewn or otherwise fastened or secured at intervals no greater than two feet along a line through the midpoint of the overlap. Additional fasteners shall be installed as necessary to prevent slippage of the geosynthetics regardless of location.

D. CONTRACTOR shall visually inspect the geosynthetics during deployment for holes, tears or improperly formed geosynthetics. Defective areas shall be repaired or removed and replaced by CONTRACTOR at no additional cost to OWNER.

E. Smoking shall not be permitted on the geosynthetics.

F. CONTRACTOR shall be responsible to provide adequate loading (e.g., sand bags or similar items that will not damage the underlying geosynthetic) to prevent movement of the geosynthetics. Any damage to the geosynthetics shall be repaired at CONTRACTOR's expense.

G. The geosynthetics shall not be exposed to the sun and elements for more than 72 hours unless the filter fabric has ultraviolet inhibitors. Fabric with ultraviolet inhibitors shall not be exposed for a period in excess of the manufacturer's recommendations, in which case manufacturer shall provide prior to product delivery.

H. Any damage to the geosynthetics during installation or any fabric that has been exposed to the sun or elements for longer than the 72 hours, or as specified by the manufacturer, shall be replaced by CONTRACTOR at no additional cost to OWNER.

I. CONTRACTOR shall be responsible to observe placement of geosynthetics. CONTRACTOR shall provide a daily inventory of all geosynthetics deployed to ENGINEER.

3.2 REPAIRS

A. Any holes, tears or defective areas in the geosynthetics shall be repaired by patching with same type of geosynthetics. The patch shall extend a minimum of twelve (12) inches in all directions beyond the area to be repaired. The patch shall be secured in place by gluing, sewing, or securing the fabric as per these specifications.

- END OF SECTION -

SECTION 31 23 15
EXCAVATION AND BACKFILL FOR BURIED PIPELINES

PART 1 GENERAL

1.1 SUMMARY

A. This item shall consist of excavating all pipeline trenches to the lines and grades indicated on the Contract Drawings or as directed by ENGINEER in the field, and the backfilling of all pipeline trenches. Excavation shall include the removal of all materials of whatever nature encountered to the depths shown on the Contract Drawings, or as modified in the Field by ENGINEER.

1.2 RELATED SECTIONS

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 45 00 Quality Control & Materials Testing
3. Section 01 50 00 Temporary Construction Utilities and Environmental Controls
4. Section 33 05 02 Reinforced Concrete Pipe (ASTM C 76)
5. Section 31 23 19 Dewatering
6. Section 33 05 05 Ductile Iron Pipe
7. Section 33 05 07 Polyvinyl Chloride (PVC) Pressure Pipe (AWWA C 900)
8. Section 33 05 07.2 Polyvinyl Chloride (PVC) Sewer Pipe (ASTM D 3034)

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referred. The publications are referred to in the text by basic designation only.

B. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

1. M 145 Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
2. T 27 Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
3. T 88 Standard Method of Test for Particle Size Analysis of Soils
4. T 96 Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
5. T 180 Standard Method of Test for Moisture Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and an 18 in (457 mm) Drop
6. T 191 Standard Method of Test for Density of Soil In Place by the Sand Cone Method
7. T 205 Density of Soil In-Place by the Rubber-Balloon Method
8. T 238 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
9. T 239 Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
10. T 310 Standard Specification for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
2. C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
3. D 422 Standard Test Method for Particle Size Analysis of Soils
4. D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3)
5. D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone method
6. D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft3)
7. D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity -Flow Applications
8. D 2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
9. D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.4 DEFINITIONS

A. Degree of Compaction: Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

B. Pipe Zone: That zone in an Excavation which supports, surrounds, and extends to 12 inches above the top of the pipe barrel. Specifically, 3 inches below the bottom (where rock, hard pan, boulders, etc. are encountered), 12 inches above the top of the pipe, and 9 inches laterally beyond both sides of the pipe, unless noted otherwise on the Drawings.

C. Trench Zone Backfill: That zone in an Excavation which begins 12 inches above the top of the pipe barrel and extends to the natural surface level or the finished grade indicated on the Plans.

D. Unyielding Material: Unyielding material shall consist of rock and gravelly soils with stones greater than 12 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.

E. Unstable Material: Unstable material shall consist of materials too wet to allow backfill compaction or to properly support the utility pipe, conduit, or appurtenant structures.

F. Rock: Solid mineral material which cannot be removed with equipment reasonably expected to be used in the Work without cutting, drilling, or blasting. Minimum equipment size, in good running order, shall be similar to a **Komatsu 300, Caterpillar 320 or 330**, or equal.

1.5 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 - Submittal Procedures:

1. Copies of Field Density Test reports shall be submitted to ENGINEER or RPR at the beginning of each workday for the previous day's testing of subgrades, embankments and backfill Materials.
2. Copies of all Laboratory Test Reports shall be submitted to ENGINEER or RPR within 24 hours of the completion of the test.
3. Submit gradations and proctors for Pipe Zone Material and Trench Zone Backfill.
4. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

1.6 SITE CONDITIONS

A. Unsuitable Weather Limitations: CONTRACTOR shall not place, spread, or roll any fill material during unsuitable weather conditions. CONTRACTOR shall not resume operations until moisture content of material is satisfactory.

B. Weather Softened Subgrade: CONTRACTOR shall remove and replace at no additional cost to OWNER soft subgrade materials resulting from adverse weather conditions.

C. Protection of Graded Areas: CONTRACTOR shall protect all graded areas from traffic and erosion and shall keep these areas free of trash and debris. Work required to repair and reestablish grades in settled, eroded, and rutted areas shall be completed to specified tolerances at CONTRACTOR's expense.

D. Reconditioning Compacted Areas: All areas compacted to required specifications that become disturbed by subsequent construction operations or weather conditions shall be scarified, moisture conditioned, and re-compacted to the required density prior to further construction.

E. Grading: the final compacted surface of base course shall not vary more than 1/4 inch above or below design grade.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stabilization Material: Stabilization material shall consist of hard, durable particles of stone or gravel, screened, or crushed to the required size and gradation. The material shall be free from vegetation matter, lumps or balls of clay, or other deleterious matter and shall conform to the following gradation when tested in accordance with AASHTO T 27 or ASTM C 136.

1. Coarse material shall be crushed or washed, and fine material shall be wasted to meet the grading requirements set forth below. Note that if stabilization material is required, an 8 oz. non-woven filter fabric shall be placed between the stabilization material and the pipe zone material.

2. Coarse aggregate, retained on the No. 4 sieve, shall have a percentage of wear not greater than 40 percent when tested by the Los Angeles Test, AASHTO T-96 or ASTM C 131.

Sieve Size (Square Opening)	Percent By Weight Passing Screen
2-inch	100
1-1/2 inch	10 - 50
3/4-inch	0 - 25
No. 4	0 - 10
No. 200	0 - 3

B. Pipe Zone Material: All material in the pipe zone shall be clean and free from alkali, salt, petroleum products, vegetative matter or other deleterious matter, slag, cinders, ashes and rubbish or other material that in the opinion of the ENGINEER may be objectionable or deleterious. "Squeegee" or any other flowable material shall not be permitted. Pipe zone material shall conform to the following:

1. Storm Drain or Drain Lines – Gravel, 100 percent crushed mineral aggregate per the following gradation:

U.S. Standard Sieve Size (Square Opening)	Percent By Weight Passing Screen
1 1/2 - inch	100
1 - inch	95-100
1/2 - inch	25-60
No. 4	0-10
No. 200	0-5

2. Waterline – Sand per the following gradation:

U.S. Standard Sieve Size (Square Opening)	Percent By Weight Passing Screen
1/2 - inch	100
No. 10	30-60
No. 40	0-30
No. 200	0-15

3. Waterline – Controlled Low-Strength Material (Flowable Fill):

a. Flowable Fill shall be per APWA Section 03 31 05 – Controlled Low Strength Material.

C. Imported Granular Trench Backfill: Imported granular trench backfill shall be used and shall consist of imported materials meeting soils classifications A-1, A-2 or A-3 (A-1-a for Granular Borrow material) of AASHTO M 145 and shall be non-plastic. The maximum particle size for backfill shall be no greater than 6 inches. Imported granular trench backfill shall be capable of meeting the compaction requirements.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavation shall be performed to the lines and grades indicated. All excavated materials not intended for reuse shall be removed from the site and disposed of by CONTRACTOR.

B. Rock Removal

1. CONTRACTOR shall cut away Rock at excavation bottom to form level bearing.
2. All shaled layers shall be removed to provide sound and unshattered base for foundations.
3. CONTRACTOR shall remove and legally dispose of excess excavated material and debris off-site unless indicated otherwise.
4. CONTRACTOR shall correct unauthorized Rock removal at no additional cost to OWNER.

3.2 SAFETY

A. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the latest requirements of OSHA Safety and Health Standards for Construction (29 CFR 1926). CONTRACTOR is responsible for assessing safety needs to meet such requirements, arranging for proper equipment and/or construction methods, and maintaining such equipment, methods, and construction practices so as to fully comply with all safety requirements.

B. CONTRACTOR is responsible for assessing needs related to confined space entry, as defined by OSHA. CONTRACTOR shall meet all such requirements, arranging for proper equipment and/or construction methods, and maintaining such equipment, methods and construction practices so as to fully comply with all confined space safety requirements.

3.3 DEWATERING

A. Water removal shall be in accordance with Section 31 23 19 - Dewatering.

3.4 TRENCH WIDTH

A. The bottom of the trench shall have a minimum width equal to the outside diameter of the pipe plus 18-inches or as detailed on the Contract Drawings.

B. The width of the trench shall be ample to permit the pipe to be laid and jointed properly, and the backfill to be placed and compacted as specified. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, sheeting, and bracing, and the handling of special units as necessary.

3.5 TRENCH PREPARATION

A. Each trench shall be excavated so that the pipe can be laid to the alignment and grade as required. The trench wall shall be so braced that the workmen may work safely and efficiently. All trenches shall be drained so the pipe laying may take place in dewatered conditions.

B. Bottom Preparation

1. Where rock, hard pan, boulders or other material which might damage the pipe are encountered, the bottom of the trench shall be over excavated 4 inches below the required grade and replaced with Stabilization Material. Otherwise, the bottom of the trench shall be over excavated 6 inches or 1/12 the outside diameter of the pipe, whichever is greater, below the required grade and replaced with Pipe Zone Backfill.
2. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 1-inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

C. Removal of Unstable Material

1. Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed by ENGINEER and replaced to the proper grade with Stabilization Material. When removal of unstable material is required due to the fault or neglect of CONTRACTOR in his performance of the work, the resulting material shall be excavated and replaced by CONTRACTOR without additional cost to OWNER.

D. The trench bottom (at the level of the base of the pipe) shall be given a final trim using a string line, laser, or another method approved by ENGINEER for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Bell holes shall be provided at each joint to permit the jointing to be made properly. The trench grade shall permit the pipe spigot to be accurately centered in the preceding laid pipe joint, without lifting the pipe above the grade, and without exceeding the permissible joint deflection.

3.6 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.7 LAYING AND JOINING PIPE

A. Laying pipe: Provide proper facilities for lowering pipe sections into place. Dropping pipe will not be permitted. Place each section true to line and gradient in close and true contact with adjacent sections.

B. Joining pipe:

1. Use methods of joining conduit sections ensuring ends are fully entered and inner surfaces are flush and even. The equipment used to force the joints together must be adequate to overcome the gasket pressure involved. Pipe shall be installed in accordance with these specifications and the manufacturers' written specifications.
2. Just prior to joining the pipes, both spigot and bell ends shall be thoroughly cleaned to remove all foreign substances which may have adhered to the bell and spigot surfaces. All dust and dirt shall be removed with a clean rag. An approved lubricant (recommended by the manufacturer), that is not injurious to the gasket, shall be applied in accordance with the manufacturer's recommendations.
3. In the event any foreign material becomes embedded in the lubricant, or the lubricant becomes contaminated by water or other substances before the joint is started, the area affected shall be re-cleaned and new lubricant applied.
4. The pipe being joined shall be carefully moved into position, line and grade checked, and, as the spigot end is started into the bell of the section previously laid, the gasket shall be checked to insure uniform entry into the bell at all points. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Apply firm steady pressure either by hand or by bar and block assembly, until the spigot easily slips through the gasket. Care must be taken to ensure that the spigot is not over-inserted and that previously assembled pipe joints are not disturbed.

3.8 PIPELINE TRENCH BACKFILLING AND COMPACTION

A. Pipe Zone:

1. Pipe Zone Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise approved or specified. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Each layer shall be compacted to at least 95 percent of the maximum Modified Proctor density (ASTM D 1557), unless otherwise specified.
2. Replacement of Unyielding Material: Unyielding material removed from the bottom of the trench shall be replaced with Stabilization Material placed in layers not exceeding 6 inches loose thickness.
3. Replacement of Unstable Material: Unstable material removed from the bottom of the trench or excavation shall be replaced with Stabilization Material placed in layers not exceeding 6 inches loose thickness.
4. Where the pipe grade exceeds 30%, cohesive material shall be used in lieu of pipe bedding. The cohesive material shall be moistened to within 2% of optimum moisture and compacted as noted.
5. The relative density of the compacted cohesionless material shall not be less than 60% as determined by the Bureau of Reclamation Relative Density of Cohesionless Soil Test (Designation E-12) of the "Earth Manual."

B. Trench Backfill: Trenches shall be backfilled to the grade shown with Trench Backfill material as specified.

1. Trench backfill in asphalted road shall consist of backfilling the trench from above the pipe zone up to underneath the noted recommended depth for untreated base course and asphalt or concrete of finished grade with Trench Backfill material compacted to 95 percent of maximum density (ASTM D 1557). Backfill shall be placed in layers not exceeding 6-inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise approved or specified.
2. Trench backfill in unimproved or landscaped areas shall consist of backfilling the trench from above the pipe zone to 8-inches below finished grade with Trench Backfill material compacted to 95 percent of maximum density (ASTM D 1557). Backfill from 8-inches below finished grade to finished grade shall consist of topsoil replacement in addition to replacement of all landscaped materials. Trench backfill shall be placed in layers not exceeding 8 inches loose thickness.
3. It shall be the responsibility of CONTRACTOR to be assured that the Trench Backfill material is capable of being compacted to the degree specified. It shall be CONTRACTOR's responsibility to remove and dispose of all excess excavated material.

C. Final Backfill:

1. Roadways shall be completed with the type and thickness of materials (i.e., Untreated Road Base and Asphalt) as indicated or shown on the Contract Drawings

3.9 SPECIAL REQUIREMENTS

A. Special requirements for both excavation and backfill relating to the specific utilities from above the pipe zone to the natural surface level or the finished grade indicated on the Plans shall be placed and compacted as follows:

1. Where existing underground pipes or conduits larger than 3-inches in diameter and all sizes of sewer lines or sewer laterals cross the trench above the new work, the backfill from the bottom of the trench to 1 foot above the top of the intersecting pipe or conduit shall be pipe zone material compacted to 95 percent of maximum density (ASTM D 1557). The pipe zone material shall extend 2 feet on either side of the intersecting pipe or conduit to ensure that the material will remain in place while other backfill is placed.

B. The maximum trench length open at any given time shall not exceed 200 feet unless approved by ENGINEER and must be backfilled in a timely manner.

3.10 MAINTENANCE OF BACKFILL

A. All backfill shall be maintained in satisfactory condition, and all places showing signs of settlement shall be filled and maintained during the life of the Contract and for a period of one year following the day of final acceptance of all work performed under the Contract. When CONTRACTOR is notified by ENGINEER or OWNER that any backfill is hazardous, CONTRACTOR shall correct such hazardous condition at once. Any utility, road and/or parking surfacing damaged by such settlement shall be repaired by CONTRACTOR to the satisfaction of OWNER and ENGINEER. In addition, CONTRACTOR shall be responsible

for the cost to OWNER of all claims for damage filed with the Court, actions brought against the said OWNER for, and on account of, such damage.

3.11 FINISH GRADING AND CLEANUP

A. CONTRACTOR shall grade the trench line to a smooth grade to affect a neat and workmanlike appearance of the trench line.

B. All tools, equipment and temporary structures shall be removed. All excess dirt and rubbish shall be removed from the site by CONTRACTOR.

C. CONTRACTOR shall restore the site to at least as good as original condition, including but not limited to final trench grade and restoration of affected public and private facilities whether in the public right-of-way or on private property. Any exception to this requirement must be in writing from ENGINEER for the job specific conditions.

3.12 COMPACTION TESTS

A. It shall be the responsibility of CONTRACTOR to accomplish the specified compaction for backfill, fill, and other earthwork. It shall be the responsibility of CONTRACTOR to control his operations by performing any additional tests necessary to verify and confirm that CONTRACTOR has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.

1. Testing of Backfill Materials
   a. Characteristics of backfill materials shall be determined in accordance with the requirements of Section 01 45 00 - Quality Control & Materials Testing.
   b. CONTRACTOR shall demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:
      i) 50 linear feet of trench backfill.
   c. Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.
   d. After satisfactory conclusion of the initial compaction demonstration and at any time during construction, earthwork which does not comply with the specified degree of compaction shall not exceed the previously specified quantities.
   e. Compliance tests may be made by ENGINEER to verify that compaction is meeting the requirements previously specified at no cost to CONTRACTOR.
   f. ENGINEER may require retesting of backfill that has settled from water penetration in the trench. CONTRACTOR shall remove the overburden above the level at which ENGINEER wishes to test and shall backfill and recompact the excavation after the test is complete at no additional cost to the OWNER.
   g. If compaction fails to meet the specified requirements, CONTRACTOR shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by CONTRACTOR. CONTRACTOR's confirmation tests shall be performed in a manner acceptable to ENGINEER.

2. Field Density Tests

   a. Field density tests shall be made in accordance with ASTM D 1557.

- END OF SECTION -

SECTION 31 23 19
DEWATERING

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section provides specifications for dewatering systems and appurtenances to be used during construction as required to remove water and continuously maintain groundwater at a level at least 1-foot below the bottom of the excavation.

B. CONTRACTOR shall obtain all necessary permits for disposal of water removed from the excavation.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures

1.3 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Before dewatering is commenced, CONTRACTOR shall provide information to ENGINEER outlining the method, installation and details of the proposed dewatering system. CONTRACTOR shall provide ENGINEER with plans setting forth details of the proposed dewatering systems. The dewatering system plans shall be of sufficient detail to indicate sizes of pumps, piping, appurtenances, the ultimate disposal point for water, and to indicate the overall completeness and effectiveness of the proposed system.

C. CONTRACTOR shall certify to OWNER that the design and implementation of the proposed dewatering system is sufficient to complete the Work.

D. Submit a plan to monitoring settlement of adjacent structures.

1.4 QUALITY CONTROL

A. CONTRACTOR shall be responsible to control the rate and effect of dewatering to avoid all settlement and subsidence.

B. Where critical structures exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement which may develop. CONTRACTOR is responsible for protecting adjacent structures from settlement. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of CONTRACTOR.

PART 2 PRODUCTS

2.1 MATERIALS

A. CONTRACTOR shall be responsible for selection of dewatering means, methods and materials.

B. Standby pumping equipment shall be maintained on the Site.

PART 3 EXECUTION

3.1 DESIGN AND IMPLEMENTATION

A. CONTRACTOR shall be responsible for complete design and implementation of the dewatering system.

B. CONTRACTOR shall be responsible for the design and implementation of any modifications that may be required to the initial design of the dewatering system (at no additional cost to OWNER) to provide a dewatering system that operates adequately to complete the Work.

C. CONTRACTOR shall furnish, install, operate and maintain all machinery, appliances, and equipment to maintain all excavations free from water during construction.

D. CONTRACTOR shall dispose of water so as to not cause damage to public or private property, or to cause a nuisance or menace to the public or violate the law.

E. CONTRACTOR shall be responsible to obtain General Construction Dewatering discharge permits, if required.

F. CONTRACTOR shall install and operate the dewatering system so as to not cause damage or endanger adjacent structures or property.

G. The control of groundwater shall be such that softening of the bottom of excavations, or formation of "quick" conditions or "boils," does not occur. Dewatering systems shall be designed and operated so as to prevent removal and migration of the natural soils.

H. CONTRACTOR shall have sufficient stand-by equipment at the project site at all times to continuously maintain the dewatering program until Work necessitating dewatering is complete.

I. CONTRACTOR shall have on hand equipment and machinery in good working condition for emergencies and shall have personnel available for operation of such equipment and machinery.

J. CONTRACTOR shall control surface water to prevent entry into excavations.

- END OF SECTION -

SECTION 31 23 23
EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers excavating, backfilling, and compacting of disturbed areas for structures and roadways as directed by ENGINEER.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 45 00 Quality Control and Materials Testing
3. Section 01 45 23 Testing Agency Services
4. Section 01 50 00 Temporary Construction Utilities and Environmental Controls
5. Section 31 23 15 Excavation and Backfill for Buried Pipelines
6. Section 31 23 19 Dewatering

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referred. The publications are referred to in the text by basic designation only.

B. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

1. M 145 Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
2. T 27 Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
3. T 88 Standard Method of Test for Particle Size Analysis of Soils
4. T 180 Standard Method of Test for Moisture Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and an 18 in (457 mm) Drop
5. T 191 Standard Method of Test for Density of Soil In Place by the Sand Cone Method
6. T 310 Standard Specification for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. D 422 Standard Test Method for Particle Size Analysis of Soils
2. D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3)
3. D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone method
4. D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft3)
5. D 2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

6. D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

D. The latest Edition of the Utah Department of Transportation Standard Specification for Road and Bridge Construction.

E. The latest Edition of the American Public Works Association (APWA) and Associated General Contractors of America Standard Plans and Standard Specifications.

1.4 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 Submittal Procedures:

1. Submit gradations and proctors for structural fill materials and backfill materials.

PART 2 PRODUCTS

2.1 WALL BACKFILL MATERIAL

A. Wall backfill material shall consist of native or import fill material meeting soils classifications A-1, A-2 or A-3 of AASHTO M 145, with a maximum particle size no greater than 6 inches in any dimension and shall be capable of meeting the compaction requirements.

1. Wall backfill material shall be free from frozen lumps, rocks larger than 6 inches in the largest dimension, roots, trash, lumber and organic material.

2.2 STRUCTURAL FILL

A. Structural fill material, if required, shall meet the following requirements.

1. Material shall be non-expansive granular soil with less than 35 percent passing the No. 200 sieve, with a liquid limit less than 30, and free from rocks larger than 4 inches in the largest dimension, frozen lumps, roots, trash, lumber and organic material. The natural soils may be used as structural fill where it meets the above stated criteria.

2.3 3/4" WASHED ROCK

A. 3/4" Washed Rock shall consist of hard, durable particles of stone or gravel, screened or crushed, to the required size and gradation. The material shall be free from vegetation matter, lumps or balls of clay, or other deleterious matter and shall conform to the following gradation when tested in accordance with AASHTO T 27 or ASTM C 136.

Sieve Size (Square Opening)	Percent By Weight Passing Screen
1-inch	100
3/4-inch	95-99
1/2-inch	60
3/8 inch	30
No. 4	0 - 5
No. 8	0 - 3
No. 200	0 - 1

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavation shall be performed to the lines and grades indicated. Excavated material not required or not satisfactory for backfill shall be removed from the site.

B. Excavations shall be braced and supported as needed to prevent the ground adjacent to the excavation from sliding or settling. Slides shall be promptly removed and corrected by CONTRACTOR.

3.2 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with granular fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface to depth of 6 inches.

3.3 DEWATERING

A. Water removal shall be in accordance with Section 31 23 19 - Dewatering.

3.4 BACKFILL

A. Backfill material shall not be placed against concrete structures that have not been properly cured. No backfill material shall be placed until concrete has cured for a minimum of 7 days or until the compressible strength is 3,400 psi, whichever is greater.

B. Backfill material shall be placed in no more than 6-inch loose lifts for compaction by hand operated machine compactors, and 8 inches loose lifts for other than hand operated machines.

C. Structural fill placed beneath foundations, footings or the floor slab shall be placed and compacted to at least 95% of maximum dry density at a moisture content within 2 percent of optimum moisture content in accordance with ASTM D 1557.

D. Backfill material shall be placed and compacted to at least 95 percent of maximum dry density at a moisture content within 2 percent of optimum moisture content in accordance with ASTM D-1557.

E. Where the moisture content is not suitable and/or sufficient compaction has not been obtained, the fill shall be reconditioned to an approved moisture content and re-compacted to the minimum required compaction prior to placing any additional fill material.

F. CONTRACTOR shall be responsible for arranging for the placing and compacting of approved fill material in accordance with these Specifications. If it is determined that CONTRACTOR is failing to meet the minimum requirements, CONTRACTOR shall stop operations and make adjustments as necessary to produce a satisfactorily compacted fill at no additional cost to OWNER.

G. Sufficient personnel, equipment, sumps or other means should be provided to maintain the site in an acceptable dry condition for the duration of this contract.

H. Excavations shall be so braced and supported as needed to prevent the ground, adjacent to the excavation, from sliding or settling. Localized slides or settlements shall be promptly removed and corrected by CONTRACTOR.

3.5 FINISHED GRADE

A. The finished subgrade and grade of the fill shall not vary more than 0.05 feet from the established grades and cross sections shown on the Contract Drawings.

3.6 COMPACTION TESTS

A. Compaction testing shall be the provided and paid for in accordance with Section 01 45 00 – Quality Control and Materials Testing.

B. It shall be the responsibility of CONTRACTOR to accomplish the specified compaction for backfill, structural fill, Untreated Base Course and other earthwork. It shall be the responsibility of CONTRACTOR to control his operations by performing any additional tests necessary to verify and confirm that CONTRACTOR has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.

1. Testing of Backfill Materials
    a. Characteristics of backfill materials shall be determined in accordance with the requirements of Section 01 45 00.
    b. Contractor shall demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:
        1) One (1) test per 1.0 feet of backfill thickness placed per structure.
    c. Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.
    d. After satisfactory conclusion of the initial compaction demonstration and at any time during construction, earthwork which does not comply with the specified degree of compaction shall not exceed the previously specified quantities.
    e. Quality Control tests may be made by ENGINEER to verify that compaction is meeting the requirements previously specified at no cost to CONTRACTOR. If

ENGINEER requires retesting of backfill, CONTRACTOR shall remove the overburden above the level at which ENGINEER wishes to test and shall backfill and recompact the excavation after the test is complete at no additional cost to OWNER.

f. If compaction fails to meet the specified requirements, CONTRACTOR shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid in accordance with Section 01 45 23 – Testing Agency Services. The confirmation tests shall be performed in a manner acceptable to ENGINEER. Frequency of confirmation tests for remedial work shall be double that amount specified for initial confirmation tests.

2. Field Density Tests
   a. Tests shall be performed in sufficient numbers to meet the requirements of Section 01 45 00 and to ensure that the specified density is being obtained.

C. Field density tests shall be made in accordance with ASTM D 1557 and ASTM D 6938.

- END OF SECTION -

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SECTION 33 05 02
REINFORCED CONCRETE PIPE

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall construct the reinforced concrete storm drain pipeline complete and in place, including connections to new and existing structures, all in accordance with the Contract Documents.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1.	Section 01 33 00	Submittal Procedures
2.	Section 31 23 15	Excavation and Backfill of Buried Pipelines
3.	Section 33 08 30	Gravity Pipeline Testing

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

1.	ASTM C 76	Standard Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
2.	ASTM C 443	Standard Specifications for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
3.	ASTM C 596	Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement
4.	ASTM D 3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
5.	ASTM F 477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer's data sheets on reinforced concrete pipe showing pipe dimensions, rubber gaskets, pipe connectors, and other appurtenances.

C. Submit manufacturer's information on grout.

D. CONTRACTOR shall furnish certificates to ENGINEER guaranteeing that the pipe is in compliance with the requirements of these Specifications.

1.5 QUALITY ASSURANCE

A. Pipe shall be subject to inspection at the place of manufacture. Notify ENGINEER not less than 14 days prior to the start of any phase of the pipe manufacture. During

manufacture ENGINEER shall be given access to all areas of the process and shall be permitted to make inspections necessary to confirm compliance with the Specifications.

B. Materials used in the manufacture of the pipe shall be tested in accordance with this Section and the referenced standards. CONTRACTOR shall perform said material tests. ENGINEER shall have the right to witness testing provided that CONTRACTOR's schedule is not delayed for convenience of ENGINEER.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

A. Reinforced Concrete Pipe: For 12-inch through 30-inch diameter reinforced concrete pipes shall conform to the requirements of ASTM C 76 for Class III, Wall B, and Type II modified or V cement and for 36-inch through 72-inch diameter reinforced concrete pipes shall conform to the requirements of ASTM C 76 for Class III, Wall C, and Type II modified or V cement; provided, that pipe shall have tongue and groove joint designed to be self-centering. Pipe shall be designed for an internal pressure of 7 feet of water, and an external design loading meeting AASHTO HS-20-44, soil weight of 120 pcf, and minimum cover depth of 1 foot. Pipe manufacturer shall be **Geneva Pipe and Precast, Inc., Oldcastle Infrastructure, Inc.**, or approved equal.

B. Bell and spigot joints, including rubber gaskets, shall conform to the requirements of the latest revision of ASTM C 443. Pipe joints shall be so designated as to provide for self-centering and when assembled, to compress the gasket to form a watertight seal. The gasket shall be confined in a groove on the spigot so that pipe movement or hydrostatic pressure cannot displace the gasket. Each pipe section shall be identified by a stamp indicating:

1. Name of Manufacturer
2. Date of Manufacture
3. Pipe Classification
4. Top of pipe

C. Quick Setting Grout: Grout shall be a high strength, non-staining grout approved by ENGINEER prior to use. It shall reach an initial set within 90 minutes at 70° F (21° C) and shall reach minimum compressive strength of 2,500 psi (17 mPa) within 24 hours. Shrinkage shall be less than 0.1 percent when tested, using the test procedures of ASTM C 596. The grout shall be mixed, handled, and placed in accordance with the manufacturer's written instructions.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

A. Excavation and backfill of trenches and for appurtenances and backfilling for reinforced concrete pipe shall be in accordance with Section 31 23 15 Excavation and Backfill for Buried Pipelines.

3.2 INSTALLATION

A. All pipes shall be installed accurately to the defined line and grade. Variance from established line and grade shall not be greater than one thirty-second (1/32) of an inch per inch of pipe diameter and not to exceed one-half (1/2) inch, provided that such variation does not result in a level or reverse sloping invert; provided also that variation in the invert elevation between adjoin ends of pipe due to non-concentricity of joining surface and pipe interior surfaces does not exceed one sixty-fourth (1/64) inch per inch of pipe diameter, or one-half inch maximum.

B. All concrete pipe installation shall proceed upgrade on a stable foundation with joints closely and accurately fitted. Rubber gaskets shall be fitted properly in place and care shall be taken in joining the pipe units to avoid twisting of gaskets. Joints shall be clean and dry before a joint lubricant, as recommended by the pipe supplier, shall be applied uniformly to the mating joint surface to facilitate easy positive joint closure.

C. Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells.

D. Select material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for a new pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

E. In addition to the above-mentioned requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

F. During the pipe installation, the trench shall be sufficiently dewatered that the joints will be free of water when jointed.

3.3 PRELIMINARY CLEANING

A. CONTRACTOR shall clean the pipeline as the work progresses by a means in accordance with good practice to ensure that sand, rocks, or other foreign material are not left in any of the pipeline.

B. Do not flush sand, gravel, concrete, debris, or other materials into existing piping systems.

3.4 TESTING OF PIPELINE

A. Testing for the reinforced concrete pipe shall be in accordance with Section 33 08 30 – Gravity Pipeline Testing.

- END OF SECTION -

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SECTION 33 05 05
DUCTILE IRON PIPE

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall furnish and install all pipe, fittings, closure pieces, supports, bolts, nuts, gaskets, jointing material, polyethylene wrap, marker tape, tracer wire, and appurtenances as shown and specified, and as required for a complete and workable piping system.

B. Hydrostatic testing shall meet the requirements of Section 33 13 00 – Pipeline Testing.

C. If there is a discrepancy between this Section or applicable AWWA Standards, the more stringent requirement shall apply.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 50 30 Protection of Existing Utilities
3. Section 09 90 00 Painting and Finishes
4. Section 31 23 15 Excavation and Backfill for Pipelines
5. Section 33 12 00 Mechanical Appurtenances
6. Section 33 13 00 Pipeline Testing

1.3 REFERENCES

A. The Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ASTM D 2041 Cast-Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250

C. AMERICAN STANDARDS FOR TESTING AND MATERIAL (ASTM)

1. ASTM A 193 Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High-Pressure Service and Other Special Purpose Applications
2. ASTM A 194 Standard Specification for Carbon Steel, Alloy Steel, and Stainless-Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
3. ASTM A 283 Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
4. ASTM A 536 Standard Specification for Ductile Iron Castings

D. American Society of Mechanical Engineers (ASME)

1. ASME B1.1 Unified Inch Screw Threads, (UN And UNR Thread Form)
2. ASME B18.2.1 Square, Hex, Heavy Hex, And Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, And Lag Screws (Inch Series)
3. ASME B18.2.2 Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, And Coupling Nuts (Inch Series)

E. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 104 Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2. AWWA C 105 Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
3. AWWA C 110 Standards for Ductile-Iron and Gray-Iron Fittings, 3-inch Through 48-inch, for Water
4. AWWA C 111 Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. AWWA C 115 Standard for Flanged Ductile-Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges
6. AWWA C 150 Standard for the Thickness Design of Ductile-Iron Pipe
7. AWWA C 151 Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
8. AWWA C 153 Standard for Ductile-Iron Compact Fittings, 3-inch Through 64-inch for Water
9. AWWA C 219 Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe
10. AWWA C 600 Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances
11. AWWA C 606 Standard for Grooved and Shouldered Joints
12. AWWA C 651 Standard for Disinfecting Water Mains

F. NSF INTERNATIONAL (NSF)

1. NSF 61 Drinking Water System Components – Health Components

1.4 SUBMITTALS

A. Submit catalog information on all pipe, fittings, valves, couplings, gaskets, tapes, bolts and nuts, wraps, safety tapes, and tracer wires as shown on the Contract Drawings. Information shall indicate manufacture specification compliance and dimensional data.

B. Submit shop drawings on all fabricated piping and pipe supports.

C. Submit bolting patterns, procedures, and bolting equipment data, and calculations for target torque calculations.

D. Certified affidavit of compliance for pipe and fittings or other materials furnished under this Section and as specified in the referenced standards.

1.5 QUALITY ASSURANCE

A. Except as modified herein, materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.

PART 2 PRODUCTS

2.1 DUCTILE IRON PIPE

A. Ductile iron pipe shall conform to the requirements of the AWWA C151 and AWWA C150. Pipe thickness rating shall be minimum Class 53 for The pipe shall be provided with rubber gaskets, specials, and fittings as required. Nominal pipe laying lengths shall be 20-feet.

B. Buried Ductile Iron Pipe shall be encased with 8 mil (minimum), Group 2, Class C magenta polyethylene, conforming to the requirements of AWWA C105. All seams in the polyethylene encasement shall be taped with a minimum 12 mil adhesive tape, **Polyken #900**, **3M Scotchrap 51,** or approved equal, to completely seal the seam.

2.2 FITTINGS

A. MJ and Push-on fittings shall conform to the (AWWA C110 or C153) and shall be for a minimum rated working pressure of 150 psi.

B. Ductile Iron flanges shall have either raised or plain faces and shall have a minimum working pressure rating as required for the Project conditions. For pipe sizes 24-inch and smaller, flanged joints may be rated for a maximum of 350 psi with the use of specially designed gaskets. CONTRACTOR shall be responsible to provide flanges that match connecting equipment and fittings.

C. All buried fittings shall be completely coated with food grade grease, **Chevron FM Grease**, or approved equal, and shall be completely encased with 8 mil (minimum), Group 2, Class C polyethylene, conforming to AWWA C105 and color to match the pipe wrap. All seams in the polyethylene encasement shall be taped with a minimum 12 mil adhesive tape, **Polyken #900**, **3M Scotchrap 51,** or approved equal, to completely seal the seam.

2.3 DUCTILE IRON PIPE JOINTS

A. Ductile iron pipe and fittings shall be furnished with mechanical joints, push-on joints, flanged joints, or restrained joints as required.

1. Mechanical and push-on joints shall conform to the requirements of AWWA C111.
2. Flanged joints shall conform to the requirements of AWWA C115.
3. Restrained joints shall conform to the requirements of AWWA C151. Restrained joints shall **be Flex-Ring, Field Flex-Ring, or Lok-Ring by American Ductile Iron Pipe, Field Lok, TR-Flex by U.S. Pipe**, or approved equal.
4. Joint restraining devices that impart point loads on the pipe wall or that require a tapped anchor as a means of joint restraint shall not be allowed unless there are no other options available. The joint restraint devices shall be **MegaLug Model 1100 by EBAA Iron**, or approved equal.

2.4 SOLID SLEEVE-TYPE COUPLINGS

A. Solid sleeve-type couplings shall be provided where shown on the Contract Drawings. Coupling shall be of ductile iron and shall be of the size to fit the pipe and fittings shown. Coupling shall be pressure rated 350 psi and comply with AWWA C110. Restraints shall be provided where indicated on the Contract Drawings.

2.5 DISMANTLING JOINT

A. Provide dismantling joints were shown on the Contract Drawings. CONTRACTOR will not be allowed to substitute any other type of dismantling joint unless approved by ENGINEER. The coupling shall be rated as indicated on the Contract Drawings or to match the pressure rating of the adjoining pipe.

B. Dismantling joint bodies shall be fabricated from steel, ASTM A512 or A 513 or Ductile Iron ASTM A536, without pipe stop. The body shall not be less than 1/4-inch thick or at least the same wall thickness as the pipe to which the joint is connected. If the strength of the body material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe. The follower ring shall be fabricated from steel, ASTM A576 or A36.

C. For dismantling joints installed in piping systems rated for positive pressure, the joint shall be restrained with harness bolts or tie rods. Other means of restraining the joint such as set screws will not be accepted. Harnesses shall be designed in accordance with AWWA Manual 11, or as indicated. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed.

D. Gaskets shall be composed of a rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions.

E. Dismantling joints shall be **Model 975 by Smith-Blair, Model 309 by JCM, Model DJ400 by Romac**, or approved equal.

2.6 MJxMJ ADAPTER

A. Provide a positive, bolt-through restraint mechanism to connect mechanical joint valves and fittings without the use of pipe. The MJ x MJ Adapter will incorporate a bolt-through restraint mechanism design that allows for connection of MJ x MJ bells of valves and fittings with T-head bolts and pigtail bolts. The MJ x MJ Adapter and spacers shall be manufactured from high strength ductile iron in accordance with ASTM A536, Grade 65-45-12. Supplied with standard NSF-61 Approved asphaltic seal coat that conforms to ANSI/AWWA C104/A21.4 or NSF-61 approved FBE coating that conforms to ANSI/AWWA C116/A21.6. Provide gaskets, bolts, and nuts as specified herein.

B. The MJ x MJ Adapter shall have a maximum water working pressure of 350 PSI for sizes 3-inch to 24-inch, and 250 PSI for sizes 30-inch to 36-inch and shall be used with standard Mechanical Joint fittings and valves. The MJ x MJ Adapter shall be **Star Pipe Products Series 100, Foster Adapter by Infact Corporation,** or approved equal.

2.7 GASKETS

A. Except as otherwise provided, gaskets for flanged joints shall be full face, 1/8-inch thick SBR elastomer and shall have at least two (2) bulb type rings molded into both faces of the gasket. Class 250 or less flange gaskets shall be **Flange-Tyte by U.S. Pipe, Toruseal Flange Gasket by American Ductile Iron Pipe,** or approved equal. For 30-inch diameter and larger pipes with working pressure over 250 psi and under 400 psi, flange gaskets shall be synthetic fiber with rubber binder and manufacturer/model shall be **Garlock Multi-Swell Style 3760-U**, or approved equal. Wherever blind flanges are shown, the gaskets shall consist of 1/8-inch thick cloth-inserted rubber sheet which shall

cover the entire inside surface of the blind flange and shall be cemented to the surface of the blind flange.

B. All buried fittings using steel bolts shall be coated with no-oxide wax and wrapped with polyethylene or as otherwise approved by ENGINEER.

2.8 BOLTS AND NUTS

A. Bolts and nuts shall be rated for the system working pressure with a minimum safety factor of three. Bolts and nuts buried, submerged, and inside vaults shall be Type 304 stainless steel. Bolts and nuts above grade, exposed or inside structures, shall be Type 304 stainless steel. Bolts and nuts in exposed to wastewater or in corrosive environments shall be Type 316 stainless steel.

B. All flange bolt lengths shall be selected by CONTRACTOR such that three full threads, as a minimum, protrude from the hex nut and washer after assembly.

C. Flange bolts shall have ASME B1.1, Class 2A threads, and be manufactured of ASTM A 193, Grade B7 steel. Bolts shall conform to ASME B18.2.1.

D. Flange nuts shall have Class 2B fit, and be manufactured of ASTM A 194, Grade 2H steel, having square or hex heavy dimensions in accordance with ASME B18.2.2.

E. Connection T-bolts for mechanical joint (MJ) fittings shall be Cor-Ten high strength, low alloy steel conforming to AWWA C111. T-Bolts and nuts shall have a zinc plating base coat and PTFE finish coat and shall be **R-Blue by Romac**, or approved equal, or a baked-on ceramic filled fluorocarbon resin and shall be **Blue Fluoropolymer by Trumbull Mfg, NAPAC Kor-10Blu, Sigma**, or approved equal.

2.9 CEMENT MORTAR LINING

A. Ductile iron pipe and fittings shall be lined with cement mortar in accordance with the requirements of the AWWA C104 except that the lining thickness shall be not less than 1/8 of an inch. The pipe interior surfaces shall be smooth and free from fractures, excessive crazing, and roughness.

2.10 THRUST BLOCKS/ RESTRAINTS

A. All fittings for pipes smaller than 20-inch diameter shall have proper thrust blocks as noted on Contract Drawings and restraints as noted for the type of installation required. Joint restraint shall be provided for all bends, fittings, and valves regardless of pipe size or location. Thrust blocks shall be concrete as per OWNER's Standards.

B. Joint restraints may be tie rods, **TR Flex piping system as manufactured by US Pipe**, or approved equal, or a **Megalug system as manufactured by EBAA Iron**. Where the required pipeline deflection exceeds the recommended deflection of the TR Flex piping system, CONTRACTOR shall use Megalugs to achieve specified deflections.

C. Restrained joints shall be suitable for 200 psi test pressures.

2.11 SAFETY TAPE

A. Safety tape shall be a minimum of 3-inch wide by 5.0 mil overall thickness, with no less than a 0.35-gauge solid aluminum foil core. It shall be Safety Blue in color per American Public Works Association (APWA) National Color Code and shall be clearly labeled with the words “CAUTION WATER LINE BELOW” or similar wording approved by ENGINEER. Safety tape shall be **MagnaTec by Empire Level Mfg Corp**, or approved equal.

2.12 TRACER WIRE

A. All piping (including service lines) shall be installed with 12 gauge solid copper THHN tracer wire for pipeline location purposes by means of an electronic line tracer.

1. The wires must be installed along the entire length of the pipe on the top of the pipe and be held in place with poly tape at all pipe joints and at 5 foot intervals.
2. Sections of wire shall be spliced together using approved splice caps and waterproof seals. Twisting the wires together is not acceptable.

2.13 PIPE COATINGS

A. All exposed piping, valves, and fittings including inside vaults and buildings and exposed to the atmosphere shall be painted as specified in Section 09 90 00 – Painting and Finishes. Exposed piping, valves, and fittings to be painted shall be primed by the manufacturer in preparation for painting. CONTRACTOR shall provide verification from the finish coating supplier that the field applied coatings are compatible with the manufacturer’s prime coat. Pipe to be painted shall not have asphalt emulsion coating. The exterior of buried pipe and fittings shall be an asphaltic coating approximately one-mil thick.

PART 3 EXECUTION

3.1 INSTALLATION

A. Excavation and backfill of trenches and for appurtenances shall be in accordance with Section 31 23 15 - Excavation and Backfill for Buried Pipelines.

B. Ductile iron fittings shall be installed in accordance with the ANSI/AWWA C 600. Inspect each pipe and fitting prior to installation to verify there is no damage and clean each pipe and fitting prior to installation.

C. Pipe shall be laid directly on the bedding material. Bell holes shall be formed at the ends of the pipe to prevent point loading.

D. No pipe shall be installed on a foundation into which frost has penetrated or at any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation before backfilling occurs.

E. Immediately before joining the pipe, the bell end of the pipe shall be thoroughly cleaned. The spigot end of the pipe and the inside surface of the gasket shall be cleaned and lubricated. The lubricant shall be non-toxic, shall not support bacteria growth, shall not be harmful to the gasket material, and shall be compliant with NSF/ANSI 61 requirements.

The lubricant shall not impart a taste or odor to the water in the pipe. Tilting of the pipe to insert the spigot into the bell will not be permitted.

F. Buried Ductile Iron pipe shall be polyethylene encased in accordance with the requirements of AWWA C105 Method A. Remove all lumps of clay, mud, cinders, etc. on the pipe surface before installation of the encasement. During installation, soil or embedment material shall not be trapped between the pipe and the polyethylene. Cut polyethylene tube to a length at least 2 feet longer than the pipe section. Wrap shall overlap the adjacent pipe joint at least 1 foot. After assembling the pipe joint, overlap the joint with the polyethylene tube and secure to the pipe with adhesive tape completely around the seam. Overlap the joint on the previous pipe with the polyethylene tube and secure to the existing wrap with adhesive tape and completely seal the seam. Take up the slack width at the top of the pipe to make a snug but not tight fit along the barrel of the pipe and secure with poly tape at 5 foot intervals. For installations below the water table or wet areas, circumferential wraps of tape should be placed at 2 foot intervals along the barrel of the pipe prior to lowering the pipe into the trench.

G. All buried Ductile Iron fittings and valves shall be completely coated with food grade grease, **Chevron FM Grease**, or approved equal, and shall be encased with polyethylene wrap and installed in conformance with AWWA C105 standards. All seams in the polyethylene encasement shall be taped with **Polyken #900, 3M Scotchrap 51,** adhesive tape, or approved equal, to completely seal the seam.

H. Repair punctures to the polyethylene wrap with adhesive tape. Repair cuts, tears, or damage to the polyethylene wrap with a tube cut open, wrapped around the pipe to cover the damaged area, and secure in place with **Polyken #900, 3M Scotchrap 51,** adhesive tape, or approved equal, to completely seal the seam.

I. Provide openings for branches, service taps, blowoffs, air valves, and similar appurtenances by cutting an “X” in the polyethylene and temporarily folding back the film. After the appurtenance is installed, tape the slack securely to the appurtenance, and repair the cut and any other damaged areas.

J. To make a direct tap, apply two or three wraps of adhesive tape completely around the polyethylene encased pipe to cover the area where the tapping machine and chain will be mounted. Install the corporation stop directly through the tape and polyethylene encasement. After the direct tap is completed, inspect for damage and repair if needed.

K. Where polyethylene wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of 3 feet. Secure the end with adhesive tape completely around the seam. Service lines with dissimilar metals shall be wrapped with polyethylene or approved dielectric tape for a minimum clear distance of 3 feet away from the ductile iron pipe.

L. Valves shall be handled in a manner to prevent damage to any part of the valve. CONTRACTOR shall adjust stem packing and operate each valve prior to installation to insure proper operation. Valves shall be installed so that the valve stems are plumb and, in the location, indicated on the drawings.

M. The pipe shall be plugged at the end of each workday or period of suspension.

N. Safety tracer tape shall be installed 12-inches above the pipe along the entire length of pipeline.

O. Tracer wire shall be brought up at valve boxes as shown on Salem City Standards. When splicing a wire use a greased filled or approved connector. All splices should occur within a valve box. Wire is to be continuous underground. Underground splices may only be used by specific permission of the OWNER and must be inspected before backfill.

3.2 THRUST BLOCKS

A. Thrust blocks shall be installed at points as indicated on the Contract Drawings.

B. Thrust blocks shall be constructed so that the bearing surface is in direct line with the major force created by the pipe or fitting.

C. Thrust blocks shall bear against solid undisturbed earth at the side and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints or the pipe or fitting.

D. Thrust blocks shall be sized and constructed per OWNER's Standards or the Contract Drawings, whichever is greater.

3.3 PRELIMINARY CLEANING AND FLUSHING

A. CONTRACTOR shall flush the pipeline as the work progresses by a means in accordance with good practice to ensure that sand, rocks, or other foreign material do not remain in any of the pipeline. If possible, the flushing shall be made with an open pipe end.

B. CONTRACTOR shall provide to ENGINEER a proposed schedule and method of flushing for review before the flushing starts.

3.4 BOLTING PROCEDURES FOR FLANGED JOINTS

A. Flange joints shall be assembled per the gasket manufacturer's instructions and as specified herein. Utilize calibrated bolting equipment capable of applying a measured torque to flange bolts during joining. Bolting patterns, procedures, and bolting equipment data shall be submitted prior to pipe fitting and bolting.

B. Gaskets, bolts, and anti-seize lubricant used in the bolting procedure shall be selected from those specified herein. Submit target torque calculations for each application. Calculations shall identify specific gasket (manufacturer, model, size, configuration, material), bolts (size and material), and anti-seize lubricant. The calculations shall document and take into consideration the pipe service, working and test pressures, pipe diameter, gasket data sheet, bolt material, gasket supplier-recommended assembly stress, and gasket-supplier recommended bolt stress. Calculations shall be stamped by a professional engineer. Target torque calculations shall be used in the assembly of bolted joints.

C. Flange bolts, nuts, and washers shall be visually inspected and cleaned prior to bolting. Lubricate bolts and nuts; if hardened washers are not used, lubricate the flange surface around the bolt holes. This lubricant must be removed by cleaning solvent prior to applying a coating system. Hand-tighten all nuts and bolts then tighten them to 10 to 20 percent of

the target torque. The initial torque shall not exceed 20 percent of the target torque. The bolts shall be tightened according to the pattern included in AWWA Manual M11, Figure 12-3.

D. For flanges having 4 to 8 bolts there shall be three rounds of tightening, after hand tightening, to 30 percent, 60 percent and then 100 percent of the target torque. For flanges having 12 or more bolts there shall be four rounds of tightening, after hand tightening, to 20 percent, 40 percent, 80 percent and 100 percent of the target torque. At 100 percent of target torque the flange gap shall be measured at every other bolt to confirm uniformity. The bolts shall be re-tightened to the target torque 24 hours after completion of the initial bolting sequence.

3.5 TRACER WIRE TESTING

A. Tracer wire shall be installed where indicated above or shown on the Contract Drawings on the pipe along the entire length of pipeline.

B. Upon completion of the pipe installation, CONTRACTOR shall demonstrate that the wire is continuous and unbroken through the entire run of the pipe.

1. Demonstration shall include full signal conductivity (including splices) when energizing for the entire run in the presence of OWNER and/or ENGINEER.
2. If the wire is broken, CONTRACTOR shall repair or replace it. Pipeline installation will not be accepted until the wire passes a continuity test.

3.6 HYDROSTATIC FIELD TESTING OF PIPE

A. CONTRACTOR shall provide additional temporary blow-off valves and fittings as required to flush and disinfect new pipelines as required in Section 33 13 00 – Pipeline Testing and Disinfection. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.

B. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for pressure testing of the pipeline.

C. Testing Procedure

1. The pipe working pressure is 100 psi unless noted otherwise on the Contract Drawings.
2. Pipe test pressure shall not exceed 125% of the working pressure unless taken into consideration during design. The test pressure shall not exceed the thrust-restraint design pressure or 1.5 times the pressure rating of the pipe or joint, whichever is less.
3. For projects with long pipeline segments, the test pressure shall not be less than 125% of the design operating pressure at the highest elevation on the pipeline and shall not be less than 150% of the working operating pressure at the lowest elevation on the pipeline.
4. Hydrostatic testing shall be in accordance with the requirements of AWWA C 600 and Section 33 13 00 - Pipeline Testing and Disinfection. In case of a conflict between these two references, the more stringent requirement shall be followed.

5. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the excessive leakage, shall take corrective measures necessary to repair the leaks, and shall repeat the pipeline test, all at no additional cost to OWNER.
6. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test
7. Air pressure testing will not be allowed.

D. Exposed piping and valves shall show no visible leaks and no pressure loss during the test.

3.7 PAINTING

A. All exposed piping including inside vaults and structures shall be coated as specified in Section 09 90 00 – Painting and Finishes.

- END OF SECTION -

SECTION 33 05 07
POLYVINYL CHLORIDE (PVC) PRESSURE PIPE, RUBBER JOINTS (AWWA C900)

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall furnish and install all PVC pipe, fittings, closure pieces, supports, gaskets, jointing material and appurtenances as shown and specified, and as required for a complete and workable piping system.

B. Hydrostatic testing shall meet the requirements of Section 33 13 00 – Pipeline Testing.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 50 30 Protection of Existing Facilities
3. Section 31 23 15 Excavation and Backfill for Pipelines
4. Section 33 05 05 Ductile Iron Pipe
5. Section 33 12 00 Mechanical Appurtenances
6. Section 33 13 00 Pipeline Testing

1.3 REFERENCES

A. The Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D 1784 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
2. ASTM D 3139 Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
3. ASTM F 477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

C. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 605 Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
2. AWWA C 651 Standard for Disinfecting Water Mains
3. AWWA C 900 Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch through 60-Inch for Water Transmission and Distribution
4. AWWA M 23 Manual of Water Supply Practices - PVC Pipe - Design and Installation

1.4 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer's affidavit certifying product was manufactured, tested, and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

C. Submit shop drawings of pipe, fittings, and appurtenances showing compliance with this Section, and manufacturer’s literature on tracer wire and accessories.

D. Submit plan for commissioning the waterline, including but not limited to cleaning, pressure testing, and disinfection.

PART 2 PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE

A. All polyvinyl chloride (PVC) pipe intended for use in public drinking water supply pipelines or in pressure pipeline systems shall be manufactured of material conforming to AWWA C900, ASTM D1784, and cell classification 12454 PVC materials for the size and class required. All PVC pipes must be certified for potable water use by the National Sanitation Foundation (ANSI/NSF 61) and must bear the logo "NSF-pw" or "NSF-61" indicating such certification. Standard laying lengths shall be 20-feet. Pipe sections shall be clearly marked to:

1. Identify manufacturer's name or trademark
2. Nominal pipe size and OD base
3. AWWA material code designation
4. Dimension ratio
5. AWWA pressure class
6. AWWA specification designation
7. Product record code

B. The PVC pipe shall be DR-18 (235 psi).

2.2 POLYVINYL CHLORIDE JOINTS

A. All joints and accessories shall be manufactured and furnished by the pipe supplier. Joints shall be bell and spigot conforming to the requirements of ASTM D 3139. Gaskets shall comply with the requirements of ASTM F 477.

B. Deflection at the joint shall not exceed 1.0 degree for AWWA C 900 pipe or the maximum deflection recommended by the pipe manufacturer. No deflection of the joint shall be allowed for joints that are over-inserted or not inserted to the assembly or stop mark.

2.3 FITTINGS

A. Fittings shall be ductile iron in accordance with Section 33 05 05 – Ductile Iron Pipe.

2.4 THRUST BLOCKS/ RESTRAINTS

A. All fittings shall have proper thrust blocks where indicated on the Contract Drawings and restraints as noted for the type of installation required. Joint restraint shall be provided for all bends, fittings, and valves regardless of pipe size or location. Thrust blocks shall be 3,000 psi concrete.

B. Joint restraints may be **EBAA Iron Megalug Series 2000PV and Series 2200, Star Pipe Product Series 1100 Pipe Restrainers, Romac Industries RomaGrip for PVC Pipe or 470 Series Pipe Restraining System with tie rods**, or approved equal. (RESTRAINTS WITH A POINT LOADING ON THE PIPE OR ANCHOR PIN WILL NOT BE ALLOWED ON PVC PIPE.)

C. Restrained joints shall be suitable for a minimum of 200 psi test pressures or the required project test pressure.

2.5 TRACER WIRE

A. All piping (including service lines) shall be installed with 12-gauge solid copper THHN tracer wire for pipeline location purposes by means of an electronic line tracer.

1. The wires must be installed along the entire length of the pipe on the top of the pipe and be held in place with ties or hitches spaced not more than 12-feet apart.
2. Sections of wire shall be spliced together using approved splice caps and waterproof seals or solder. Twisting the wires together is not acceptable.

PART 3 EXECUTION

3.1 INSTALLATION

A. Excavation and backfill of trenches and for appurtenances shall be in accordance with Section 31 23 15 - Excavation and Backfill for Buried Pipelines.

B. Polyvinyl Chloride (PVC) pipe shall be installed in accordance with AWWA Manual M23.

C. The pipe shall be plugged at the end of each workday, or period of work suspension.

D. Tracer wire shall be installed 3-inch minimum above pipe as required by the Contract Drawings.

3.2 THRUST BLOCKS AND JOINT RESTRAINTS

A. Thrust blocks and/or joint restraints shall be installed at points as indicated on the Contract Drawings.

B. Thrust blocks shall be constructed so that the bearing surface is in direct line with the major force created by the pipe or fitting.

C. Thrust blocks shall bear against solid undisturbed earth at the side and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints or the pipe or fitting.

D. Thrust blocks shall be sized and constructed per OWNER's Standards or the Contract Drawings, whichever is greater.

E. Thrust blocks shall be concrete as per OWNER's Standards.

3.3 PRELIMINARY CLEANING AND FLUSHING

A. CONTRACTOR shall flush the pipeline as the work progresses by a means in accordance with good practice to ensure that sand, rocks, or other foreign material are not left in any of the pipeline. If possible, the flushing shall be made with an open pipe end.

B. CONTRACTOR shall provide to ENGINEER a proposed schedule and method of flushing for review before the flushing starts.

3.4 TRACER WIRE TESTING

A. Tracer wire shall be brought up at valve boxes as shown on Salem City Standards. When splicing a wire use a greased filled or approved connector. All splices should occur within a valve box. Wire is to be continuous underground. Underground splices may only be used by specific permission of the OWNER and must be inspected before backfill.

B. Upon completion of the pipe installation, CONTRACTOR shall demonstrate that the wire is continuous and unbroken through the entire run of the pipe.

1. Demonstration shall include full signal conductivity (including splices) when energizing for the entire run in the presence of OWNER OR ENGINEER.
2. If the wire is broken, CONTRACTOR shall repair or replace it. Pipeline installation will not be accepted until the wire passes a continuity test.

3.5 HYDROSTATIC TESTING OF PIPE

A. CONTRACTOR shall provide temporary blow-off valves and fittings as required to flush and disinfect new pipelines as required in Section 00 13 00 – Pipeline Testing and Disinfection. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.

B. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection and pressure testing of the pipeline.

C. Testing Procedure

1. The pipe working pressure is 100 psi unless noted otherwise on the Contract Drawings.
2. Pipe test pressure shall not exceed 125% of the working pressure unless taken into consideration during design. The test pressure shall not exceed the thrust-restraint design pressure or the pressure rating of the pipe, valve, fitting, or joints.
3. For projects with long pipeline segments, the test pressure shall not be less than 125% of the design operating pressure at the highest elevation on the pipeline and shall not be less than 150% of the working operating pressure at the lowest elevation on the pipeline.

4. Hydrostatic testing shall be in accordance with the requirements of AWWA C 605 and Section 33 13 00 - Pipeline Testing and Disinfection. In case of a conflict between these two references, the more stringent requirement shall be followed.
5. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the excessive leakage, shall take corrective measures necessary to repair the leaks, and shall repeat the pipeline test, all at no additional cost to OWNER.
6. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.
7. Air pressure testing will not be allowed.

D. Exposed piping shall show no visible leaks and no pressure loss during the test.

- END OF SECTION -

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SECTION 33 05 07.2
POLYVINYL CHLORIDE (PVC) SEWER PIPE
(ASTM D 3034 and F 679, modified)

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall furnish and install all PVC sewer pipe and appurtenances as shown and specified, and as required for a complete and workable piping system.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 31 23 15 Excavation and Backfill for Pipelines

1.3 REFERENCES

A. The Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM C 1173 Standard Specification for Flexible Transition Couplings for Underground Piping Systems
2. ASTM D 1784 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (PVC) Compounds
3. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
4. ASTM D 2412 Standard Specification for External Loading Properties of Plastic Pipe by Parallel-Plate Loading
5. ASTM D 2444 Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
6. ASTM D 3034 Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
7. ASTM D 3212 Standard Specification for Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Seals
8. ASTM F 477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
9. ASTM F 913 Standard Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe
10. ASTM F 679 Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
11. ASTM F 1417 Standard Practice for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit Shop Drawings and laying diagrams of pipe, joints, bends, special fittings, and piping appurtenances.

C. Submit manufacturer's certificate that the pipe conforms to these specifications.

D. Submit plan for commissioning the sewer pipeline, including but not limited to cleaning and testing plan. The written testing plan shall include methods for water conveyance, leak testing, and water disposal.

PART 2 PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE

A. PVC sewer pipe shall conform to the requirements of ASTM D 3034 for pipe sizes 3-inch to 15-inch and to ASTM F 679 for pipe sizes 18-inch to 48-inch. Material for PVC pipe shall conform to the requirements of ASTM D 1784, for cell classification 12454 or 12364 as defined therein. The manufacturer shall test a sample from each batch according to ASTM D 2444.

B. Joints shall conform to ASTM D 3212. Elastomeric seals for compression type joints shall conform to the requirements of ASTM F 477 or ASTM F 913.

C. Pipe sections shall be clearly marked to:

1. Identify manufacturer's name or trademark
2. Nominal pipe size and OD base
3. ASTM material code designation
4. Dimension Ratio
5. ASTM specification designation
6. Product record code

D. The PVC pipe shall meet the testing in accordance with ASTM D 2412 and shall be SDR 35.

2.2 FITTINGS

A. Fittings shall conform to the requirements of ASTM D 3034. The ring groove and gasket ring shall be compatible with PVC pipe ends.

B. The stiffness of the fittings shall be no less than the stiffness of the adjoining pipe.

2.3 FLEXIBLE COUPLINGS

A. Flexible couplings shall be neoprene, full-circle, clamp-on type conforming to ASTM C1173 and provided with 2 stainless steel band screw-clamps to secure the coupling tightly to entering and exiting pipes. Screw-clamp hardware shall be Type 304 or Type 316 stainless steel. Neoprene material shall be suitable for sewage service.

PART 3 EXECUTION

3.1 INSTALLATION

A. Excavation and backfill of trenches and for appurtenances shall be in accordance with Section 31 23 15 - Excavation and Backfill for Buried Pipelines.

B. PVC pipe shall be installed in accordance with the requirements of ASTM D 2321 and as indicated. Pipe sections shall be closely jointed to form a smooth flow line. Immediately before placing each section of pipe in final position for jointings, the bedding for the pipe shall be checked for firmness and uniformity of slope.

C. Handling of the pipe shall be done with tools as recommended by the pipe manufacturer to ensure the pipe is not damaged in any manner during storage, transit, loading, unloading and installation. Pipe shall be inspected both prior to and after installation in the ditch and all defective lengths shall be rejected and removed from the working area.

D. Fittings shall be lowered into the trench by means of rope, cable, chain, or other means without damage. Cable, rope, or other devices used for lowering the fitting into the trench shall be attached around the exterior of the fitting for handling never through the interior of the fitting.

E. Adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work shall be CONTRACTOR's responsibility.

F. Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections to main sewers, or main drains, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the CONTRACTOR in cooperation with owners of such utility structures. Unless otherwise indicated, protection of existing utility structures shall be CONTRACTOR's responsibility.

G. When pipe laying is not in progress, the open ends of the pipe shall be closed to prevent trench water from entering pipe. Adequate backfill shall be deposited on pipe to prevent floating of pipe. Any pipe that has floated shall be removed from the trench, cleaned, and re-laid in an acceptable manner. No pipe shall be laid when, in the opinion of ENGINEER, the trench conditions or weather are unsuitable.

3.2 PIPE PREPARATION

A. Prior to installation, each pipe length shall be carefully inspected, flushed clean of any debris or dust, and be straightened, if not true. The ends of threaded pipes shall be reamed and filed smooth. Pipe fittings shall be equally cleaned before assembly.

3.3 PIPE JOINTS

A. Each pipe compression type joint shall be joined with a lock-in rubber ring and a ring groove that is designed to resist displacement during pipe insertion.

B. The ring and the ring seat inside the bell shall be wiped clean before the gasket is inserted. A thin film of lubricant shall be applied to the exposed surface of the ring and to the outside

of the clean pipe end. Lubricant other than that furnished with the pipe shall not be used. The end of the pipe shall be then forced into the ring to complete the joint.

C. The pipe shall not be deflected either vertically or horizontally in excess of the printed recommendations of the manufacturer of the coupling.

D. Fittings shall be carefully connected to pipe and joint shall be checked to insure a sound and proper joint.

3.4 PRELIMINARY CLEANING AND FLUSHING

A. CONTRACTOR shall flush the pipeline as the work progresses by a means in accordance with good practice to ensure that sand, rocks, or other foreign material are not left in any of the pipeline. If possible, the flushing shall be made with an open pipe end.

B. CONTRACTOR shall provide to ENGINEER a proposed schedule and method of flushing for review before the flushing starts.

3.5 INSPECTION

A. PVC sewer pipes and service laterals shall be visually inspected prior to placement of pipe zone material.

3.6 DEFLECTION TEST

A. Mandrel Test

1. CONTRACTOR shall test all flexible pipe 30-inches and smaller for deflection, joint displacement, and other obstructions by passing the mandrel through the pipe not less than 30 days after completion of the trench backfill, but prior to permanent pavement resurfacing.
2. Pipe with diameter less than the mandrel will be considered defective, and CONTRACTOR shall replace it.

B. Flexible pipe in sizes larger than 30-inches shall have deflections measured by a rigid metal bar, a rigid frame, or other method approved by ENGINEER.

- END OF SECTION -

SECTION 33 05 13
PRECAST CONCRETE MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. CONTRACTOR shall provide precast concrete manholes and structures (vaults), complete and in place, in accordance with the Contract Documents.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1.	Section 01 33 00	Submittal Procedures
2.	Section 01 45 00	Quality Control and Materials Testing
3.	Section 01 60 00	Product Requirements
4.	Section 31 23 15	Excavation and Backfill for Buried Pipelines
5.	Section 31 23 23	Excavation and Backfill for Structures
6.	Section 33 05 02	Reinforced Concrete Pipe (ASTM C 76)
7.	Section 33 05 07.2	Polyvinyl Chloride (PVC) Sewer Pipe (ASTM D3034 and F679)

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

1.	ASTM A 48	Standard Specification for Gray Iron Castings
2.	ASTM A 536	Standard Specification for Ductile Iron Castings
3.	ASTM A 615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
4.	ASTM A 1018	Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
5.	ASTM B 86	Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings
6.	ASTM C 150	Standard Specification for Portland Cement
7.	ASTM C 478	Standard Specification for Precast Reinforced Concrete Manhole Sections
8.	ASTM C 497	Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile
9.	ASTM C 857	Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
10.	ASTM C 858	Standard Specification for Underground Precast Concrete Utility Structures
11.	ASTM C 913	Standard Specification for Precast Concrete Water and Wastewater Structures

12. ASTM C 923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
13. ASTM C 990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
14. ASTM C 1802 Standard Specification For Design, Testing, Manufacture, Selection, And Installation Of Horizontal Fabricated Metal Access Hatches For Utility, Water, And Wastewater Structures

C. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

1. AASHTO M 306 Standard Specification for Drainage, Sewer, Utility, and Related Castings

1.4 SUBMITTALS

A. CONTRACTOR shall provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.

B. Shop Drawings: Indicate manhole and concrete structure locations, elevations, and piping sizes, material, and elevations of penetrations.

C. Product Data: Submit cover and frame construction, features, configuration, and dimensions. Submit pipe connector materials and dimensions. Submit manhole step materials and dimensions. Submit manhole and structure joint sealant materials.

1.5 QUALITY ASSURANCE

A. CONTRACTOR shall demonstrate that manholes and structures have been properly installed, level, with tight joints, at correct elevations and orientations, and have been backfilled and compacted in accordance with the specifications.

1.6 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with precast concrete manufacturer’s instructions for unloading, storing, and moving precast manholes and structures.

C. Store precast concrete manholes and structures to prevent damage to OWNER’s property or other public or private property. Repair property damaged from materials storage.

D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Contract Drawings to indicate its intended use.

PART 2 PRODUCTS

2.1 MANHOLES

A. Reinforced precast concrete manholes in accordance with ASTM C 478 with HS-20 loading. Axial length of barrel sections shall be selected to provide the correct total height

with the fewest joints. Conical sections shall be designed to support cast iron frames and covers under H-20 loading, unless noted otherwise. Design criteria shall be as shown in the Contract Drawings. Manholes shall be manufactured by **Oldcastle Precast, Geneva Pipe and Precast**, or approved equal.

B. Joints shall be sealed with butyl-rubber sealants, **ConSeal CS-102, Ram-Nek RN101**, or approved equal, conformation to ASTM C 990. Wrap exterior section joints with membrane waterproofing and exterior joint wrap meeting the requirements of ASTM C877, Type III, **Marmac, Conseal CS212, or Press-Seal Corp EA-Wrap**, or approved equal.

C. Barrel section to pipe connections shall be sealed with resilient connectors, **Kor-N-Seal by Trelleborg**, or approved equal, complying with ASTM C 923. Mechanical devices shall be stainless steel.

2.2 STRUCTURES

A. Provide reinforced concrete structures and vaults designed for the applications and sizes as shown on the Contract Drawings. Structures shall conform to the requirements of ASTM C 857, ASTM C 858, or ASTM C 913 as required. The minimum wall thickness shall be 5-inches. Cement shall be Type V Portland cement conforming to the requirements of ASTM C 150. The minimum 28-day concrete compressive strength shall be 4,000 psi. Reinforcing steel shall be embedded in the concrete with a minimum rebar clear cover as recommended by ACI 318. Structures and vaults shall be manufactured by **Oldcastle Precast, Geneva Pipe and Precast**, or approved equal.

B. Structures in areas subject to traffic shall be designed for H-20 traffic loading. Structures in other areas shall be designed for a vertical live load of 300 psf.

C. Where joints are required, joints shall be interlocking to secure proper alignment between members and shall prevent migration of soil through the joint. Joints shall be sealed with butyl-rubber sealants, **ConSeal CS-102, Ram-Nek RN101**, or approved equal, conforming to ASTM C 990. Wrap exterior section joints with membrane waterproofing and exterior joint wrap meeting the requirements of ASTM C877, Type III, **Marmac, Conseal CS212, or Press-Seal Corp EA-Wrap,** or approved equal.

D. Openings, where required, shall be of the size and location indicated on the Contract Drawings and shall be provided without obstructions from brackets and supports. Unless noted otherwise, frames and covers shall be fabricated from steel and galvanized after fabrication. Frames shall be integrally cast into the structure concrete sections. Covers shall be tight fitting to prevent dirt and debris entering the structure.

E. Where penetrations are required for piping, conduits, or ducts, such penetrations shall be through precast openings or core drilled through unreinforced thin-wall knock-out sections. Penetrations shall be smooth and exposed reinforcing steel will not be allowed. Unless noted otherwise, structures do not need to be designed to resist thrust from piping passing through the structure.

2.3 FRAMES AND COVERS

A. Manufacturers or approved equal shall be:

1. D & L Foundry and Supply, East Jordan, Neenah Foundry Co. Model Number shall be as shown on the Contract Drawings.

B. Product Description: Casting frames and covers shall be non-rocking and shall conform to the requirements of ASTM A 48, Class 35B for Gray Iron and ASTM A 536 for ductile iron.

2.4 CONFIGURATION

A. Shaft Construction: Square or rectangular with flat lid top section; lipped male/female joints; shaped to receive pipe sections.

B. Clear Inside Dimensions: As indicated on the Contract Drawings.

C. Design Depth: As indicated on the Contract Drawings.

D. Clear Cover Opening: As indicated on the Contract Drawings.

2.5 BEDDING AND COVER MATERIALS

A. Bedding: 3/4-inch Washed Rock as specified in Section 31 23 23 – Excavation and Backfill for Structures.

B. Soil Backfill to Finish Grade: Trench Backfill Material as specified in Section 31 23 15 – Excavation and Backfill for Buried Pipelines.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify built-in items are in proper location, and ready for roughing into Work.

C. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Do not install structures where site conditions induce loads exceeding structural capacity of structures.

B. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.3 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

A. Lift precast components at lifting points designated by manufacturer.

B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.

C. Set precast structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 23 23 – Excavation and Backfill for Structures.

D. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections.

E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

F. Joint sealing materials may be installed on site or at the manufacturer's plant.

G. Verify manholes and structures installed satisfy required alignment and grade.

H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe.

I. Steps shall be installed 12-inches on centers vertically not more than 1/2-inch out of plumb. The top step shall not be more than 12-inches below the manhole cover.

J. Prior to backfilling, fill all cracks and voids in the manholes or vaults with non-shrink grout or polyurethane sealant.

3.4 FRAME AND COVER INSTALLATION

A. Set frame and cover 2-inches above finished grade for manholes and structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1-inch below top surface of frame.

3.5 FIELD QUALITY CONTROL

A. Section 01 45 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Vertical Adjustment of Existing Manholes and Structures

1. Where required, adjust top elevation of manholes and structures to finished grades shown on Contract Drawings.
2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.

- END OF SECTION -

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SECTION 33 08 30
GRAVITY PIPELINE TESTING

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall test storm drain and other gravity drains in accordance these specifications and with the Contract Documents.

B. CONTRACTOR shall be responsible for obtaining permits for discharging excess testing water and dechlorination of such water, if required.

1.2 RELATED SECTIONS

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 33 05 02 Reinforced Concrete Pipe

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM C 828 Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines
2. ASTM C 969 Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
3. ASTM C 1103 Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
4. ASTM D 3034 Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
5. ASTM F 1417 Standard Test Method for Installation of Plastic Gravity Sewer Line Using Low Pressure Air

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Furnish a written testing plan and schedule, including water source and methods for conveyance to the project, sequence, control, and disposal.

C. Where deflection testing of flexible pipe is required, submit a method for mandrel testing or other measurement, as applicable to pipe size.

1.5 PERFORMANCE REQUIREMENTS

A. Gravity flow sanitary sewers are required to have a straight alignment and uniform grade between manholes.

B. Flexible pipe, including “semi-rigid” pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of a line segment but prior to final acceptance using a standard mandrel to verify that installed pipe is within specified deflection tolerances.

C. Maximum allowable leakage for infiltration and exfiltration:

1. The total infiltration or exfiltration shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of 2 feet above the crown of the pipe at the upstream manhole or 2 feet above the groundwater elevation, whichever is greater.

D. Time allowed for pressure loss from 3.5 psig to 2.5 psig shall be per Table 33 08 30 – 2 at the end of this Section.

PART 2 MATERIALS

2.1 DEFLECTION MANDREL

A. Design: CONTRACTOR shall construct a mandrel of steel or rigid plastic which can withstand a force of 200 psi without deforming. The mandrel shall have 9 or more "runners" or legs, as long as the number is an odd number. The mandrel barrel length shall be at least 75 percent of the pipe inside diameter.

B. Sizing: The rigid mandrel shall have an outside diameter (O.D.) equal to 95 percent of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe. Dimensions shall be per appropriate standard. Statistical or other “tolerance package” shall not be considered in mandrel sizing.

2.2 VIDEO EQUIPMENT

A. Use color video equipment. Prepare three copies of the video in DVD format and deliver two copies to OWNER and one copy to ENGINEER. Record the project name, contractors name, date recorded, and locations of the video on the DVD.

B. Produce a DVD using a pan-and-tilt radial-viewing pipe inspection camera that pans 275 degrees and rotates 360 degrees. Use a camera with an accurate footage counter which displays on the monitor the exact distance of the camera from the centerline of the starting manhole. Use a camera with camera height adjustment so that the camera lens is always centered at one-half the inside diameter, or higher, in the pipe being videoed. Provide a lighting system that allows the features and condition of the pipe to be clearly seen. A reflector in front of the camera may be required to enhance lighting in dark or large diameter pipes.

PART 3 EXECUTION

3.1 GENERAL

A. Gravity pipes shall be tested for exfiltration or infiltration and deflection as indicated. Manholes and pipe shall be backfilled prior to testing. The maximum length of pipe tested

shall be the 4 reaches between 5 manholes. Leakage tests shall be completed and approved prior to placing of permanent resurfacing of pavement. When leakage or infiltration exceeds the allowed amount, CONTRACTOR shall locate the leaks and make the necessary repairs or replacements to reduce the leakage or infiltration to the allowable limits. Individually detectable leaks shall be repaired, regardless of whether the test results are acceptable or not.

B. CONTRACTOR shall assume all responsibility to obtain the necessary water for testing of the gravity pipes.

C. No materials shall be used which could damage the pipeline.

D. Air test gauges shall be laboratory-calibrated test gauges, and if required by ENGINEER, shall be recalibrated by a certified laboratory prior to the leakage test. Air test gauges shall have a size and pressure range appropriate for the pipe being tested.

E. Testing shall be performed in the presence of OWNER and/or ENGINEER.

F. Remove debris, sediment, and other material from installed pipe prior to testing. Do not discharge or flush sand, gravel, concrete, debris, or other foreign material into any existing pipeline system. Flushing with clean water only will be allowed but with minimal flows to eliminate exceeding capacities of the existing gravity systems.

3.2 TESTING SCHEDULE

A. Leakage Tests

1. Perform leakage tests as determined from the Table 33 08 30 - 1 below:

TABLE 33 08 30 - 1				
	Criterion 1 Slope Between Manholes		**Criterion 2 Difference in Water Levels**	
Pipe Size	Manhole Delta H (feet)		Test Water vs Ground Water Delta H (feet)	
	Less than or equal to 10 ft	Greater than 10 ft	Greater than or equal to 4 ft	Less than 4 ft
Less than or equal to 24 inches	See Criterion 2	Infiltration or Air (See Note 1)	Exfiltration	Infiltration or Air
Greater than 24 inches	See Criterion 2	See Criterion 2	Exfiltration	Infiltration

Notes:
1) If groundwater is present and at least 1 foot above the top of the pipe, perform an infiltration test. If groundwater is not present, perform an air test.
2) Definitions:
   a) Manhole Delta H is the invert elevation difference between two adjacent manholes.
   b) Test Water vs Groundwater Delta H is the required elevation of water surface for testing minus the average elevation of groundwater adjacent to the pipe to be tested.

3.3 AIR PRESSURE TEST

A. Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.

B. Lines 36-inch average inside diameter and larger shall be “joint” tested at each joint. The minimum allowable for the pressure drop from 3.5 psig to 2.5 psig during a joint test shall be 10 seconds, regardless of pipe size. Joint test shall be conducted as follows:

1. Each joint shall be tested successfully.
2. Joint tester shall be set over joint to be tested so that the two inflation tubes straddle the joint.
3. Inflate tubes to 25 psig to seal off joint to be tested.
4. Apply air pressure into void between inflation tubes until pressure reaches 4 psig.
5. After pressure has stabilized, bleed air pressure back to 3.5 psig.
6. Record time required for pressure to drop from 3.5 psig to 2.5 psig.
7. If the time in seconds for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than 10 seconds, the joint shall be presumed to be free from defect. When the time is less than 10 seconds pipe breakage, joint leakage, or leaking testing seals are indicated and an inspection must be made to determine the cause. CONTRACTOR shall affect such repairs as may be required to accomplish a successful air joint test.

C. For pipe sections less than 36-inch average inside diameter:

1. Determine the groundwater level.
2. Plug both ends of the pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug pipe.

3. After a manhole-to-manhole section of pipe has been sliplined and prior to any services lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
4. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in the system. Allow pressure to stabilize for 2 to 4 minutes. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 33 08 30 - 2 at the end of this Section.
5. To determine air loss, measure the time interval for pressure to drop to 2.5 psig. The time must exceed that listed in the Table 33 08 30 - 2 at the end of this Section for pipe diameter and length. For sliplining, use diameter of carrier pipe.

D. The test of the pipe and service laterals shall be conducted in the presence of ENGINEER. Testing of pipe, regardless of the pipe material, shall be performed in accordance with ASTM C 828, C 1103, or ASTM F 1417, as applicable.

E. Any section of pipe which fails to meet requirements shall be repaired and retested.

3.4 EXFILTRATION TEST

A. Exfiltration testing shall be completed in accordance with ASTM C 969 and as modified below. Testing shall be conducted in the presence of ENGINEER and/or OWNER.

B. Each section of gravity lines shall be tested between successive manholes by closing the lower end and the inlet gravity lines of the upper manhole with stoppers or inflatable plugs. The pipe and manhole shall be filled with water to a point 4-feet above the centerline of the gravity line at the center of the upper manhole; or if ground water is present, 4-feet above the average adjacent ground water level, whichever is higher.

C. Water shall remain in the pipe for at least one hour or until the water level stabilizes, whichever is longer, before the test begins. The minimum test duration shall be 4 hours.

D. Unless indicated otherwise, CONTRACTOR shall measure exfiltration. Measure the amount of water added to the upstream manhole to maintain the water level at the elevation set above. Compare the amount added to the allowable leakage calculated below, and if the amount added is equal to or less than the allowable amount, the tested section of the pipe has passed.

E. The allowable leakage will be computed by the formula:

$$E = 0.000012\ LD\ (H)^{1/2}$$

Where:

E = Allowable leakage in gallons per minute of gravity line tested.
L = Length of gravity line and house connections tested, in feet.
D = Internal diameter of the pipe, in inches.
H = Elevation difference in feet between the water surface in the upper manhole and the centerline of the pipe at the lower manhole; or if ground water is present above the centerline of the pipe in the lower manhole, the difference in elevation between the water surface in the upper manhole and the ground water at the lower manhole.

3.5 INFILTRATION TEST

A. Infiltration testing shall be completed in accordance with ASTM C 969 and as modified below. Testing shall be conducted in the presence of ENGINEER and/or OWNER.

B. Groundwater elevation must be not less than 2 feet above the highest point of pipe or service lead (house service).

1. Determine groundwater elevation
2. Plug incoming pipes in upstream manhole.
3. Insert calibrated 90° V-notch weir in pipe on downstream manhole.
4. Allow water to rise and flow over weir until it stabilizes.
5. Take five readings of accumulated volume over a period of 2 hours and use average for infiltration. The average must not exceed that calculated using the equation in paragraph 3.4.D above.

3.6 DELFECTION TEST

A. Mandrel Test

1. CONTRACTOR shall test all flexible and semi-rigid pipe 30-inches and smaller for deflection, joint displacement, and other obstructions by passing the mandrel through the pipe not less than 30 days after completion of the trench backfill, but prior to permanent pavement resurfacing.
2. Testing shall confirm the pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Pull the approved mandrel by hand through sewer sections.
3. Pipe with diameter less than the mandrel will be considered defective and CONTRACTOR shall replace it.

B. Flexible or semi-rigid pipe larger than 30-inches shall have deflections measured by a rigid metal bar, a rigid frame, or other method approved by ENGINEER.

1. The average inside diameter shall be measured before the pipe is installed and backfilled.
2. Deflection is defined as the difference between vertical inside diameter in the pipe before and after installation and backfilling.

3.7 MANHOLE TEST

A. Manholes shall be hydrostatically tested for leakage prior to backfilling. Prior to testing, manholes shall be visually inspected for obvious defects. Leaks or cracks shall be repaired to the satisfaction of ENGINEER.

B. All pipes entering the manhole shall be sealed at a point outside the manhole walls to include testing of the pipe to manhole joints. The manhole shall be filled with water to a level 2-inches below the top of the frame. Safety lines shall be secured to all plugs utilized. After a period of at least one hour to allow the water level to stabilize, the manhole shall be refilled, and the water level shall be marked. The water level shall again be checked after 4 hours. The maximum leakage shall be 0.025 gallons per foot of manhole diameter per foot of manhole depth per hour. The exterior of the manhole shall be inspected during this period for visible evidence of leakage. Visible moisture, sweating, or beads of water

on the exterior of the manhole shall not be considered leakage, but any water running across the surface will be considered leakage and shall be repaired to the satisfaction of ENGINEER regardless of the volume of water lost.

3.8 VIDEO INSPECTION

A. Immediately after cleaning and testing, video the gravity pipeline to document the condition of the line. Notify ENGINEER 24 hours in advance of any video inspection so that ENGINEER or RESIDENT PROJECT REPRESENTATIVE may observe inspection operations.

B. Survey video inspection DVDs shall be continuous for pipe segments between manholes. Do not leave gaps in the videotaping of a segment between manholes and do not show a single segment on more than one DVD.

C. Do not pull or propel the video camera through the line at a speed greater than 30 feet per minute.

3.9 ALIGNMENT AND GRADE TEST

A. Line and grade of pipe may not vary more than 1/2 inch in 10 feet and not more than 1 inch variance from true line at any location.

B. Grade of pipe may not vary more than 1/4 inch in 10 feet for all design grades less than or equal to 1 percent and not more the 1/2 inch total variance from true grade at any location. Also, grade of pipe may not vary more than 1/2 inch in 10 feet for all design grades greater than 1 percent and not more than 1 inch total variance from true grade at any location. These tolerances shall be acceptable provided that such variation does not result in a level or reverse sloping invert.

C. The variation in the invert elevation between adjoining ends of pipe due to eccentricity of joining surface and pipe interior surfaces shall not exceed 1/64 inch per inch of pipe diameter, or 1/4 inch maximum.

TABLE 33 08 30 – 2 (1.0 psi Pressure Drop)

Pipe Diameter (inch)	Minimum Time (min:sec)	Length for Minimum Time (ft)	Time for Longer Length (sec/ft)	Specification Time for Length (L) Shown (min:sec)								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft
6	5:40	398	0.8548	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07
8	7:33	298	1.5196	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40
10	9:27	239	2.3743	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47
12	11:20	199	3.4190	11:20	11:20	11:20	14:15	17:06	19:57	22:48	25:39	28:30
15	14:10	159	5.3423	14:10	14:10	17:48	22:16	26:43	31:10	35:37	40:04	44:31
18	17:00	133	7.6928	17:00	19:14	25:39	32:03	38:28	44:52	51:17	57:42	64:06
21	19:50	114	10.4708	19:50	26:11	34:54	43:38	52:21	61:05	69:48	78:32	87:15
24	22:40	99	13.6762	22:48	34:11	45:35	56:59	68:23	79:47	91:10	102:34	113:58
27	25:30	88	17.3089	28:51	43:16	57:42	72:07	86:33	100:58	115:24	129:49	144:14
30	28:20	80	21.3690	35:37	53:25	71:14	89:02	106:51	124:39	142:28	160:16	178:05

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SECTION 33 12 00
MECHANICAL APPURTENANCES

PART 1 GENERAL

1.1 SUMMARY

A. CONTRACTOR shall furnish and install all valves, and equipment, complete and operable in accordance with the Specifications.

B. Where 2 or more valves or equipment of the same type and size are required, the valves shall be furnished by the same manufacturer.

C. CONTRACTOR shall verify that flanges on pipe match the bolt hole pattern of the flanges on the mechanical appurtenances.

D. All valves and mechanical appurtenances shall be new and of current manufacture.

E. Unless noted otherwise below or in the Contract Drawings, all system components shall be rated for the maximum system pressure or higher.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1.	Section 01 33 00	Submittal Procedures
2.	Section 01 45 00	Quality Control & Materials Testing
3.	Section 01 50 00	Temporary Construction Utilities and Environmental Controls
4.	Section 31 23 15	Excavation and Backfill for Buried Pipelines
5.	Section 31 23 23	Excavation and Backfill for Structures
6.	Section 33 05 05	Ductile Iron Pipe and Fittings
7.	Section 33 05 07.1	Polyvinyl Chloride (PVC) Pressure Pipe (ASTM D 1785)
8.	Section 40 05 13.13	Steel Process Piping

1.3 REFERENCES

A. The latest edition of the following publications form a part of these Specifications to the extent referenced. The publications are referred to in the text to by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1.	A 126	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
2.	A 216	Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
3.	A 536	Standard Specification for Ductile Iron Castings
4.	B 584	Standard Specification for Copper Alloy Sand Castings for General Applications

C. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1.	AWWA C 223	Fabricated-Steel and Stainless-Steel Tapping Sleeves

2. AWWA C 504 Rubber-Seated Butterfly Valves, 3-inch through 72-inch
3. AWWA C 508 Swing-Check Valves for Waterworks Service
4. AWWA C 509 Resilient-Seated Gate Valves for Water Supply Service
5. AWWA C 512 Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
6. AWWA C 515 Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
7. AWWA C 518 Dual-Disc Swing-Check Valves for Waterworks Service
8. AWWA C 550 Protective Interior Coatings for Valves and Hydrants
9. AWWA C 800 Underground Service Line Valves and Fittings

D. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI B 16.1 Gray Iron Pipe Flanges and Flanged Fittings
2. ANSI B 16.34 Valves – Flanged, Threaded, and Welding End

E. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

1. MSS-SP-60 Connecting Flange Joints between Tapping Sleeves and Tapping Valves
2. MSS-SP-80 Bronze Gate, Globe, Angle, and Check Valves
3. MSS-SP-110 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
4. MSS-SP-124 Fabricated Tapping Sleeves
5. MSS-SP-139 Copper Alloy Gate, Globe, Angle, and Check Valves for Low Pressure/Low Temperature Plumbing Applications

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit catalog cut sheets on all mechanical appurtenances including fittings, valves, or other items shown on the Contract Drawings referencing each item by mark number. Information shall indicate manufacturer specification compliance, Cv factor, pressure rating, and dimensional data.

PART 2 PRODUCTS

2.1 GATE VALVES

A. Gate valves shall conform to the requirements of AWWA C 509. Valves shall be of the resilient-seat type with non-rising stem (NRS), opening to the left, and provided with a 2-inch square operating nut for buried valves or hand wheel for valves located in structures. Buried valves shall be of flange or mechanical joint design to match pipe joint system or as indicated on the Contract Drawings.

B. The valve shall have a two-part thermosetting or fusion bonded epoxy protective coating (10 mil minimum inside and out) system that is non-toxic and imparts no taste to water. The epoxy shall be applied in accordance with AWWA C 550.

C. Downstream of pressure reducing valves, flanges of valves may be raised or plain faced. Flanges of valves shall be faced and drilled to 125-lb American Standard template.

D. All valves shall be furnished with pressure classes equal to or better than the pressure class of the pipe with which the valves are to be used. Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

E. Valves shall be manufactured by **Mueller Co., Clow Valve Co.**

2.2 DOUBLE ECCENTRIC BUTTERFLY VALVES

A. Double Eccentric Butterfly valves shall conform to the following requirements:

1. Butterfly valves shall have a double offset disc design to reduce torque and seat wear, known as a double eccentric type. Valves shall be AWWA C 504 Standard Class 150B.
2. The valves shall have a heavy-duty ductile iron body conforming to ASTM A 536 65-45-12 with flanges fully faced and drilled per ANSI Class 300. Working pressure rating shall be a minimum of 375 psi.
3. Disc body shall conform to ASTM A536 65-45-12 or 60-40-18 and shall be pinned using 2205 Duplex stainless steel pin. Disc seat shall be elastomeric and shall be secured to the disc with Type 316 stainless steel hardware. Disc seat shall be EPDM unless manufacturer recommends alternative which demonstrates better resistance to abrasion.
4. Body seat shall be 316L stainless steel and shall be applied through a high alloy weld double overlay process with a minimum thickness of 5mm.
5. The valve shall have a hand wheel operator or valve stem as shown on the Contract Drawings and shall be geared to close slowly.
6. Valves located within the vault shall have a position indicator.
7. The valve shall have a fusion bonded epoxy protective coating inside and outside with a minimum DFT of no less than 14 mils. Coating shall meet AWWA C 550 and shall be non-toxic and impart no taste to water.

B. The valve shall be manufactured by **Av-Tek, VAG, AVK**, or approved equal.

2.3 BALL VALVES

A. **Brass Ball Valves** shall be full port opening brass, blow out proof stem design, adjustable stem packing, secondary O-ring stem seal, zinc plated steel handle with vinyl insulator. The valves shall conform to MSS-SP-110. Provide **Apollo Series 77FLF-100, Watts Series LFFBV-3C, NIBCO FP600A-LF, FNW X410C,** or approved equal.

2.4 FABRICATED TAPPING SLEEVE

A. Fabricated tapping Sleeves shall be split sleeve, drop-in bolt design with Type 304 or Type 316 Stainless steel body and branch outlet and shall conform to the requirements of AWWA C223 and MSS-SP-124. Bolts, nuts and washers shall be stainless steel.

B. The tapping sleeve outlet shall be provided with a 3/4-inch NPT test plug with a square head.

C. The tapping sleeve shall have a stainless-steel outlet flange meeting the requirements of AWWA C 228 with drilling recessed for tapping valve per MSS-SP-60. Flange bolting pattern shall match gate valve bolt pattern.

D. A 1/4-inch thick full circumferential gasket shall be molded of synthetic rubber compounded shall be provided with a gridded surface and have a raised hydromechanical outlet seal.

E. The tapping sleeve shall have a rated working pressure of 200 psi.

F. The tapping sleeve manufacturer shall be **Mueller Hymax H304SS, JCM 6432, Romac Style SSTIII**, or approved equal.

2.5 VALVE BOXES AND LIDS

A. All buried valves shall be installed complete with nominal 6-inch diameter screw type, two-piece cast iron valve box. Manufacturer be **Tyler Union 6850 Series**, or approved equal. The valve box lid shall be designated “WATER” unless noted otherwise on the Contract Drawings.

B. Concrete Collars shall be 10" thick x 2'- 6" in diameter centered on the valve box. They shall have two circumscribing #4 bars, one at three inches from the outside edge and a second bar nine inches from the outside edge each centered in the concrete. Concrete shall be 3,000 psi.

2.6 PRESSURE GAUGES

A. Pressure gauges shall be provided where shown on the Contract Drawings. Gauges shall meet the requirements of ASME B40.1 Grade 2A and be industrial type with stainless steel movement, liquid filled, and stainless steel, Polypropylene, or Phenolic case. Gauges shall have a rear blowout disc or panel. Unless noted otherwise on the Contract Drawings, pressure gauges shall have a 4-1/2-inch dial with white face and black lettering, a 1/2-inch threaded connection, and shut-off valve. The measuring element shall be a stainless-steel Bourdon Tube. Gauges shall be calibrated to read in applicable units, with an accuracy of ± 0.5 percent to 150 percent of the working pressure. Gauges shall be manufactured be **Ashcroft Model 1279 Duragauge, 1900 Series SOLFRUNT by Ametek (U.S. Gauge), Process Gauge by Marsh Bellofram**, or approved equal.

B. Pressure gauges that connect to lines other than potable water shall have gauge guards to prevent corrosion and clogging. Gauge guards shall have a durable flexible diaphragm which serves as a protective barrier between the process fluid and instrument. The diaphragm shall be either elastomer or Teflon and rated for the pressure of the gauge.

2.7 PRESSURE REDUCING VALVES

A. Pressure Reducing Valves shall automatically reduce higher inlet pressure to a steady lower downstream pressure, regardless of changing flow rate and/or varying inlet pressure. Each valve shall have an accurate, pilot-operated regulator capable of holding downstream pressure to a pre-determined limit. When downstream pressure exceeds the pressure setting of the control pilot, the main valve and pilot valve close drip tight. The valve shall be hydraulically operated, single diaphragm actuated, globe type valve. The valve stem, trim, and pilot system shall be stainless steel and the valve body shall be ductile iron conforming to ASTM A 536. Ends shall be flanged Class 300 rated for a working pressure of 400 psi. Valves shall be equipped with KO Anti-Cavitation Trim. Valves shall be equipped to remotely adjust pressure setting. The valve manufacturer shall provide a 3-year warranty on the valve. The pressure reducing valve shall be **Model**

390-02 KO Anti-Cavitation Pressure Reducing Valve by Cla-Val Company, or approved equal.

B. A direct factory representative shall provide start-up assistance, inspection, and adjustments. The representative shall provide 2 to 4 hours of assistance for each valve installed on the project.

2.8 PRESSURE RELIEF/PRESSURE SUSTAINING VALVES

A. Pressure Relief/Pressure Sustaining Valves shall be hydraulically operated, pilot-controlled, modulating valve designed to maintain constant upstream pressure within close limits. The valve can also be used for pressure relief in a by-pass system. If upstream pressure decreases below the spring setting, the valve shall close. The valve shall be hydraulically operated, single diaphragm actuated, globe type valve. The valve shall be provided with a backflow check feature. Valve stem, trim, and pilot system shall be stainless steel and the valve body shall be ductile iron conforming to ASTM A 536. Ends shall be flanged Class 300 rated for a working pressure of 400 psi. Valves shall be equipped with KO Anti-Cavitation Trim. The valve manufacturer shall provide a 3 year warranty on the valve and 1 year warranty on the electrical components. The pressure relief/pressure sustaining valves shall be **Model 50-01 KO Anti-Cavitation Pressure Relief and Pressure Sustaining Valve by Cla-Val Company**, or approved equal.

B. The pressure relief pilot shall be a direct-acting, adjustable, spring-loaded, diaphragm valve designed to permit flow when controlling pressure exceeds the adjustable spring setting. Pilot control sensing shall be upstream of the pilot system strainer so accurate control may be maintained if the strainer is partially blocked. A full range of spring settings shall be available from 0 to 450 psi.

C. A direct factory representative shall provide start-up assistance, inspection, and adjustments. The representative shall provide 2 to 4 hours of assistance for each valve installed on the project.

2.9 SMOOTH NOSE SAMPLING TAPS

A. Smooth nose sampling taps shall be full port design with quarter-turn operation. Sampling taps shall be no-lead brass. Sampling taps shall be **AY McDonald 2002NT, Boshart 0874NL, Merril Manufacturing SSSV,** or approved equal.

2.10 FLOW METER

A. See Section 40 91 23 – Miscellaneous Properties Measurement Devices.

2.11 PRESSURE TRANSMITTERS

A. See Section 40 91 23 – Miscellaneous Properties Measurement Devices.

PART 3 EXECUTION

3.1 INSTALLATION

A. Valves, valve-operating units, stem extensions and other accessories shall be installed by CONTRACTOR where shown, or where required in the opinion of ENGINEER, to provide for convenience in operation. Where buried valves are indicated, CONTRACTOR shall

furnish and install valve boxes at grade with concrete collars or install valve boxes to 3-inches above grade in unimproved areas.

B. Install mechanical appurtenances as indicated in the Contract Drawings and in accordance with the manufacturer's written instructions.

- END OF SECTION -

SECTION 33 13 00
PIPELINE TESTING

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers testing. Disinfection is only required if the pipeline is used for potable water.

B. CONTRACTOR shall be responsible for obtaining permits for discharging excess testing water, if required.

C. Hydrostatic testing shall meet the requirements of this Section, or the requirements provided in each individual pipeline Section, whichever is more stringent.

D. If there is a discrepancy between this Section, the individual pipe Sections, or applicable AWWA Standards, the more stringent requirement shall apply.

1.2 RELATED SECTIONS

A. Related Work specified in other Sections includes but is not limited to:

1. Section 01 33 00 Submittal procedures
2. Section 33 05 05 Ductile Iron Pipe
3. Section 33 05 07 Polyvinyl Chloride (PVC) Pipe (AWWA C900)
4. Section 40 05 13.13 Steel Process Piping

1.3 REFERENCES

A. The Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.

1. AWWA C 600 Standard Installation of Ductile-Iron Mains and Their Appurtenances
2. AWWA C 604 Standard Installation of Buried Steel Water Pipe – 4-inch (100mm) and larger
3. AWWA C 605 Standard Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
4. AWWA C 651 Standard for Disinfecting Water Mains
5. UAC R309-550-8 Installation of Water Mains

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Furnish a written testing plan and schedule, including water source and methods for conveyance to the project, sequence, control, and disposal. Include the name of the certified bacteriological testing laboratory.

C. Disinfection Report:

1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Name of person collecting samples.
5. Initial and 24-hour disinfectant residuals in treated water in parts per million (ppm) for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual after flushing in ppm for each outlet tested.

PART 2 MATERIALS

2.1 DESCRIPTION

A. All test equipment, temporary valves, bulkheads, and other water control equipment shall be as determined by CONTRACTOR. No materials shall be used which damage the project pipelines for future conveyance of potable water.

B. Disinfecting materials shall consist of liquid chlorine, sodium hypochlorite solution, or calcium hypochlorite granules or tablets.

C. Dechlorination agents may be sodium bisulfate, sodium sulfite, or sodium thiosulfate.

PART 3 EXECUTION

3.1 GENERAL

A. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water for testing and disinfection of the water line system. All testing water used in the pipeline shall be potable water from a State approved drinking water system.
2. All pressure pipelines shall be tested.
3. Disposal of flushing water and water containing chlorine shall be by methods acceptable to the State of Utah, Division of Water Quality.

3.2 HYDROSTATIC TESTING OF PIPELINES PROCEDURE

A. Prior to hydrostatic testing, pipelines 24-inches diameter and larger shall be swept free of debris and visually inspected that all debris has been removed prior to filling.

B. Prior to hydrostatic testing, pipelines shall be flushed or blown out as appropriate. CONTRACTOR may test pipelines in sections. Sections to be tested shall be defined by isolation valves in the pipeline. Where such valves are not present, CONTRACTOR shall install temporary bulkheads or plugs for the purpose of testing. Sections that do not have isolation valves shall be tested in approximate one-mile segments. Sections that have a zero-leakage allowance may be tested as a unit. No section of the pipeline shall be tested until field-placed concrete or mortar has attained an age of 14 Days. The test shall be made by closing valves when available or by placing bulkheads and filling the line slowly with water (maximum filling velocity shall not exceed 0.25 foot per second, calculation based on the full area of the pipe). CONTRACTOR shall be responsible for ascertaining

that test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test to avoid movement and damage to piping and equipment. Remove or protect any pipeline-mounted devices that may be damaged by the test pressure. CONTRACTOR shall provide sufficient temporary tappings in the pipelines to allow for trapped air to exit or for water to be drained. After completion of the tests, such taps shall be permanently plugged. Care shall be taken that air relief valves are open during filling.

C. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the release valves at a reasonable velocity. The air within the pipeline shall be allowed to escape completely. The differential pressure across the orifices in the air release valves shall not be allowed to exceed 5 psi at any time during filling. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb water and to allow the escape of air from air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to ENGINEER shall be taken. Additional water shall be added to the pipeline to replace any water absorbed by the cement mortar lining.

D. The hydrostatic test shall consist of holding 125% of the working operating pressure on the pipeline segment for a period of 2 hours. For projects with long pipeline segments, the test pressure shall not be less than 125% of the design operating pressure at the highest elevation on the pipeline and shall not be less than 150% of the working operating pressure at the lowest elevation on the pipeline. The test pressure shall never exceed the pipe of thrust-restraint design pressure or the pressure rating of the pipe unless allowed per the type of pipe specifications.

E. Visible leaks that appear during testing shall be repaired regardless of the amount of leakage.

F. Add water to restore the test pressure if the pressure decreases 5 psi below test pressure during the test period. Record the amount of water added.

G. Pipe with welded joints shall have no leakage. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipeline, repeating as necessary until the pipeline passes.

H. Exposed piping and valves shall show no visible leaks and no pressure loss during the test.

I. Blowoff isolation gate valves and plug valves (throttling valves) shall be operated and tested during a simulated blow down operation to demonstrate functionality of the valves to the satisfaction of ENGINEER. Isolation valves (gate valves) shall not be used for throttling.

J. CONTRACTOR shall test all piping either in sections such that dissimilar pipe materials shall not be tested together, or the more stringent leakage allowance shall hold for whole section of tested piping, regardless of pipe material.

K. Steel Pipeline Pressure and Leak Test

1. Hydrostatic testing for Steel pipe shall be in accordance with the requirements of AWWA C 604 and this Section. In the event of a conflict between these two references, the more stringent requirement shall be followed.
2. The test shall be made by placing temporary bulkheads or blind flanges as needed in the pipe and filling the line slowly with water. Care shall be taken to see that all air vents are open during the filling. Bulkheads, valves, and connections shall be examined for leaks. If any leaks are found, corrective measures satisfactory to ENGINEER shall be taken. The test shall consist of holding a minimum pressure as shown above or on the Contract Drawings on the section being tested for a minimum period of two hours using either pneumatic or hydraulic means to maintain the pressure. Suitable means shall be provided by CONTRACTOR for determining the quantity of water lost by leakage under the test pressure.
3. Steel pipelines with fully welded joints shall have no leakage. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipeline, repeating as necessary until the pipeline passes.
4. Steel pipeline with rubber gasketed joints. The testing allowance is defined as the quantity of water that must be applied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. The maximum allowable makeup water shall not exceed 10 gal per inch diameter per mile per 24 hours. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipeline, repeating as necessary until the pipeline passes.

L. Ductile Iron Pipe Pressure and Leak Test

1. Ductile Iron pipe shall be tested per paragraph K – Steel Pipeline Pressure and Leak Test.

M. PVC C900 Pipe Gasketed Joints Pipeline Pressure and Leak Test

1. Hydrostatic testing for Ductile Iron pipe shall be in accordance with the requirements of AWWA C 605 and this Section. In the event of a conflict between these two references, the more stringent requirement shall be followed.
2. The test shall be made by placing temporary bulkheads as needed in the pipe and filling the line slowly with water. Care shall be taken to see that all air vents are open during the filling. Bulkheads, valves, and connections shall be examined for leaks. If any leaks are found, corrective measures satisfactory to ENGINEER shall be taken. The test shall consist of holding a minimum pressure as shown above or on the Contract Drawings on the section being tested for a minimum period of two hours using either pneumatic or hydraulic means to maintain the pressure. Suitable means shall be provided by CONTRACTOR for determining the quantity of water lost by leakage under the test pressure. The testing allowance is defined as the quantity of water that must be applied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. The maximum allowable leakage shall be defined as follows:

$$Q = LD\sqrt{(P)}/148{,}000$$

Q = Testing allowance (makeup water) in gallons per hour of test
L = Length of pipe tested in feet
D = Nominal diameter of pipe in inches
P = Average Test Pressure in pounds per square inch (gauge)

3.3 CONNECTIONS TO EXISTING SYSTEM

A. Where connections are to be made to an existing potable water system, the interior surfaces of all pipes and fittings used in making the connections shall be swabbed or sprayed with a one percent hypochlorite solution before installation. Thorough flushing shall be started as soon as the connection is completed and shall be continued until discolored water is eliminated.

B. Final Fill: After successful pressure and disinfection tests, the pipeline(s) shall be filled with fresh potable water and shall remain filled.

- END OF SECTION -

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SECTION 40 05 13.13
STEEL PROCESS PIPING

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall furnish and install all steel process piping and appurtenances as shown and specified, and as required for a complete and workable piping system.

B. This Section includes schedule 80 steel process pipe in accordance with ASTM A 53 and ASTM A 106 with welded or flanged and wrought or forged carbon steel fittings.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 09 90 00 Painting and Finishes
3. Section 26 42 14 Galvanic Cathodic Protection Systems
4. Section 31 23 15 Excavation and Backfill for Pipelines
5. Section 33 12 00 Mechanical Appurtenances
6. Section 33 13 00 Pipeline Testing

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

1. ASME B 16.1 Gray Iron Flanges and Fittings, Classes 25, 125, and 250
2. ASME B 16.3 Malleable Iron Threaded Fittings, Classes 150 and 300
3. ASME B 16.4 Gray Iron Threaded Fittings, Classes 125 and 250
4. ASME B 16.47 Large Diameter Steel Flanges: NPS 26 through NPS 60, Metric/Inch Standard
5. ASME B 16.5 Pipe Flanges and Flanged Fittings
6. ASME B 16.9 Factory-Made Wrought Butt-Welded Fittings
7. ASME B 16.11 Forged Fittings, Socket-Welding and Threaded
8. ASME B 16.12 Cast Iron Threaded Drainage Fittings
9. ASME B 18.2.1 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
10. ASME B 18.2.2 Nuts for General Applications: Machine Screw Nuts; and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
11. ASME B 31.1 Power Piping
12. ASME BPVC VIII Boiler and Pressure Vessel Code (BPVC) Section VIII-Rules for Construction of Pressure Vessels Division 1

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
2. ASTM A 105 Standard Specification for Carbon Steel Forgings for Piping Applications
3. ASTM A 106 Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
4. ASTM A 193 Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
5. ASTM A 194 Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
6. ASTM A 234 Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
7. ASTM A 307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
8. ASTM A 563 Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric)
9. ASTM F 593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
10. ASTM F 594 Standard Specification for Stainless Steel Nuts

D. AMERICA WELDING SOCIETY (AWS)

1. AWS D1.1 Structural Welding Code

E. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 206 Field Welding of Steel Water Pipe
2. AWWA C 207 Steel Pipe Flanges for Waterworks Services
3. AWWA C 210 Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines)
4. AWWA C216 Heat-shrinkable Cross-linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
5. AWWA C217 Cold-Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
6. AWWA C 606 Grooved and Shouldered Joints
7. AWWA C 651 Standard for Disinfecting Water Mains

F. AMERICAN PETROLEUM INSTITUTE (API)

1. API 1104 Welding Pipelines and Related Facilities

G. NACE

1. NACE RP0274 Standard Recommended Practice High-Voltage Electrical Inspection of Pipeline Coatings

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer's affidavit certifying product was manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

C. Submit shop drawings of pipe, fittings, supports and appurtenances showing compliance with this Section including necessary dimensions, details, pipe joints and material lists.

1. Prepare and submit dimensional drawings consistent with the pipe layout in the Contract Drawings, including all fittings and appurtenances, and with the size, location, elevations.
2. Joint and pipe/fitting wall construction details which indicate the type and thickness of cylinder; the position, type, size, and area of reinforcement; coating and lining holdbacks, manufacturing tolerances; and other pertinent information required for the manufacture of the product.
3. Welding Information
   a. The Shop Drawings shall define the weld type and distinguish between shop and field welds. Shop Drawings shall indicate by welding symbols or sketches the details of the welded joints and the preparation of parent metal required to make them. Joints or groups of joints in which welding sequence or technique are especially important and shall be carefully controlled to minimize shrinkage stresses and distortion.
   b. Written welding procedures for shop and field welds, including Welding Procedures Specifications (WPS's) and Procedure Qualification Records (PQR's) shall be submitted.
   c. Written nondestructive testing procedure specifications and nondestructive testing personal qualifications for shop and field welds shall be submitted.
   d. Current (within the last 6 months) Welder Performance Qualifications (WPQ's) shall be submitted for each welder used prior to their performing any Work either in the shop or field. Qualification testing shall be as specified in paragraph 1.3 – Quality Assurance.
   e. Submit the credentials of CONTRACTOR's Certified Welding Inspectors (CWI's) and quality control specialist for review prior to starting any welding in the shop or field. The credentials shall include, but not be limited to, American Welding Society (AWS), QC-1 Certification. Other nondestructive testing (NDT) quality control personnel shall be certified as required by AWS D1.1.
   f. Submit NDT data for each shop-welded and field-welded joint. This data shall include all testing on each weld joint, including re-examination of repaired welds, using radiographic testing (RT), magnetic particle testing (MT), dye penetrant testing (PT), ultrasonic testing (UT), or air test examination methods as specified. Test data shall be reviewed and signed by the CWI.
   g. Submit a welder log for field and shop welding. Log shall list all welders to be used for the Work and the types of welds each welder is qualified to perform.
   h. Submit a written weld repair procedure for each type of shop and field weld proposed for use on the project.
   i. Submit a written rod control procedure for shop and field operations demonstrating how CONTRACTOR intends to maintain rods in good condition throughout the

Work. The rod control procedure shall also demonstrate how the rods are used for each weld.

D. Submit gasket material data including manufacturer's catalog indicating that the proposed product is suitable for each fluid of service application.

E. Manufacturer's Qualifications: Furnish a copy of manufacturer's certification to ISO 9000, SPFA, or LRQA, and documentation of manufacturer's experience in fabricating steel pipe fittings and flanges.

F. Submit field welders' qualifications in accordance with AWS D1.1.

1.5 QUALITY ASSURANCE

A. Shop Nondestructive Testing: Nondestructive testing shall be performed for various weld categories as indicated below. Testing shall include submitting written documentation of procedures per Section V of the ASME Boiler and Pressure Vessel Code, and acceptance criteria shall be in accordance with Section VIII of the ASME BPVC.

1. Field Butt Joint Welds: Spot radiographically examine pipe in accordance with Paragraph UW-52 of the ASME BPVC Section VIII Division 1. If in the opinion of the ENGINEER, the welds cannot readily be radiographed, they shall be 100 percent ultrasonically examined.
2. Fillet Welds: 100 percent examine every fillet weld using the magnetic particle inspection method.
3. Groove Welds: 100 percent ultrasonically examine groove welds that cannot be readily radiographically spot examined.
4. CONTRACTOR's certified welding inspector (CWI) shall 100 percent visually examine every weld as a minimum.
5. In addition to weld tests indicated, doubler pads shall be air tested as stated in AWWA C206.
6. CONTRACTOR shall be responsible for performing and paying for said tests and the ENGINEER has the right to witness testing conducted by CONTRACTOR.

B. Certified Welding Inspector: Furnish the services of a certified welding inspector(s) (CWI) for the shop and field welding as specified in AWWA C200 and C206. After receiving CWI qualification, the CWI shall have at least 3 years of professional work experience similar to the work being performed for the project. The CWI's shall be directed by a CWI supervisor with at least 5 years of professional work experience similar to the work being performed for the project. The certified welding inspector(s) shall submit written certification that all welds were performed in conformance with these documents. Shop weld tests shall be reviewed and signed by the certified welding inspector(s).

C. Field Testing: Field testing shall conform to the requirements of Section 33 13 00 - Pipeline Testing and Disinfection.

D. Welding Requirements: Welding procedures used to fabricate and install pipe shall be prequalified under the provisions of ANSI/AWS D1.1 - Structural Welding Code-Steel or the ASME Boiler and Pressure Vessel Code, Section 9. Welding procedures shall be required for longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

E. Welder Qualifications: Welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 or the ASME Boiler and Pressure Vessel Code, Section 9 by an independent local, approved testing agency not more than 6 months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the project shall be used in qualification tests.

PART 2 PRODUCTS

2.1 STEEL PIPE

A. Galvanized and black steel process pipe shall be fabricated in accordance with ASTM A 53 or ASTM A 106, Grade B, and shall be Standard Weight.

2.2 PIPE JOINTS

A. Flanged joints shall be in accordance with ASME B 16.5 or AWWA C 207 flanges for the pressure class required for the project conditions or as indicated on the Contract Drawings. CONTRACTOR is responsible for providing the appropriate flanges required to connect steel pipe to equipment and other appurtenances. CONTRACTOR shall replace flanges that do not match the mating equipment or appurtenance at no additional cost to OWNER. Gaskets shall be full-face, 1/8-inch thick, cloth-inserted rubber, **Garlock 3505, Durlon 7910**, or approved equal and suitable for the pressure rating of the piping as indicated on the Contract Drawings.

B. Bolts for exposed flanges in vaults and structures shall be carbon steel, ASTM A 307, Grade B for Class B and D flanges and nuts shall be ASTM A 563, Grade A heavy hex. Bolts for Class E and F and Class 300 flanges shall be ASTM A 193, Grade B7 and nuts shall be ASTM A 194, Grade 2H heavy hex. Nuts and bolts for buried flanges shall be Hex type ASME B18.2.2 and B18.2.1 and be Type 304 stainless steel conforming to ASTM F 593 and ASTM F 594. Buried stainless steel nuts and bolts for Class 300 flanges shall be Grade B8 Class 2 in accordance with ASTM A 193 and ASTM A 194.

C. Shop lining and coating shall be continuous to the end of the pipe or back of the flange. Flanges shall be shop coated with a soluble rust preventive compound which is NSF 61 certified if used on potable water pipelines.

D. Joint Shop Coating: Holdback areas for welded joints and butt straps shall be thoroughly cleaned and given a shop coat of rust-inhibitive primer. The surface preparation and primer shall be compatible with the intended finish coating as specified in Section 09 90 00 Painting and Finishes.

2.3 FITTINGS

A. Welded fittings shall be wrought or forged in accordance with ASTM A 234, ASME B 16.11 or ASME B 16.9.

B. Flanged fittings shall be in accordance with ASTM A 105, ASME B 16.1, ASME 16.47, or ASME B 16.5.

2.4 COATING AND LINING OF PIPE AND FITTINGS

A. Steel pipe coatings and linings shall be in accordance with AWWA C 210.

B. Shop-applied interior linings and exterior coatings shall be held back from the ends of the pipe as indicated. Holdback areas shall be coated as indicated in Table 40 05 13.13-1 below.

C. Exterior Coating of Exposed Piping: The exterior surfaces of pipe and fittings that will be exposed to the atmosphere inside structures or above ground shall be thoroughly cleaned and then given a shop coat of primer compatible with the finish coating required by Section 09 90 00 - Painting and Finishes.

D. Exterior Coating of Buried Piping: Pipe for buried service, including bumped heads, shall be epoxy coated per Section 09 90 00 – Painting and Finishes.

E. Interior Lining of Exposed and Buried Piping: Lining for buried or exposed pipes, including bumped heads, shall be epoxy lined per Section 09 90 00 – Painting and Finishes.

2.5 EXTERIOR FIELD JOINT COATING

A. Pipe joints shall be field coated after pipe assembly in accordance with AWWA C 216, except as modified herein.

B. Field joint coating shall be compatible with the shop-applied coating system and be provided by the same manufacturer or a manufacturer approved by the pipe coating manufacturer.

C. Field joint coating materials shall be as follows or an equal.

1. Heat Shrink Sleeves
    a. Filler Material: Provide filler material for push-on, flange, and coupling type joints. Filler material shall adhere to pipe and heat shrink sleeves and shall not melt under joint welding temperatures. Size and type shall be as recommended by the sleeve manufacturer for type of pipe and joint.
    b. Joint Coating: Heat shrink, cross-linked polyolefin wrap or sleeve with an adhesive, backing and sleeve with a total of, 200-mils minimum thickness, suitable for pipeline operating temperature, as recommended by the manufacturer.
    c. Provide standard recovery sleeve for girth weld or bell and spigot steel pipe joints. High recovery sleeves shall be provided for flange joints, coupling style joints, and ductile iron pipe joints.
    d. Width of heat shrink sleeves shall be sufficient to overlap existing coating 2 inches minimum. Overlap on tape coated steel pipe shall be based on a sequential 2-inch-wide step from outer wrap to middle wrap to inner wrap.
    e. Consider sleeve shrinkage during installation and joint profile in determining sleeve width required. Overlapping of 2 or more heat shrink sleeves to achieve the necessary width on pipe joints will not be permitted without OWNER approval.
    f. Manufacturers: **AquaSleeve by Canusa-CPS, Covalence by Berry CPG**, or approved equal.
2. Wax Tape Coating

a. Wax tape coatings shall be limited to field application on joints, fittings, or irregular shapes or complex configurations that are not suited for the use of heat shrink or hand-applied tape wrap coating systems.
b. Apply coating in accordance with AWWA C 217, except as modified herein.
c. Provide filler material to fill and smooth irregular surfaces, such that no tenting or voids remain under the applied wax tape.
d. Protect coating from damage and provide special sand backfill to protect wax coating from damage.
e. Coating System
    1) Surface Preparation: SP3 Power Tool or SP11 Power Tool to Bare Metal.
    2) Primer: Petroleum or petrolatum wax.
    3) Filler Material: Filled petroleum or petrolatum wax.
    4) Inner Tape: Petroleum or petrolatum wax impregnated fabric, 6-inch width maximum, 40-mils thick.
    5) Outer Wrap: PVC or tape suitable for application to inner tape.
f. Wax tape coating system shall be as manufactured by, or approved equal:
    1) **Petrolatum Tapes by Denso North American**
    2) **Wax-Tape by Trenton**

2.6 INTERIOR FIELD JOINT COATING

A. Surface preparation and field lining of pipe joints shall be with the same coating system as the shop-applied lining.

B. Field application shall be performed by qualified personnel trained in the proper application of the coating system.

C. Field coating application requirements shall be the same as the shop-applied coating requirements. Provide heating and/or dehumidification equipment as required to meet the environmental conditions necessary for proper coating application.

PART 3 EXECUTION

3.1 INSTALLATION

A. For buried pipelines, excavation and backfill of trenches and for appurtenances shall be in accordance with Section 31 23 15 - Excavation and Backfill for Buried Pipelines.

B. Above ground steel process piping shall be installed in a neat and workmanlike manner, properly aligned, and cut from measurements taken at the Site to avoid interferences with structural members, architectural features, openings, and equipment. Exposed pipes shall afford maximum headroom and access to equipment, and where necessary, piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points.

C. Piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with Section 05 45 00 – Mechanical Metal Supports. Where necessary to avoid stress on equipment or structural members, the pipe shall be anchored or harnessed. Expansion joints and guides shall compensate for pipe expansion due to temperature changes.

D. Unless otherwise indicated, connections to fixtures, groups of fixtures, and equipment shall be provided with a shutoff valve and union, unless the valve has flanged ends. Unions shall be provided at threaded valves, equipment, and other devices requiring occasional removal or disconnection. Low points shall be provided with a drain valve.

3.2 PIPE PREPARATION

A. Prior to installation, each pipe length shall be carefully inspected, flushed clean of any debris or dust, and be straightened, if not true. Ends of threaded pipes shall be reamed and filed smooth. Pipe fittings shall be equally cleaned before assembly

3.3 WELDED JOINTS

A. General: Field welded joints shall be in accordance with AWWA C 206.

B. Welding Procedures, Welding Qualifications and Testing:

1. Field welding procedures, welders, welding operators, and tackers shall be qualified in accordance with AWS D1.1 and as defined in Section 3 of ANSI/AWWA C 206 or ANSI/AWWA C 200, as applicable. Qualifications shall be in accordance with all position pipe tests as defined in Section 5 of AWS D1.1.
2. CONTRACTOR shall obtain the services of an independent testing laboratory to perform the welder qualification on-Site. Copies of test data and certifications shall be provided to ENGINEER. Costs for welder qualification testing shall be paid by CONTRACTOR at no increased cost to OWNER.
3. Upon completion of each field-welded joint CONTRACTOR shall provide a record system that traces a welder's work completion to a specific joint as it relates to the pipeline stationing.
4. Field lap welds shall be inspected by magnetic particle or dye penetration methods. Field butt welds shall be inspected in accordance with the requirements of API 1104 by the radiographic method and the acceptance criteria of API 1104. Magnetic particle testing is not required for seal welds.
5. Double welded lap joints and butt strap joints shall be air tested. Repairs and retesting shall be required if any loss of pressure occurs and shall be at no increased cost to OWNER.
6. Personnel performing the visual inspection of welds shall be qualified and currently certified as Certified Welding Inspector (CWI) in accordance with AWS QC1, Standard for Qualification and Certification of Welding Inspectors. Personnel performing nondestructive tests shall be qualified and certified to meet the requirements of SNT-TC-1A.

C. Where exterior welds are performed, adequate space shall be provided for welding and inspection of the joints.

D. Butt straps shall be as indicated. When fitting up the ends of pipe to be welded or fitting butt-strap pieces, jacking or clamping shall not be allowed. Cold working the metal with sledges or localized application of heat and working the metal with sledges shall not be allowed. If field displacement of joints, where butt strap joints are indicated, does not allow proper fit up with the tolerances indicated, special closure butt straps or mitered pieces shall be shop fabricated and installed.

E. A heat-resistant shield shall be draped over at least 24-inches of coating beyond the holdback on both sides of the joint during welding to avoid damage to the coating by hot weld splatter. Welding grounds shall not be attached to the coated part of the pipe.

F. Care shall be exercised during the initial backfilling to prevent movement of the pipe and to prevent any backfill material from being deposited on the joint.

G. To control temperature stresses, the unbackfilled joint areas of the pipe shall be shaded from the direct rays of the sun by the use of properly supported awnings, umbrellas, tarpaulins, or other suitable materials for a minimum period of 2 hours prior to the beginning of the welding operation and until the weld has been completed. Shading materials at the joint area shall not rest directly on the pipe but shall be supported to allow air circulation around the pipe. Shading of the pipe joints need not be performed when the ambient air temperature is below 50 deg F as measured in the trench.

H. Prior to the beginning of the welding procedure, any tack welds used to position the pipe during laying shall be removed. Any annular space between the faying surfaces of the bell and spigot shall be equally distributed around the circumference of the joint by shimming, jacking, or other suitable means. The weld shall then be made in accordance with AWWA C 206. Where more than one pass is required, each pass except the first and final ones shall be peened to relieve temperature stresses, and dirt, slag, and flux shall be removed before the succeeding bead is applied.

I. Prior to butt welding, the pipe and joint shall be properly positioned using line up clamps so that, in the finished joint, the abutting pipe sections shall not be misaligned more than 1/16-inch.

J. Unless double fillet welds are indicated, field welded lap joints may, at the CONTRACTOR'S option, be made on either the inside or the outside of the pipe.

K. Inspection of Field Welded Joints: An independent testing laboratory shall inspect the joints. Inspection shall be as soon as practicable after the welds are completed.

1. Fillet welds shall be tested by the Magnetic Particle Inspection Method in accordance with ASME Section VIII, Division 1, Appendix VI.
2. In addition, double fillet welds on butt strap joints or double welded lap joints shall be air tested by shop drilling and tapping for 1/4-inch national pipe thread in the lap or bell end of the pipe. Apply 40 psi of air or other satisfactory gas into the connection between the 2 fillet welds. Test pressure shall be measured with a 4-inch diameter, minimum, pressure gauge with a range no greater than 0 to 100 psi. The air test shall consist of holding the test pressure undiminished for 5 minutes. If the air test fails, paint the welds with a soap solution and mark any leaks indicated by the escaping gas bubbles. Leaking portions of the welds or defective welds shall be removed and rewelded. The amount of material removed shall be limited to that required to correct the defect. After the repair is made, the joint shall be checked by repeating the original test procedure to verify that there is no leakage at the inside weld. Close the threaded openings with pipe plugs or by welding them.
3. Butt welds shall be inspected by radiographic methods in accordance with API Standard 1104.

L. Following tests of the joint, the exterior joint spaces shall be coated in accordance with these specifications after which backfilling may be completed.

M. Repair of Welds: Welds that are defective shall be repaired by CONTRACTOR to meet the requirements of this Specification. Defects in welds or defective welds shall be removed, and that section of the joint shall then be re-welded. Only sufficient removal of defective material that is necessary to correct the defect is required. After the repair is made, the joint shall be checked by repeating the original test procedure. Welds deficient in size shall be repaired by adding weld metal.

3.4 FIELD COATING JOINTS

A. General

1. Remove oil or grease contamination by solvent wiping the pipe and adjacent coating in accordance with SSPC-SP1, Solvent cleaning.
2. Clean pipe surface and adjacent coating of mud, rust, and other foreign contaminates in accordance with SSPC-SP11, Power Tool Cleaning to Bare Metal or abrasively field blast joints in accordance with SSPC-SP10, near white blast, that exhibit any surface rust. Clean the full circumference of the pipe and a minimum of 6-inches onto the existing coating.
3. Remove loose or damaged pipe coating at joint and either repair the coating or increase the length of the joint coating, where reasonable and practical.
4. Complete joint bonding (where shown) of pipe joints before application of joint coating. Joint bonds shall be installed per Section 26 24 14 – Galvanic Cathodic Protection Systems. Joint bonds shall be low profile bonds, and gaps and crevices around the bonds shall be filled with mastic sealant.
5. CONTRACTOR shall electrically test completed joint coating for holidays with high voltage spark tester.

B. Heat Shrink Sleeve Joint Coating

1. Store, handle, and apply field heat shrink sleeve coatings in accordance with AWWA C216 and these specifications.
2. Store sleeves in shipping box until use. Keep dry and sheltered from exposure to direct sunlight. Store off the ground or concrete floors and maintain at a temperature between 60- and 100-degrees F as recommended by the sleeve manufacturer.
3. Metal pipe surface shall be free of dirt, dust, and flash rusting prior to sleeve application. Surface preparation shall be in accordance with the joint coating manufacturer’s recommendations. At a minimum, surfaces shall be prepared by abrasive blasting to SSPC-SP10 or by power tool cleaning to bare metal in accordance with SSPC-SP11.
4. Preheat pipe uniformly as recommended by the sleeve manufacturer. Monitor pipe temperature using a surface temperature gauge, infrared thermometer, or color changing crayons. Protect preheated pipes from rain, snow, frost, or moisture with tenting or shields and do not permit the joint to cool.
5. Fill cracks, crevices, gaps, and step-downs greater than 1/4- inch with filler mastic in accordance with the manufacturer’s recommendations for the full circumference of the pipe.
6. Apply heat shrink sleeve when it is at a minimum temperature of 60 degrees F and while maintaining the pipe temperature above the preheat temperature above. Apply sleeves in accordance with the manufacturer’s instructions and center the sleeve over the joint to provide a minimum 2 inch overlap onto the existing pipe coating.

7. Completed joint sleeves shall be fully bonded to the pipe and existing coating surface without voids. Mastic beading shall be visible along the full circumference of the sleeve. There shall be no wrinkling or excessive burns on the sleeves. Sleeves that do not meet these requirements shall be removed and the joint recoated. Minor coating repairs may be made using heat applied patch material indicated.

8. Allow the sleeve to cool before backfilling. In hot climates, provide shading from direct sunlight. Water quenching will be allowed only when permitted by the sleeve manufacturer.
9. Heat shrink joint coatings which have become wrinkled or disbonded because of prolonged exposure to UV light or thermal cycling shall be removed and replaced.
10. Double coating of defective or damaged heat shrink coatings will not be permitted. Any double coated heat shrink sleeves shall be immediately rejected and CONTRACTOR shall remove and recoat the joint.

3.5 INSPECTION AND TESTING OF PIPELINE

A. Completed steel process piping systems shall be inspected for proper supports, anchorage, and damage to pipe, fittings, and coatings. Any damage shall be repaired by CONTRACTOR at no additional cost to OWNER.

B. CONTRACTOR shall provide temporary blow-off valves and fittings as required to flush and disinfect new pipelines. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.

C. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection and/or pressure testing of the pipeline.

D. Testing Procedure

1. Prior to enclosure or burying, piping systems shall be pressure tested as required on the Drawings, for a period of not less than one hour, without exceeding the tolerances listed on the Drawings. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. CONTRACTOR shall furnish test equipment, labor, materials, and devices
2. Leakage shall be determined by loss of pressure, soap solution, or other positive and accurate method. Fixtures, devices, or other accessories that would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines shall be plugged or capped as appropriate during the testing procedures.
3. Leaks shall be repaired, and the piping shall be re-tested until no leaks are found.
4. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

E. Holiday Testing

1. Holiday tests on epoxy coating shall be conducted on the completed coating after cure or 24-hours, whichever is less, using a high voltage spark test in accordance with NACE Standard RP 0274 and these specifications.
2. Coating thickness used for holiday testing shall be the minimum coating thickness.
3. Dry Film Thickness Testing

a. Coatings shall be tested for dry film thickness using a properly calibrated magnetic pull off or eddy current equipment.
b. Coating thickness measurements shall be conducted as necessary and without limitation. Testing conformance to the requirements of SSPC PA-2 is specifically excluded from this specification.

3.6 LINING AND COATING

A. Steel pipe and fittings shall be lined and coated per Section 09 90 00 – Painting and Finishes and as indicated in the Contract Drawings.

B. General: The interior and exterior joint recesses shall be thoroughly wiped clean and water, loose scale, dirt, and other foreign material shall be removed from the inside surface of the pipe.

C. Every joint will be tested by CONTRACTOR with an electrical detector capable of at least a 12,000 volt output, furnished by SUPPLIER. Holiday tests will be conducted in accordance with NACE RP0274. Holidays shall be repaired by CONTRACTOR at no additional cost to OWNER.

D. Coating Repair: Coating repair shall be in accordance with the manufacturer's requirements.

E. Coating holdbacks shall be straight and cut through the full thickness of the coating. Cutbacks shall be completed in a manner that permits field coating of joints in accordance with the manufacturer's recommendations and these requirements.

F. Holdbacks shall be as required for proper jointing of pipe, considering joint welding requirements, and be as shown in Table 40 05 13.13-1.

Table 40 05 13.13-1
Coating Holdbacks

Polyurethane or Epoxy coating	
Push-on joint, spigot	Flush with spigot end
Push-on, bell	Flush with bell end
Welded, spigot	3-inches, minimum
Welded, Bell	4-inches, minimum

G. Holdback Corrosion Protection

1. Holding primer for corrosion protection of cutbacks or holdbacks shall be compatible with the joint coating system, shall prevent corrosion of prepared pipe ends for duration of storage and construction, and be recommended for buried exposures.
2. Primer shall be compatible with welding operations and shall not result in running or melting of the coating during welding operations.

3. Application and thickness of holding primer shall be in accordance with the primer manufacturer's recommendations but shall not impair the clearances required for proper joint installation.
4. Any corroding holdback areas shall be abrasively blasted to SP10 or power tool cleaned to bare metal in accordance with SP11 prior to applying joint coating.

3.7 INSTALLATION OF PIPE APPURTENANCES

A. Installation of Valves: Valves shall be handled in a manner to prevent any injury or damage to the valve or any part of it. Joints shall be thoroughly cleaned and prepared prior to installation. CONTRACTOR shall adjust stem packing and operate each valve prior to installation to verify proper operation.

B. Valves shall be installed so that the valve stems are plumb and, in the location, indicated.

C. Buried valves and flanges shall be coated and protected in accordance with Section 09 90 00 – Painting and Finishes.

D. Installation of Flanged Joints: Before the joint is assembled, the flange faces shall be thoroughly cleaned of foreign material with a power wire brush. The gasket shall be centered, and the connecting flanges drawn up watertight without unnecessarily stressing the flanges. Bolts shall be tightened in a progressive diametrically opposite sequence and torqued with a suitable calibrated torque wrench. Clamping torque shall be applied to nuts only. Full face reinforced rubber gaskets shall be applied to the inside face of blind flanges with adhesive.

E. Insulated Joints: Insulated joints and appurtenant features shall be provided as required. CONTRACTOR shall exercise special care when installing these joints to prevent electrical conductivity across the joint. After the insulated joint is completed, an electrical resistance test shall be performed by CONTRACTOR. If the resistance test indicates a short circuit, CONTRACTOR shall remove the insulating units to inspect for damage, replace all damaged portions, and reassemble the insulating joint. The insulated joint shall then be retested to assure proper insulation.

F. Flexible Coupled Joints: When installing flexible couplings, care shall be taken that the connecting pipe ends, couplings, and gaskets are clean and free of dirt and foreign matter with special attention given to the contact surfaces of the pipe, gaskets, and couplings. The couplings shall be assembled and installed in conformity with the recommendation and instruction of the coupling manufacturer.

G. Wrenches used in bolting couplings shall be of a type and size recommended by the coupling manufacturer. Coupling bolts shall be tightened so as to secure a uniform annular space between the follower rings and the body of the pipe. Bolts shall be tightened approximately the same amount. Diametrically opposite bolts shall be tightened progressively and evenly. Final tightening shall be done with a suitable calibrated torque wrench set for the torque recommended by the coupling manufacturer. Clamping torque shall be applied to the nut only.

3.8 CORROSION CONTROL

A. Joint Bonding, Anodes and Test Stations: Unless specifically indicated otherwise, bond all non-welded joints. Install test stations at the anode locations on all pipes 24-inch

diameter and larger. Joint Bonding, Anodes, and test stations shall be in accordance with Section 26 42 14 – Galvanic Cathodic Protection Systems.

3.9 REPAIR OF COATING AND LININGS

A. General

1. Areas where holidays are detected or coating is visually damaged, such as blisters, tears, rips, bubbles, wrinkles, cuts, or other defects shall be repaired. Areas where no holidays are detected but are visually damaged shall also be repaired.
2. Maximum defects allowed shall be as indicated for the coating system.

B. Epoxy Coating or Lining Repairs

1. General
   a. Complete coating repairs in accordance with the coating manufacturer's written instructions and these Specifications, whichever is stricter.
2. Defect Size
   a. Minor repairs - repairs that are less than 4-inches in the greatest dimension.
   b. Major repairs - repairs that exceed 4-inches in the greatest dimension.
3. Maximum Quantity of Defects Allowed:
   a. Minor coating repairs on any joint of pipe shall not exceed 1.5 per 100 square feet of surface area.
      1) Two or more minor repairs within 6-inches diameter will be considered a single repair.
      2) Repairs for adhesion testing will not be included in the total number of repairs.
   b. Major repairs shall not exceed two per pipe joint and the combined area shall not be greater than 40 percent of the pipe.
   c. Pipes exceeding the maximum number or size of coating defects shall be stripped of coating, reblasted, and recoated.
   d. Pipe arriving in the field with defects or repairs exceeding the maximum number or size of coating defects will be returned to the shop for recoating at the CONTRACTOR’s expense.
4. Minor repairs shall be repaired using coating repair kits.
   a. Surface Preparation: Clean and feather the defect by power tool sanding with 80 grit or coarser sandpaper to roughen the existing coat and feather the edges of the defect for a minimum of 2-inches around the defect.
   b. Shop and Field Repairs
      1) Re-apply coating to the specified thickness.
      2) Coating manufacturer’s coating touch-up kits subject to ENGINEER’S approval.
   c. Major Repairs:
      1) Surface Preparation: The metal surface and surrounding coating shall be abrasively blasted in accordance with SSPC-SP11, Power Tool Cleaning to Bare Metal, or equal in cleanliness and profile as the original surface. Existing coating shall be feathered and roughened to the equivalent of 40 grit sandpaper.
      2) Shop Repairs: Same material as the pipeline coating and shall be applied by using plural component spray equipment.

3) Field Repairs: Same material as the pipeline coating and shall be applied by using plural component spray equipment or Heat shrink sleeves for pipeline joints. The metal surface and surrounding coating shall be re-blasted to equal cleanliness and profile as the original surface preparation. Existing coating shall be feathered and roughened to the equivalent of coarse sandpaper by abrasive blasting.

d. One coat of the original coating material shall be applied over the repaired surface at the indicated thickness.

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SECTION 40 05 57
ELECTRIC ACTUATORS

PART 1 – General

1.1 THE REQUIREMENT

A. The Contractor shall furnish, test, install, and place into satisfactory operation the electric actuators, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.
B. The actuators shall be suitable for use on a nominal 120 volt, 1 phase, 60Hz power supply and are to incorporate motor, integral reversing starter, local control facilities and terminals for remote control and indication connections housed within a self-contained, sealed enclosure.
C. As a minimum the actuators should meet the requirements set out in EN15714-2 and ISA SP96.02
D. In order to maintain the integrity of the enclosure, setting of the torque levels, position limits and configuration of the indication contacts etc. must be carried out without the removal of any actuator covers and without mains power over an Infrared or *Bluetooth*® wireless interface. Sufficient commissioning tools must be provided with the actuators and must meet the enclosure protection and certification levels of the actuators. Commissioning tools must not form an integral part of the actuator and must be removable for secure storage / authorized release. In addition, provision shall be made for the protection of configured actuator settings by a means independent of access to the commissioning tool. Provision shall be made to disable *Bluetooth*® communications or only allow a *Bluetooth*® connection initiated by an Infra-Red command for maximum security.
E. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel irrespective of the connection sequence of the power supply.
F. As manufactured by:

    1. Cla-val

    2. Or approved equal.

1.2 ACTUATOR SIZING: The actuator must be sized to guarantee valve closure at the specified differential pressure and temperature. The safety margin of motor power available for seating and unseating the valve must be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal. For linear operating valves, the operating speed shall be such as to give valve closing and opening at approximately 10-12 inches per minute unless otherwise stated in the data sheet. For 90° valve types the operating time will be specified.

1.3 ENVIRONMENTAL: Actuators must be suitable for indoor and outdoor use with a standard corrosivity category, C4 medium durability as per ISO 12944. The actuator must be capable of functioning in an ambient temperature ranging from -30°C (-22°F) to +70°C (+158°F), up to 100% relative humidity. Actuators for hazardous area applications must meet the area classification, gas group and surface temperature requirements specified in the data sheet.

1.4 ENCLOSURE: Actuators shall be O-ring sealed, watertight to IP66/IP68 20m for 10 days, NEMA 4, 6. The motor and all other internal electrical elements of the actuator must be protected from ingress of moisture and dust when the terminal cover is removed for site cabling. The terminal compartment must maintain the same ingress protection rating with the terminal cover removed. The actuator enclosure must allow

for temporary site storage without the need for electrical supply connection. All external fasteners shall be suitable for the actuator corrosivity category and installation environment indicated on the datasheet.

1.5 MOTOR: The motor must be an integral part of the actuator, designed specifically for valve actuator applications. The motor shall be a low inertia, high torque design and class F insulated. Resulting in class B temperature rise with a time rating of 15 minutes at 40°C (104°F) at an average load of at least 33% of maximum valve torque. Temperature shall be limited by thermostat device embedded in the motor end windings and integrated into the actuator control. Electrical and mechanical disconnection of the motor shall be possible without draining the lubricant from the actuator gearcase. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel irrespective of the connection sequence of the power supply.

1.6 MOTOR PROTECTION: Protection must be provided for the motor as follows:

A. Stall - the motor must be de-energised within 8 seconds in the event of a stall when attempting to unseat a jammed valve.

B. Over temperature - thermostat will cause tripping of the motor. Auto-reset on cooling

C. Single phasing - lost phase protection.

D. Direction – phase rotation correction.

1.7 GEARING: The actuator gearing must be totally enclosed in an oil-filled gearcase suitable for operation at any angle. Grease lubrication is not permissible. All drive gearing and components must be of metal construction and incorporate a lost-motion hammer blow feature. For rising spindle valves the output shaft shall be hollow to accept a rising stem, and incorporate thrust bearings of the ball or roller type at the base of the actuator. The design should be such as to permit the opening of the gearcase for inspection or disassembled without releasing the stem thrust or taking the valve out of service. For 90° operating type valves, drive gearing shall be self-locking to prevent the valve back-driving the actuator.

1.8 HAND OPERATION: A handwheel must be provided for emergency operation, engaged when the motor is declutched by a lever or similar means, the drive being restored to electrical operation automatically by starting the motor. The handwheel or selection lever must not move on restoration of motor drive. Provision shall be made for the hand/auto selection lever to be locked in both hand and auto positions. It should be possible to select hand operation while the actuator is running or start the actuator motor while the hand/auto selection lever is locked in hand without damage to the drive train.

Clockwise operation of the handwheel must give closing movement of the valve unless otherwise stated in the data sheet. For linear valve types the actuator handwheel drive must be mechanically independent of the motor drive and should be such as to permit valve operation in a reasonable time with a manual force not exceeding 400N through stroke and 800N for seating/unseating of the valve.

1.9 DRIVER INTERFACE: The actuator shall be furnished with a drive bushing easily detachable for machining to suit the valve stem or gearbox input shaft. The drive bush shall be positioned in the base of the actuator. Thrust bearings shall be sealed

for life and the base shall be capable of withstanding five times the rated thrust of the actuator.

1.10 LOCAL CONTROLS: The actuator must incorporate local controls for Open, Close and Stop operation and a Local/Stop/Remote mode selector switch. Mode selection must be lockable in any one of the following three positions: local control plus local stop only, stop (no electrical operation), remote control plus local stop only. It must be possible to select maintained or non-maintained local control.

The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator.

The local controls and display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.

1.11 TORQUE AND LIMITS: Torque and turns limitation to be adjustable as follows:

A. Position setting range – multi-turn: 2.5 to 8,000 turns, with resolution to 7.5° of actuator output.

B. Position setting range – direct drive part turn actuators: 90° +/-10°, with resolution to 0.1° of actuator output.

C. Torque setting: 40% to 100% rated torque.

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Position measurement – Absolute position measurement should be incorporated within the actuator. The technology must be capable of reliably measuring position even in the case of a single fault. The design must be simple with the minimum amount of moving parts (no more than 5). Technologies such as LEDs or potentiometers for position measurement are considered unreliable and therefore not preferred.

Measurement of torque for multi-turn actuators must be from direct measurement of force at the output of the actuator. Methods of determining torque-using data derived from the motor such as motor speed, current, flux etc. are only acceptable for part-turn actuators.

A means for automatic “torque switch bypass” to inhibit torque off during valve unseating and “latching” to prevent torque switch hammer under maintained or repeated control signals shall be provided.

The electrical circuit diagram of the actuator should not vary with valve type remaining identical regardless of whether the valve is to open or close on torque or position limit.

1.12 REMOTE VALVE POSITION AND STATUS INDICATION: Four contacts must be provided which can be selected to indicate any position of the valve; Provision must be made for the selection of a normally closed or open contact form. Contacts shall maintain and update position indication during handwheel operation when all external power to the actuator is isolated.

The contacts must be rated for 5mA to 5A, 120V AC, 30V DC.

As an alternative to providing valve position indication, any of the four contacts shall be selectable to signal one of the following:

A. Valve opening, closing or moving

B. Thermostat tripped, lost phase

C. Motor tripped on torque in mid travel, motor stalled

D. Remote selected, Local selected, Stop selected

E. Actuator being operated by handwheel

F. Actuator fault

Provision shall be made in the design to support an additional eight contacts with the same configurable functionality.

A configurable monitor relay must be provided as standard, which can be used to indicate either Availability or Fault. The relay should be a spring return type with a Normally Open / Normally Closed contact pre-wired to the terminal block.

The Monitor (availability or fault) relay, being energized from the control transformer will de-energise under any one or more the following conditions:

Available Mode

- Loss of main or customer 24V DC power supply
- Actuator control selected to local or stop
- Motor thermostat tripped
- Actuator internal fault

Fault Mode

- Loss of main or customer 24V DC power supply
- Motor thermostat tripped
- Actuator internal fault

Provision shall be made in the design for the addition of a contactless transmitter to give a 4-20mA analogue signal corresponding to valve travel and / or torque for remote indication when required. The transmitter will auto range to the set limits

1.13 LOCAL POSITION INDICATION: The actuator display must include a dedicated numeric/symbol digital position indicator displaying valve position from fully open to fully close in 0.1% increments. Valve closed and open positions shall be indicated by symbols showing valve position in relation to the pipework to ensure that valve status is clearly interpreted. With mains power connected, the display must be backlit to enhance contrast at all ambient light levels and must be legible from a distance of at least 5m (16ft). A power save mode shall be available to switch off the display backlight during long periods of inactivity.

Red, green, and yellow LEDs corresponding to open, closed and intermediate valve positions must be included on the actuator display when power is switched on. The yellow LED should also be fully programmable for on/off, blinker and fault indication. The digital display must be maintained and updated during handwheel operation when mains power to the actuator is isolated.

The actuator display shall include a fully configurable dot-matrix display element with a minimum pixel resolution of 168 x 132 to display operational, alarm, configuration and graphical datalogger information. The text display shall be selectable between English and other languages such as: Spanish, German, French, and Italian. Provision shall be made to upload a different language without removal of any covers or using specialized tools not provided as standard with the actuator.

Datalogger graphical displays and trend graphs must be available on the local LCD for the following functions:

A. Torque versus Position

B. Number of Starts versus Position

C. Number of starts per hour

D. Dwell Time

E. Average temperature

The main display must include configurable a minimum of four different home-screens that include the following information:

A. Position and status

B. Position and torque (analogue)

C. Position and torque (digital)

D. Position and demand (positioning)

An optional environmental cover to protect the display from high levels of UV radiation or abrasive materials must be available and shall be fitted without the need for any special tooling.

The local controls and display must be rotatable through increments of 90 degrees to suit valve and actuator installation orientation.

1.14 INTEGRAL STARTER AND TRANSFORMER: The reversing starter, control transformer and local controls must be integral to the valve actuator and suitably housed to prevent breathing and condensation. The starter shall be suitable for 60 starts per hour during normal service or 1,200 starts per hour under reduced load conditions and of rating appropriate to motor size. The controls supply transformer shall be fed from two of the incoming three phases and incorporate overload protection. It must have the necessary voltage tapping and be adequately rated to provide power for the following functions:

A. Energizing of the contactor coils

B. 24V DC or 110V AC output for remote controls (maximum 5W/VA)

C. Supply for all the internal electrical circuits

An alternative solid state motor starter is permissible for applications requiring up to 1,200 starts per hour. 24VDC remote controls should be used in combination with a solid state starter to maximise response time. The solid state starter must facilitate configurable electrical braking functionality.

Speed adjustable actuators must have an integral motor controller to manage starting, speed and operation.

1.15 REMOTE CONTROL FACILITIES: The necessary control, wiring and terminals must be contained within the actuator enclosure. Open and close external interlocks must

be made available to inhibit local and remote valve opening / closing control. It must be possible to configure the interlocks to be active in remote control only.
Remote control signals fed from an internal 24VDC (or 110VAC) supply and/or from an external supply between 20V and 60VDC or 40V and 120VAC, must be suitable for any one or more of the following methods of control:

A. Open, Close and Stop control

B. Open and Close maintained or “push to run” (inching) control

C. Overriding Emergency Shut-Down; to close (or open) valve from a normally closed or open contact

D. Two-wire control; energise to close (or open), de-energise to open (or close)

Additionally, provision shall be made for a separate ‘drive enable’ permissive input to prevent any unwanted electrical operation.

It must be possible to reverse valve travel without the necessity of stopping the actuator or moving through an intermediate stop control position. The motor starter must be protected from excessive current surges during rapid travel reversal. The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses up to 2kV.

Operation by distributed control system must be possible utilising one or more of the following network systems:

A. Profibus

B. Modbus

C. Foundation Fieldbus

D. DeviceNet

E. Pakscan

F. HART

1.16 MONITORING FACILITIES: Facilities to indicate actuator availability and monitor operation must be included as standard.

Actuator text display indication of the following status/alarms:

A. Closed Limit, open limit, moving open, moving closed, stopped

B. Torque trip closing, torque trip opening, motor stalled

C. ESD active, interlock active

D. Thermostat trip, phase lost, 24V supply lost, local control failure

E. Configuration error, position sensor failure, torque sensor failure

F. Battery low, battery discharged, power loss inhibit

Integral datalogger to record and store the following operational data:

A. Opening last / average torque against position

B. Closing last / average torque against position

C. Opening motor starts against position

D. Closing motor starts against position

E. Total open / closed operations

F. Maximum recorded opening and closing torque values

G. Event recorder logging operational conditions (valve, control and actuator)

The event log must include time and date information for each stored event.

A. Logged data must be accessible via non-intrusive *Bluetooth*® communication and also visible on the actuator display. An intrinsically safe portable tool must be provided to extract datalogger and actuator configuration files from the actuator. The portable tool must permit *Bluetooth*® connection with a PC to perform file transfer. The actuator manufacturer must supply PC software to enable extracted actuator files to be viewed and analysed.

1.17 WIRING AND TERMINATION: Internal wiring shall be tropical grade PVC insulated stranded cable of appropriate size for the control and power. Each wire shall be clearly identified at both ends. The terminals shall be embedded in a terminal block of high tracking resistance compound.

The terminal compartment must be separated from the inner electrical components of the actuator by means of a watertight seal. A minimum of four threaded cable entries with provision for an additional four extra conduit entries must be available to accommodate wiring connections.

All wiring supplied as part of the actuator must be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable. A durable terminal identification card showing a plan of terminals must be attached to the inside of the terminal box cover indicating:

A. Serial number

B. External voltage values

C. Wiring diagram number

D. Terminal layout

The code card must be suitable for the contractor to inscribe cable core identification alongside terminal numbers.

1.18 COMMISSIONING KIT: Each actuator must be supplied with a start-up kit comprising installation instruction manual, electrical wiring diagram and cover seals to make good any site losses during the commissioning period. In addition, sufficient

actuator commissioning tools shall be supplied to enable actuator set up and adjustment during valve/actuator testing and site installation commissioning.

1.19 PERFORMANCE AND TEST CERTIFICATE: Each actuator must be performance tested by the manufacturer and individual test certificates are to be supplied free of charge. Test certificates must be retained by the manufacturer for the serviceable life of the product. The test certificate must include details of the equipment specification such as:

A. Serial number

B. Test date

C. Manufacturing site address

D. Customer

E. Customer order number (where applicable)

F. Actuator size

G. Mounting flange

H. Enclosure type

I. Lubricant

J. Paint coating

K. Power supply

L. Operating speed/time

M. Drive close direction

N. Gear ratio for second stage gearbox (where applicable)

O. Electrical optional extras

P. Catalogue performance

The test equipment should simulate a typical valve load. The following parameters must be recorded and clearly stated on the certificate:

A. Torque at maximum torque setting in both directions

B. Current at maximum torque setting in both directions

C. Flash test statement

D. Test power supply voltage

END OF SECTION

SECTION 40 12 50
PRESSURE TRANSMITTER

PART 1 GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall furnish, test, install, and place into satisfactory operation the pressure transmitters, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 40 20 00 – Instruments, General

PART 2 PRODUCTS

2.1 PRESSURE TRANSMITTERS

A. Pipeline Pressure Transmitters

1. Acceptable manufactures are:
    a. Emerson Rosemount 2088 Series
    b. Schneider Foxboro IAP/IAG Series
    c. ABB 266 series
2. Power supply shall be 24VDC, powered from PLC panel power supply. Process connection shall be 1/2-inch female NPT flange adapter. Signal output shall be 4 to 20 mA.
3. Pressure transmitter shall be capacitance or resonant-wire type. Unless otherwise specified, wetted parts shall be ASTM A276, type 316 stainless steel. Span shall be adjustable over a 6:1 or greater range. Over range capacity without affecting calibration shall be not less than 200 percent of maximum specified range. Volumetric displacement shall not exceed 0.01 cubic inch over the specified span. Fill fluid unless otherwise specified shall be silicone oil. Adjustable dampening shall be provided. External zero adjustment shall be provided. Accuracy shall be 0.25 percent of span or better for spans greater than 5 inches water column and 0.5 percent of span or better for spans less than or equal to 5 inches water column.
4. Transmitter shall be provided with the following adjustable range:

Adjustable range of transmitter, water column	Span specified in the instrument schedule, water column
0.5 to 6 inches	0.5 to 5.5 inches
5 to 30 inches	5.5 to 27.5 inches
25 to 150 inches	27.5 to 137.5 inches
125 to 750 inches	137.5 to 750 inches

Higher ranges and spans shall be provided as specified in the instrument schedule. Transmitter for spans less than or equal to 25 psig shall be provided with one 1/2-inch flanged process connection and two 1/4-inch drain/vent ports, one plugged and one provided with bleed valve. Transmitter shall be provided with an evacuated sealed chamber and reference diaphragm shall be provided with a weatherproof, bug proof atmospheric vent. Transmitters for spans greater than 25 psig shall be similar except designed for gage pressure service, and overpressure rating shall be greater than the lesser of 2000 psig and 150 percent of maximum range.

B. Submersible Pressure/Level Transmitters

1. Submersible Pressure transmitter shall be Keller Levelgage, or equal. Signal output shall be 4 to 20 mA.
2. Unless otherwise specified, wetted parts shall be ASTM A276, type 316 stainless steel drinking water grade. Accuracy shall be Static ±0.25% FS, Total Error Band ±1% BR.
3. Transmitter shall be provided with Drying Tube Assembly optional accessory.
4. Transmitter shall be provided with the following adjustable range: Relative Pressure Ranges shall be Infinite between 0...3 and 0...900 ft W.C.

PART 3 EXECUTION

3.1 REQUIREMENTS

A. Refer to Section 40 20 00.

END OF SECTION

SECTION 40 20 00
INSTRUMENTS GENERAL

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall furnish, install, test, and place in operation process instrumentation (flow elements, level transmitters, etc.) as scheduled herein together with all signal converters, transmitters, isolators, amplifiers, etc. to interface with all instrumentation, panels, controls, and process equipment control panels with the process control system as shown on the Drawings and as specified. Mounting of associated transmitters, indicators, power supplies, brackets, and appurtenances shall be provided as specified herein and shown on the Drawings.

B. It is the intent of this Specification and the Contract Documents that all process taps, isolation valves, nipples, penetrations, embedded instrumentation supports, conduit, wiring, terminations, and the installation of the process instrumentation on process lines shall be provided under this Contract.

C. Taps and connections for primary process sensors shall be sized to suit each individual installation and the requirements of the instrument served. It is the Contractor's responsibility to ensure that the location, supports, orientation, and dimensions of the connections and taps for instrumentation as such as to provide the proper bracing, the required accuracy of measurement, protection of the sensor from accidental damage, and accessibility for maintenance while the plant is in operation. Isolation valves shall be provided at all process taps.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Division 26.

1.3 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title

Reference	Title
ISA S20	Specification Forms for Process Measurement and Control Instrumentation, Primary Elements, and Control Valves
ISA S51.1	Process Instrumentation Terminology

1.4 GENERAL INFORMATION AND DESCRIPTION

A. These Specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment furnished. They are, however, intended to cover the furnishing, the shop testing, the delivery, and complete installation and field testing of all instruments and appurtenances whether specifically mentioned in the Specification or not.

B. The instruments shall be furnished and installed with all necessary accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not. The installations shall incorporate the highest standards for the type of service shown on the Drawings including loop testing of the entire installation and instruction of operating personnel in the care, operation, calibration, and maintenance of all instrumentation.

C. All instrumentation shall be of first-class workmanship and shall be entirely designed and suitable for the intended services. All materials used in fabricating the equipment shall be new and undamaged.

PART 2 - PRODUCTS

2.1 GENERAL

A. All instrumentation supplied shall be the manufacturer's latest design. Unless otherwise specified, all instruments shall be solid state, electronic, using enclosures to suit specified environmental conditions. Microprocessor-based equipment shall be supplied unless otherwise specified. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings or as required.

B. Equipment installed in hazardous areas shall meet Class, Group, and Division as shown on the Drawings, to comply with the National Electric Code.

C. All instruments shall return to accurate measurement without manual resetting upon restoration of power after a power failure.

D. Unless otherwise shown or specified, local indicators shall be provided for all instruments. Where instruments are located in inaccessible locations, local indicators shall be provided and shall be mounted as specified in paragraph 3.1.B. All indicator readouts shall be linear in process units. Readouts of 0-100% shall not be acceptable, except for speed and valve position. Floating outputs shall be provided for all transmitters.

E. Unless otherwise specified, field instrument and power supply enclosures shall be 316 stainless steel, fiberglass, or PVC coated copper free cast aluminum NEMA 4X construction.

F. Where separate elements and transmitters are required, they shall be fully matched, and unless otherwise noted, installed adjacent to the sensor. Special cables or equipment shall be supplied by the associated equipment manufacturer.

G. Electronic equipment shall utilize printed circuitry and shall be coated (tropicalized) to prevent contamination by dust, moisture, and fungus. Solid-state components shall be conservatively rated for long term performance and dependability over ambient atmospheric fluctuations. Ambient conditions shall be –15 to 50 degrees C and 10 to 100 percent relative humidity, unless otherwise specified. Field mounted equipment and system components shall be designed for installation in dusty, humid, and corrosive service conditions.

H. All devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models which are currently in production. All equipment provided, where applicable, shall be of modular construction and shall be capable of field expansion.

I. All non-loop powered instruments and equipment shall be designed to operate on a 60 Hz alternating current power source at a nominal 117 V, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided. Where equipment requires voltage reduction, constant voltage transformers shall be supplied.

J. All analog transmitter and controller outputs shall be isolated, 4-20 milliamps into a load of 0-750 ohms, unless specifically noted otherwise. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA, unless specified otherwise.

K. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials is available.

2.2 INSTRUMENT LIST

A. The instrument index, attached as an appendix to this section, lists major instruments required to provide the process instrumentation system. All instrument functions specified on this list shall be provided by the Contractor. Additional instruments may be required to complete the instrument loops because of certain characteristics of the particular equipment selected by the Contractor. Such additional instruments shall be provided at no additional cost even though not specified in the instrument index or on the contract drawings.

2.3 ACCESSORIES

A. Isolation Valves – Valves shall be full port ball valves with ASTM A276, Type 316 stainless steel trim and body and with Teflon seats and packing. Valves shall be Parker CPI, Whitey, Hoke, or equal.

B. Gage Valves – Gage valves shall be machined from ASTM A276 bar stock and shall be provided with 1/2-inch NPT connections and integral bleed valve. Valves shall be Anderson, Greenwood & Company M9530, Hoke 6801L8Y, or equal.

C. Root Valves – Root valves shall be ASTM A276, Type 316 stainless steel bar stock with 1/2-inch NPT male process connection and three 1/2-inch NPT female instrument connections. One instrument connection shall be provided with an ASTM A276, Type 316 stainless steel bleed valve. ASTM A276, Type 316 stainless steel plugs shall be provided for unused ports. Lagging type units shall be provided for insulated vessels and pipes. Root valves shall be Anderson, Greenwood & Company M5 AVS-44, Hoke 6802L8Y, or equal.

D. Manifolds – Manifolds shall be three-valve bar-stock type. Manifold body shall be machined from 316 stainless steel bar stock. Valves shall be globe configuration with 316 stainless steel ball seats and Teflon stem packing. Manifolds shall be designed for direct mounting to differential pressure transmitters in place of the flanges normally furnished. Fabricated manifolds or manifolds employing needle or soft seat valves are not acceptable. Purge taps, 1/8-inch NPT shall be furnished on manifolds where water purge is specified. Manifolds shall be Anderson Greenwood M4TVS, Hoke 8123F8Y, or equal.

E. Tubing – Instrument tubing between the process connection and instruments shall be 1/2-inch x 0.065-inch seamless annealed ASTM A269, Type 316 stainless steel. Tubing fittings shall be Type 316 stainless steel. Fittings shall be of the swage ferrule design and shall have components (nut, body and ferrule system) interchangeable with those of at least one other manufacturer. Flare and ball sleeve compression type are not acceptable. Fittings shall be Parker CPI, Crawford Swagelok, Hoke Gyrolok, or equal.

F. Chemical Seals

1. Diaphragm – Seal shall be the diaphragm type with flushing connection, Type 316 stainless steel body and Type 316L diaphragm unless otherwise specified. Seal shall be Mansfield and Green Type SG, Ashcroft Type 101, or equal.

2. Annular Ring – Seal shall be the in-line full stream captive sensing liquid type. Metallic wetted parts shall be Type 316 stainless steel. Flexible cylinder shall be Buna-N unless otherwise specified. Seals shall be rated 200 psig with not more than 5-inch WC hysteresis. Seals shall be Ronningen-Petter Iso-Ring, Red Valve series 40, or equal.
3. Fill Fluid – Chemical seals and associated instruments shall be factory filled as follows: Instrument side of seal, capillary tubing, and instrument shall be evacuated to an absolute pressure of 1.0 Torr or less; filled; and sealed. Unless otherwise specified, fill fluid shall be silicone oil, Dow Corning DC200, Syltherm 800, or equal.

G. Bushings and Thermowells – Bushings or thermowells shall comply with SAMA PMC17-10. Temperature taps shall be 1/2-inch NPT, and lagging extensions shall be provided on insulated vessels or pipes. Thermowells and bushings shall be machined from Type 316 stainless steel bar stock unless otherwise specified.

H. Purge Assemblies

1. Air – Air purge assembly shall consist of a constant-differential relay, needle valve, check valve and 0.2 to 2.0 scfh rotameter. Assembly shall be Moore Products 62VA, Fischer & Porter 10A3137N-3BR2110, or equal.
2. Water – Water purge assembly shall consist of a strainer, constant-differential regulator, needle valve, check valve, and 20 to 200 cc/m rotameter. Assembly shall be Moore Products 63BD4A, Fischer & Porter 10A3137N-53BR2110, or equal. Strainer shall be 155 micron wye-type, ASCO 8600A2, Crane, or equal.

2.4 POWERED INSTRUMENTS GENERAL REQUIREMENTS

A. Powered instruments are those instruments which require power (120 VAC or 24 VDC loop power) to operate. Each instrument includes an element or analyzer and a transmitter/controller.

B. Transmitters shall be 4 to 20 milliampere output two-wire type with operating power derived from the transmission circuit. Transmitter shall support an external load of 0 to 600 ohms or greater without requiring trimming resistors with a transmission circuit power supply of 24 volts. Transmitter output shall be galvanically isolated from the process and the transmitter case. Time constant of transmitters used for flow or pressure measurement, including level transmitters used for flow measurement, shall be adjustable from 0.5 to 5.0 seconds. Transmitter output shall increase with increasing measurement except where "reverse action" is specified in the instrument schedule.

C. Electrical parts of transmitter and/or primary element mechanisms shall, as a minimum be housed in enclosures meeting NEMA 250, Type 4 requirements. Where electrical mechanisms are located outdoors or in areas specified as corrosive, enclosures shall meet NEMA 250, Type 4X requirements.

D. Transmitters located outdoors shall be provided with surge protectors: Rosemount Model 470A, Taylor 1020FP, or equal.

E. Where two-wire transmitter is located in an area classified as hazardous, it shall be made safe by means of an intrinsic safety barrier. Intrinsic safety barriers for two-wire transmitters shall be of the active, isolating, loop powered type. Barrier shall be Measurement Technology LTD. type MT3042, Stahl 9005/01-252/100/00, or equal.

F. Where four-wire transmitters are permitted, they shall be provided with a loop powered signal current isolator connected in the output signal circuit. Isolator shall provide galvanic isolation of milliampere transmission signals from transmitters with inadequately isolated output circuits. Isolator shall be housed in a NEMA 250, type 4/7 conduit body and shall derive its operating power from the signal input circuit. Input and output signals shall be 4 to 20 milliamperes, and error shall not exceed 0.1 percent of span. Input resistance shall not exceed 550 ohms with an output load of 250 ohms. Isolator shall be Moore Industries SCX/4-20MA/ 4-20/MA/6.5DC/-RF(EX).

PART 3 - EXECUTION

3.1 INSTALLATION

A. General – Equipment shall be located so that it is accessible for operation and maintenance. Electrical work shall be performed in compliance with all applicable local codes and practices. Where these specifications and the Drawings do not delineate precise installation procedures, API RP550 shall be used as a guide to installation procedures.

B. Equipment Mounting and Support

1. Field equipment shall be wall mounted or mounted on two-inch diameter aluminum pipe stands welded to a 10-inch square, ½-inch thick aluminum steel baseplate. Instruments attached directly to concrete shall be spaced out from the mounting surface not less than ½-inch by use of phenolic spacers. Expansion shields in walls shall be used for securing equipment or wall supports to concrete surfaces. Unless otherwise noted, field instruments shall be mounted between 48 and 60 inches above the floor or work platform.
2. Embedded pipe supports and sleeves shall be schedule 40, 304 stainless steel pipe, with stainless steel blind flange for equipment mounting as shown on the Drawings.
3. Materials for miscellaneous mounting brackets and supports shall be 304 stainless steel.
4. Pipe stands, mounting brackets, and supports shall comply with the requirements of Division 5.
5. Where transmitters are supported from process piping, leveling saddles shall be provided. Transmitters shall be oriented such that output indicators are readily visible.

C. Control and Signal Wiring – Electrical, control, and signal wiring connections to transmitters and elements mounted on process piping or equipment shall be made through liquid-tight flexible conduit. Conduit seals shall be provided where conduits enter all field instrument enclosures and all cabinetry housing electrical or electronic equipment.

3.2 CLEANING AND ADJUSTMENT

A. General

1. The Contractor shall comply with the requirements of Division 1 and all instrumentation and control system tests, inspection, and calibration requirements for all instrumentation and controls provided under this Contract and specified herein. The Engineer, or his designated representative(s), reserve the right to witness any test, inspection, calibration, or start-up activity. Acceptance by the Engineer of any plan, report, or documentation relating to any testing or commissioning activity specified herein shall not relieve the Contractor of his responsibility for meeting all specified requirements.
2. The Contractor shall provide the services of factory trained technicians, tools, and equipment to field calibrate, test, inspect, and adjust each instrument to its specified performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any contract requirements, or any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer, at no cost to the Owner. The Contractor shall bear all costs and provided all personnel, equipment, and materials necessary to implement all installation tests and inspection activities for equipment specified herein.

B. Field Instrument Calibration Requirements

1. Each instrument shall be calibrated at 0, 25, 50, 75, and 100 percent of span using test instruments to simulate inputs and read outputs. Test instruments shall be rated to an accuracy of at least five times greater than the specified accuracy of the instrument being calibrated. Where applicable, such test instruments shall have accuracies as set forth by the National Bureau of Standards.
2. The Contractor shall provide a written calibration sheet to the Engineer for each instrument, certifying that it has been calibrated to its published specified accuracy. This sheet shall include but not be limited to date, instrument tag numbers, calibration data for the various procedures, name of person performing the calibration, listing of published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerance, defect noted, corrective action required, and corrections made.
3. If doubt exists as to the correct method for calibrating or checking calibration of an instrument, the manufacturer's recommendations shall be used as an acceptable standard, subject to approval of the Engineer.
4. Upon completion of calibration, devices calibrated hereunder shall not be subjected to sudden movements, accelerations, or shocks, and shall be installed in permanent protected positions not subject to moisture, dirt, and excessive temperature variations. Caution shall be exercised to prevent such devices being subjected to overvoltages, incorrect voltages, overpressures, or incorrect air. Damaged equipment shall be replaced and recalibrated at no cost to the Owner.
5. Upon completion of instrumentation installation, the Contractor shall perform a loop check. The Contractor shall submit final loop test results with all instruments listed in the loop. Loop test results shall be signed by all representatives involved for each loop test.

- END OF SECTION -

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SECTION 40 91 23
MISCELLANEOUS PROPERTIES MEASUREMENT DEVICES

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers the Work necessary to install a ready to use and tested process and analysis system. CONTRACTOR shall provide all components required for a complete and functional system.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 207 Steel Pipe Flanges for Waterworks Service—Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
2. AWWA C 751 Magnetic Inductive Flowmeters

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit catalog cuts on all process equipment including: switches, meters, sensors, or other items shown on Contract Drawings referencing each item by mark number. Information shall indicate manufacturer specification compliance and dimensional data.

C. CONTRACTOR shall supply operation and maintenance manuals for all process equipment.

1.5 WARRANTY

A. Manufacturer shall provide to OWNER written guarantee against defects in material or workmanship for a period of one (1) year.

1.6 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants. Each system shall be factory calibrated and certified prior to delivery.

1.7 QUALITY ASSURANCE

A. Equipment to be furnished under this section shall be the product of manufacturers regularly engaged in the design and manufacturing of this type of equipment. The manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving CONTRACTOR from responsibility for the proper installation and functionality of the work.

PART 2 PRODUCTS

2.1 GENERAL

A. Each process measurement system shall typically consist of a sensor and analyzer/transmitter. Where shown on the Contract Drawings, the analyzer/transmitter may be utilized for multiple sensors. When an analyzer/transmitter is used for multiple sensors, it shall be capable of displaying simultaneously each process measurement.

B. Each analyzer/transmitter shall be equipped with a means to transmit process measurement data to the plant SCADA system.

1. For hardwired signals, unless indicated otherwise in Contract Drawings, provide the following:
   a. 4-20 mA output signals for each process measurement (for up to 500 Ohm loads).
   b. Two programmable SPDT relay outputs, rated at 5A up to 230 VAC, for each process measurement.
2. Where shown on the Contract Drawings, provide the following digital communications to the plant SCADA system:
   a. HART Protocol
   b. PROFIBUS
   c. MODBUS
3. Magnetic flow meters shall be provided with an EtherNet/IP digital communication port.

C. Each analyzer/transmitter shall be powered by 115VAC (+/- 10%) at 60 Hz unless shown on Contract Drawings as being powered by 24 VDC (+/- 15%). Each analyzer/transmitter shall retain its programmable settings in non-volatile memory. Battery powered instruments, analyzer, or transmitters will not be accepted.

D. Each sensor and corresponding analyzer/transmitter shall be supplied as a complete and operable system. This includes all cabling, mounting hardware and fasteners. When installed outdoors, the analyzer/transmitter shall be protected from the sun such that direct sunlight will not shine on the display.

E. All analyzers/transmitters shall be waterproof and made from corrosion resistant materials.

F. All sensors to be immersed in liquids shall be rated for permanent submersion and shall be corrosion resistant.

2.2 MAGNETIC FLOW METERS

A. Magnetic flow meters shall be the low the low frequency induction type which produces a

DC pulsed signal directly proportional to and linear with the flow rate. Liners shall be polyurethane. Flow meters shall be rated at 250 psi. Standard output shall be an EtherNet/IP with a local indication from a liquid crystal display (LCD) reading in gallons per minute flow. The meter shall also have a totalizer (with pulsed output), and non-full pipe detection. Meters shall have a minimum of 2 self-cleaning electrodes. CONTRACTOR shall field verify length of cable for connection.

B. Flanged connections shall be constructed of carbon steel with pressure ratings to match the connecting pipe.

C. Liner shall be polyurethane or PTFE and electrodes stainless steel suitable for irrigation water service. Liners and electrodes for service other than potable water shall be constructed of materials conforming to the manufacturer's recommendation for the intended service.

D. Meter housing shall be rated for NEMA 6 for submersible operation.

E. Meters shall include grounding rings.

F. The transmitter shall have six digit LCD displays for flow rate, percent of span, and totalization; be capable of measuring flow in both directions; automatic range change; capability to convert DC pulse signal from the tube to a standardized 4 to 20 mA DC signal into a minimum of 700 ohms; self-diagnostics and automatic data checking, and a scaleable frequency output, 0 to 100 Hz.

G. The flow measuring system shall conform to the following:

1. Time constant: 0.5 to 1000 seconds; galvanic or optic isolation
2. Accuracy: 0.50 percent of flow rate from 10 to 100 percent full scale velocities over 3 feet per second.
3. Repeatability: 0.25 percent of full scale
4. Power consumption: 30 watts or less
5. Power requirements: 120 VAC, plus or minus 10 percent, unless indicated otherwise on the Contract Drawings. Battery powered flow meters will not be accepted.

H. Magnetic flow meters shall be **Proline Promag W400 by Endress+Hauser, 8700 Series by Rosemount, Siemens 5100W,** or approved equal.

2.3 PRESSURE TRANSMITTER

A. The pressure transmitter shall be an electronic pressure transducer tailored to the installation as shown on the Contract Drawings and suitable for the planned application. The system shall include a pressure transducer with integral diaphragm seal. The pressure transmitter shall operate on 24 VDC, and shall provide a 4-20 mA DC signal to the RTU panel. The loop signal shall measure the water pressure and have a 4-20 mA signal output. The pressure transmitter shall have a LCD display showing the pressure in "psi". The pressure transmitter shall be coded "DW" for NSF drinking water certification. Pressure transmitters shall be **Rosemount Series 3051**, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. All equipment shall be mounted and installed as per manufacturer recommendations. Coordinate final location with ENGINEER.

3.2 FLOW METER FIELD QUALITY CONTROL

A. Each instrument shall be tested before commissioning and ENGINEER shall witness the interface capability in the PLC control system and associated registers.

1. Each instrument shall provide direct programming capability through the PLC
2. Each instrument shall provide direct control of totalizer reset functions through the PLC
3. Each instrument shall be supported with a device profile permitting direct integration in the PLC

B. ENGINEER shall witness all instrument verifications in the field.

C. Manufacturers Field Services shall be provided for start-up and commissioning by a Factory field service representative or a manufacturer's authorized service provider (ASP).

1. Manufacturer representative shall verify installation of all installed flow tubes and transmitters.
2. Manufacturer representative shall notify ENGINEER in writing of any problems or discrepancies and proposed solutions.
3. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested.
4. Manufacturer representative shall generate a configuration report for each meter.

3.3 TESTING

A. After installation of the equipment is complete, operating tests shall be carried out to assure that the equipment operates properly. All piping shall be tested hydrostatically and for leaks. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

- END OF SECTION -