Montezuma Valley Irrigation Co.

Groundhog Dam – Intake Structure Modification

CONTRACT DOCUMENTS AND CONSTRUCTION SPECIFICATIONS

DAM ID: 710107

SEO Filling #: C-0328B

Water Division 7, District 71, Dolores County Colorado

Prepared for: Montezuma Valley Irrigation Co.

Prepared by: Applegate Group, Inc

August 2021

BIDDING MANUAL

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SECTION C-111 ADVERTISEMENT FOR BIDS

Montezuma Valley Irrigation Co. Cortez, Colorado

General Notice

The Montezuma Valley Irrigation Co. (Owner) is requesting Bids for the construction of the following Project:

Groundhog Reservoir Outlet Modification Project

Bids for the construction of the project shall be submitted via electronic means to BOTH <u>bjohnson@mvic.info</u> AND <u>tylerd@applegategroup.com</u>, by Friday February 25, 2022 5:00 PM local time. Bids received will be privately opened and read. The owner plans to award the project by March 10, 2022. The Project includes the following Work:

Partial demolition of existing concrete intake structure and existing gates. Construction of a new cast in place concrete structure (approx. 175 CY), installation of 3 hydraulically operated slide gates (owner supplied), construction of concrete grade beam (30 CY), trash rack material and install, installation of hydraulic pressure unit for gate control (owner supplied), and construction of foundation 10 micropiles. The reservoir will be drained for this work, contractor is responsible for dewatering of the project site and reservoir below the outlet.

The Project has an expected duration of **60** days and should be substantially complete by November 1, 2022.

Obtaining the Bidding Documents

To obtain bidding documents email a request to <u>tylerd@applegategroup.com</u> and you will be sent a link to the designated site. 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. 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 mandatory pre-bid conference for the Project will be held on Thursday February 3rd at 1:00 PM at the MVIC office located at 24055 Road L.4, Cortez, CO 81321. Bids will not be accepted from Bidders that do not attend the mandatory pre-bid conference. Subcontractors are not required to attend. **Bidders wishing to tour the site should do so on their own time ASAP. It is likely that access will be prohibited at some point soon due to snow.** Attendance at the meeting may also be made available via web conferencing if necessary. Interested bidders will be notified via email prior to the meeting if this option will be made available.

Instructions to Bidders.

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

SECTION C-200 INSTRUCTIONS TO BIDDERS

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ARTICLE 1—DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the Agreement. 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. 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 Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader Version 2019.012.20035 or later. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the 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 2.04.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 Bidder is to submit the following information with its Bid to demonstrate Bidder's qualifications to perform the Work:
 - A. Written evidence establishing its qualifications such, previous experience on projects similar in size and nature, and present commitments.
 - B. A written statement that Bidder is authorized to do business in the state where the Project is located.
 - C. Bidder's state or other contractor license number, if applicable.
 - D. List of Subcontractors and Suppliers and associated qualification information.
 - E. Three references for previous experience with a contact name and current phone number.
- 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 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. Proposals will not be accepted from Bidders who do not attend the conference. It is each Bidder's responsibility to sign in at the pre-bid conference to verify its participation. Bidders must sign in using the name of the organization that will be submitting a Bid. A list of qualified Bidders that attended the pre-bid conference and are eligible to submit a Bid for this Project will be issued in an Addendum.
- 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. Underground Facilities: Underground Facilities are shown or indicated on the Drawings

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. Geotechnical Engineering Study – Groundhog Reservoir Intake Gated Bulkhead Structure.

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

- B. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Siterelated 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 the Contract Documents.

5.04 Site Visit and Testing by Bidders

- A. All access to the Site must be coordinated through the following Owner or Engineer contact for visiting the Site: **bjohnson@mvic.info**. Bidder must conduct the required Site visit during normal working hours.
- B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.
- C. On request, and to the extent Owner has control over the Site, and schedule permitting, the 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.
- D. 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.
- E. 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.

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 Express Representations and Certifications in Bid Form, Agreement

- The Bid Form that each Bidder will submit contains express representations regarding the Α. 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.**
- Bidder shall submit all questions about the meaning or intent of the Bidding Documents to 7.02 Engineer in writing. Contact information and submittal procedures for such questions are as follows:
 - Α. Submit questions via electronic means to:
 - stevenmorris@applegategroup.com and 1.
 - 2. tylerd@applegategroup.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 two 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 five 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 company that is duly licensed or authorized to issue bonds in the required amounts in the jurisdiction in which the Project is located. 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 the 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 A Bidder must be prepared to retain specific Subcontractors and Suppliers for the performance of the Work if required to do so by the Bidding Documents or in the Specifications. If a prospective Bidder objects to retaining any such Subcontractor or Supplier and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.
- 11.02 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the Work within five days after Bid opening.
- 11.03 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.

11.04 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 Article 7.04 of the Agreement.

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 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. The 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.
- 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. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 Unit Price

- A. Bidders must submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.
- B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity", which Owner or its representative has set forth in the Bid Form, for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Article 5 of the Agreement.
- C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

ARTICLE 14—SUBMITTAL OF BID

- 14.01 The Bidding Documents include the Bid Form, and, if required, the Bid Bond Form. 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 in the Advertisement or invitation to bid. **The Bid must be submitted via electronic means** to the email(s) indicated in the Advertisement and must be accompanied by the Bid security and other required documents.
- 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 A 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.
- 15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.
- 15.03 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 privately.

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.
 - B. For the determination of the apparent low responsible Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.

- 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 Agreement 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 Agreement.

SECTION C-410 BID FORM

The terms used in this Bid with initial capital letters have the meanings stated in the Agreement.

ARTICLE 1—OWNER AND BIDDER

- 1.01 This Bid is submitted to: Montezuma Valley Irrigation Company
- 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. Required Bid security;
 - B. List of Proposed Subcontractors;
 - C. List of Proposed Suppliers;
 - D. Evidence of authority to do business in the state of the Project;
 - E. Contractor's license number as evidence of Bidder's State Contractor's License;
 - F. Required Bidder Qualification Statement with supporting data as required in Article 3 of the Instructions to Bidders.

ARTICLE 3—BASIS OF BID—UNIT PRICES

- 3.01 Unit Price Bids
 - A. Bidder will perform the following Work at the indicated unit prices:

Item No.	Description	Units	Quantity	Unit Cost	Total Cost
1	General				
1.01	Mobilization	LS	1		
1.02	Dewatering	Day	60		
1.03	Demolition	LS	1		
2	Conrete				
2.01	Capsule Concrete Foundation	CY	80		
2.02	Capsule Concrete Walls	CY	72		
2.03	Capsule Concrete - void fill	CY	10		
2.04	Trash Rack Extension Concrete	CY	12		
2.05	Grade Beam Concrete (210 ft, 30"x18")	LF	220		
3	Hydraulic Appurtenances				
3.03	Hydraulic Control Unit installation	EA	1		
3.04	Trash Rack	EA	3		
3.06	Gate Installation including hydraulic lines	LS	3		
4 Geotechnical					
4.01	Micropile	EA	10		
Construction Total					

- B. Bidder acknowledges that:
 - 1. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and
 - 2. estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.
- 3.02 Total Bid Price (Lump Sum and Unit Prices)

Total Bid Price (Total of all Lump Sum and Unit Price Bids)	\$	
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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 4.01 of the Agreement on or before the dates or within the number of calendar 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 30 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 Contract Documents.
 - 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 Contract Documents.
 - 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; and the Bidding Documents or by definition, with respect to the effect of such information, observations, and documents 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 8.02.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:	(tuned or printed)
Title	(typed of printed)
Thee.	(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:	(tuned or printed)
Title	(typed of printed)
indic.	(typed or printed)
Date:	
	(typed or printed)
Address f	or giving notices:
Bidder's (Contact:
Name:	
	(typed or printed)
Title:	
	(typed or printed)
Phone:	
Email:	
Address:	
Bidder's (Contractor License No.: (if applicable)

CONTRACT FOR CONSTRUCTION

This Contract is by and between	Montezuma Valley Irrigation Company	(Owner) and

(Contractor).

Owner and Contractor hereby agree as follows:

ARTICLE 1 - THE WORK

1.01 Work

A. Work includes all labor, materials, equipment, services, and documentation necessary to construct the Project defined herein, including, without limitation, any additional work pursuant to Article 10, below, and any testing, start-up, and commissioning necessary or appropriate to the proper functioning of the Project as designed.

B. The Contractor shall complete all Work as specified or indicated in the Contract Documents defined below. The "Project" is generally described as follows:

1. Groundhog Reservoir – Outlet Modification which includes partial demolition of the existing concrete intake structure and existing gates, construction of a new cast in place concrete structure (approx. 175 CY), installation of 3 slide gates (owner supplied), construction of concrete grade beam (30 CY), trash rack material and install, installation of hydraulic pressure unit for gate control (owner supplied), and construction of foundation micropiles. The reservoir will be drained for this work. Additional dewatering of the reservoir below the outlet will be the responsibility of the Contractor.

2. The Groundhog Reservoir outlet structures are located on the southeast side of Groundhog Reservoir where Groundhog Creek continues southward from the reservoir dam just south of the Groundhog Lake RV Park and Campground west and south of Telluride, Colorado and north and east of Cortez, Colorado at approximately 8,724 feet of elevation in Dolores County (the "Site")including property, easements, and designated work areas described in greater detail in the Contract Documents.

ARTICLE 2 - CONTRACT DOCUMENTS

2.01 Intent of Contract Documents

A. It is the intent of the Contract Documents to describe a functionally complete project. The Contract Documents do not indicate or describe all of the Work required to complete the Project. Additional details required for the good and workmanlike completion of the Project and/or the correct installation of selected materials are to be provided by the Contractor and coordinated with the Owner and Engineer. This Contract supersedes prior negotiations, representations, and agreements, whether written or oral. The Contract Documents are complementary; what is required by one part of the Contract Documents is as binding as if required by other parts of the Contract Documents.

B. During the performance of the Work and until final payment, Contractor and Owner shall submit all matters in question concerning the requirements of the Contract Documents, or relating to the acceptability of the Work under the Contract Documents to the Engineer. Engineer

will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.

C. Engineer will render a written clarification, interpretation, or decision on the issue submitted, or initiate a modification to the Contract Documents in Engineer's discretion exercised pursuant to Engineer's best professional judgment.

D. Contractor, and its subcontractors and suppliers, shall not have or acquire any title to or ownership rights to any of the Drawings, Specifications, or other documents (including copies or electronic media editions) prepared by Engineer or its consultants.

2.02 Contract Documents Defined

- A. The Contract Documents consist of the following documents:
 - 1. This Contract.
 - 2. Specifications listed in the Table of Contents, attached hereto.
 - 3. Drawings as listed on the Drawing Sheet Index, attached hereto.

4. Any modifications to the Specifications, Drawings or other Contract Documents (the "Addenda").

5. The following which may be delivered or issued on or after the Effective Date of the Contract:

- a. Work Change Directives (EJCDC C-940).
- b. Change Orders (EJCDC C-941).

ARTICLE 3 - ENGINEER

3.01 Engineer

A. The Engineer for this **Project is Applegate Group Inc.**

ARTICLE 4 - CONTRACT TIMES

4.01 Contract Times

A. The Work must be substantially completed on or before **November 15, 2021** and completed and ready for final payment on or before **December 1, 2021**, together the "Contract Times".

4.02 Liquidated Damages

A. As a result of the remote, high altitude location of the Site, and its intended use to store water largely generated by snow melt, Contractor and Owner recognize that time is of the essence in the performance of the Contract, and that Owner will incur damages if Contractor does not complete the Work according to the requirements of Paragraph 4.01 or if it should be necessary for any reason to stop the Work before it is complete due to the onset of winter weather conditions at the Site. Because such damages for delay would be difficult and costly to determine, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty) Contractor shall pay Owner the amounts specified in the table below for each day that expires after the Contract Time for substantial completion.

November 16, 2021 through	December 2, 2021 through
December 1, 2021	Substantial Completion
\$1,000 per day	\$2,000 per day

4.03 Delays in Contractor's Progress

A. No extension of time to complete performance of the Work will be given in the absence of significant, presently unforeseen adverse conditions including i) severe weather or climatic conditions that could not reasonably have been anticipated on the date of this contract, ii) major labor disputes, iii) acts of God, iv) the intervention of any governmental or quasi-governmental agency, to the extent not caused by Contractor, and iv) acts by the Owner, Engineer or anyone for whose actions Owner or Engineer are legally responsible that directly cause or necessitate a delay in the Work.

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 or their subcontractors or suppliers, including, without limitation, Contractor's failure to make proper allowance for material lead times and delivery or shipping times.

C. Contractor shall not be entitled to an adjustment Contract Times for any delay, disruption, or interference for which extension might otherwise be available under §4.03.A if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor or Contractor's subcontractors or suppliers or for which Contract would not be entitled to an adjustment in Contract Times hereunder.

4.04 Progress Schedules

A. Contractor shall develop a progress schedule and submit to the Engineer for review and comment before starting Work on the Site. The Contractor shall modify the schedule in accordance with the comments provided by the Engineer.

B. The Contractor shall update and submit the progress schedule to the Engineer each month, and more frequently upon request. The Owner may withhold payment if the Contractor fails to submit the schedule or fails to perform in accordance with the schedule once submitted.

ARTICLE 5 - CONTRACT PRICE

5.01 Payment

A. Subject to the provisions of Article 14, Owner shall pay Contractor in accordance with the Contract Documents at the following unit prices for each unit of Work completed, the "Contract Price"):

ltem No.	Description	Unit	Estimated Quantity	Unit Price	Extended Price

ltem No.	Description	Unit	Estimated Quantity	Unit Price	Extended Price
Total of all extended prices for Estimated Quantities of Work					\$

Payment will be made in an amount equal to the total of all extended prices for actual Work completed. The extended price is determined by multiplying the unit price times the actual quantity of that Work item completed. Actual quantities installed will be determined by the Engineer.

ARTICLE 6 - BONDS AND INSURANCE

6.01 Insurance

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A. Before starting Work, Contractor shall furnish evidence of insurance from companies that are duly licensed or authorized in the jurisdiction in which the Project is located with a minimum AM Best rating of A-VII or better. Contractor shall provide insurance in accordance with the following:

1. Contractor shall provide coverage for not less than the following amounts, or greater where required by Laws and Regulations:

Workers' Compensation:

u.	Workers compensation.	
	State:	Statutory
b.	Commercial General Liability:	
	General Aggregate	\$ 2,000,000
	Products - Completed Operations Aggregate	\$ 2,000,000
	Personal and Advertising Injury	\$ 1,000,000
	Each Occurrence (Bodily Injury and Property	
	Damage)	\$ 1,000,000
c.	Automobile Liability herein:	
	Combined Single Limit of:	\$ 1,000,000

B. All insurance policies required to be purchased and maintained will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the insured and additional insured.

C. Automobile liability insurance provided by Contractor shall provide coverage against claims 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 shall be written on an occurrence basis.

D. Contractor's commercial general liability policy shall be written on a 1996 or later ISO commercial general liability occurrence form and include the following coverages and endorsements:

1. Products and completed operations coverage maintained for three years after final payment;

- 2. Blanket contractual liability coverage;
- 3. Broad form property damage coverage;
- 4. Severability of interest;

5. Subsidence/earth movement, subcontractor liability, underground, explosion, and collapse coverages; and

6. Personal injury coverage.

E. The Contractor's commercial general liability and automobile liability, umbrella or excess, and pollution liability policies shall include and list Owner and Engineer and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each as additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis.

1. Additional insured endorsements will 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.

2. Contractor shall provide ISO Endorsement CG 20 32 07 04, "Additional Insured— Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent for design professional additional insureds.

F. Umbrella or excess liability insurance shall be written over the underlying employer's liability, commercial general liability, and automobile liability insurance. Subject to industry-standard exclusions, the coverage afforded shall be procured on a "follow the form" basis as to each of the underlying policies. Contractor may demonstrate to Owner that Contractor has met the combined limits of insurance (underlying policy plus applicable umbrella) specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policies and an umbrella or excess liability policy.

G. The Contractor shall provide property insurance covering physical loss or damage during construction to structures, materials, fixtures, and equipment, including those materials, fixtures, or equipment in storage or transit.

H. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 15.

6.02 Payment, Performance and Warranty Bonds

A. Prior to the commencement the Work, Contractor shall provide Owner a general performance, payment and warranty bond(s) executed by Contractor and an acceptable corporate surety, or supported by adequate alternative collateral acceptable to the Owner in its

discretion, in the full amount of the Contract Price, including provisions for the adjustment thereof in accordance with the terms of this contract (the "Bonds"). The Bonds shall expressly guarantee i) faithful, full and timely performance of this contract and completion of the Project in compliance with the Contract Documents, ii) repair and replacement, if required, or payment of the costs of all defective equipment, materials and Work incorporated in or performed on the Project for the full duration of the contract and the warranty period provided, and iii) payment to all persons performing labor and furnishing materials, supplies, tools and equipment in connection with the Project.

ARTICLE 7 - CONTRACTOR'S RESPONSIBILITIES

7.01 Supervision and Superintendence

A. Contractor shall supervise and direct the Work competently and efficiently, in a good and workmanlike manner and in full compliance with the Contract Documents, devoting such attention thereto and applying such skills and expertise as may be necessary. Contractor shall be solely responsible for the means, methods, techniques, sequences, safety, and procedures of construction.

B. Contractor shall assign a competent resident superintendent who is to be present at all times during the execution of the Work. This resident superintendent shall not be replaced without written notice to and approval by the Owner and Engineer except under extraordinary circumstances.

C. Contractor shall at all times maintain good discipline and order at the Site.

D. 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 shall be performed during regular working hours, Monday through Friday only.

7.02 Other Work at the Site

A. In addition to and apart from the Work of the Contractor, other work may occur at or adjacent to the Site. 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.

7.03 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 shall be new, of good quality and shall 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.

7.04 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.

7.05 Quality Management

A. Contractor is fully responsible for managing quality to ensure Work is completed in accordance with the Contract Documents and in a good and workmanlike manner, free from defects.

7.06 Licenses, Fees and Permits

A. Contractor shall pay all license fees and royalties and assume all costs incident to performing 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.

B. Contractor shall obtain and pay for all construction permits and licenses unless otherwise provided in the Contract Documents.

7.07 Laws and Regulations; Taxes

A. Contractor shall give all notices required by and shall comply with all local, state, and federal laws and regulations applicable to the performance of the Work (the "Laws and Regulations"). Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. 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, insurers and subcontractors of each and any of them from and against all claims, costs, losses, and damages if Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations.

C. Contractor shall pay all applicable sales, consumer, use, and other similar taxes Contractor is required to pay in accordance with the Laws and Regulations.

7.08 Record Documents

A. Contractor shall maintain one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved shop drawings in a safe place at the Site (the "Record Documents"). Contractor shall annotate the Record Documents to show changes made during construction. Contractor shall deliver the Record Documents to Engineer upon completion of the Work and shall make the Record Documents reasonably available to Owner and Engineer upon request during the prosecution of the Work.

7.09 Safety and Protection

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work.

B. 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 as a part of the Work.

C. All damage, injury, or loss to any property caused, directly or indirectly, in whole or in part, by Contractor, or anyone for whose acts the Contractor may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to a fault or defect in the Contract Documents or to the acts or omissions of Owner or Engineer and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor).

D. Contractor shall be responsible for coordinating any exchange of 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.

E. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor shall act to prevent threatened 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 thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.10 Shop Drawings, Samples, and Other Submittals

A. Contractor shall review and coordinate timely submittal of shop drawing and samples with the requirements of the Work and the Contract Documents and shall verify all related field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information.

B. Each submittal shall 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, that Contractor approves the submittal and the Contractor believes in good faith based on its best judgment that the submittal conforms to the requirements of the Contract Documents.

C. With each submittal, Contractor shall give Engineer specific written notice, in a communication separate from the submittal, of any variations that the shop drawings or samples may have from the requirements of the Contract Documents.

D. 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.

7.11 Warranties and Guarantees

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Owner and Engineer and their respective officers,

directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.

7.12 Correction Period

A. If within one year after the date of substantial completion, any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly and without cost to Owner, correct such defective Work to the satisfaction of Owner and Engineer.

7.13 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, insurers 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 performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury 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 they may be liable.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 Owner's Responsibilities

A. Owner shall generally issue communications to Contractor through Engineer; provided however, that if Owner chooses to communicate with Contractor directly, Owner shall assure that Engineer is copied or otherwise included.

B. Owner shall make payments to Contractor as provided in this Contract.

C. Owner shall provide access to the Site and any easements or other rights of access as may reasonably be required to construct the Project.

D. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, unless stated elsewhere in the Contract Documents, Owner shall have sole authority and responsibility for such coordination.

E. 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, 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.

F. 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.

G. Owner shall furnish copies of any applicable Owner safety programs, if any, to Contractor.

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 Engineer's Status

A. Engineer will be Owner's representative during construction. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in this Contract.

B. Neither Engineer's authority or responsibility under this Article 9 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, shall 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.

C. Engineer will make visits to the Site at intervals appropriate to the various stages of construction.

D. Engineer has the authority to reject Work if Contractor fails to perform Work in accordance with the Contract Documents.

E. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work on Owner's behalf.

F. 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, 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.

ARTICLE 10 - CHANGES IN THE WORK

10.01 Authority to Change the Work

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order changes in the Work consisting of additions, deletions or other revisions or any size, nature or extent, and in an unlimited amount subsequent to the execution of this contract, the Contract Price and the Contract Times being adjusted under this Article.

10.02 Change Orders

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in the 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 the Work which are: (a) ordered by Owner or (b) agreed to by the parties or (c) resulting from the Engineer's decision, 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

3. Changes in the Contract Price or Contract Times or other changes which embody the substance of any final binding results under Article 12.

B. 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.

10.03 Work Change Directives

A. In the event changes or modifications in the Work are ordered but he parties are unable to agree on a Change Order under Section 10.02, above, Contractor, prior to the commencement of such changed or revised Work, shall submit promptly to Owner and Engineer a written claim for adjustment to the Contract Price and/or Contract Times for such changed or revised Work in a manner consistent with requirements of the Contract Documents. Such a claim shall state the requested adjustment sought by Contractor and the basis of the request.

B. Upon receipt of a claim from the Contractor under sub-section A, Owner and Engineer shall determine, in their absolute discretion, what adjustment, if any, should be made to the Contract Price and Contract Times or other terms and conditions of this contract, and notify Contractor of the determination. Such notice shall be termed a "Work Change Directive". Following the issuance of a Work Change Directive, Contractor must immediately comply with the requested change and move forward with the Work, as changed or revised. If Contractor wishes to preserve any right to claim additional or different adjustments than those approved by the Work Change Directive or to make any other or further claim for compensation relating to a change or revision in the Work, Contractor must, within three (3) days of receiving the Work Change Directive, notify Owner and Engineer in writing that the Work being performed is performed under protest.

C. While performing work under protest, Contractor shall provide Owner and Engineer with daily reports signed by Contractor's designated representative on the Site, showing:

1. The name and number, if any, of each worker employed in performing the work under protest, and the number of hours each was employed for that purpose together with a description of the nature of the work performed by each; and

2. the nature, price, and quantity of all materials, tools, machinery, equipment, supplies, goods and personal property of every description and all other services or facilities every kind related to the performance of the work under protest, including actual invoices or other records reflecting actual amounts charged to Contractor.

D. In the event that the parties have not resolved by mutual agreement the issue of what adjustments to the Contract Price, Contract Times, or other terms or conditions of this contract should be made in connection with any change or revision in the Work after the Work, as changed or revised, has been completed under protest, the parties will proceed to resolve their disputes under Article 12.

E. If, after receiving notice of a change or modification, or a Work Change Directive, Contractor commences any addition, deletion, or other modification to the Work, or continues with the Work, without making a timely claim for adjustment or without complying with the requirements of this contract for performance of work under protest, Contractor shall be deemed bound to perform the Work, as modified by the change, and without any adjustment in the Contract Price, Contract Times, or any other term or condition of this contract.

ARTICLE 11 - DIFFERING SUBSURFACE OR PHYSICAL CONDITIONS

11.01 Differing Conditions Process

A. If Contractor believes that any subsurface or physical condition of the Site including but not limited to utilities or other underground facilities that are uncovered or revealed at the Site either differs materially from that shown or indicated in the Contract Documents or 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 in the immediate area of the Project 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), 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. After receipt of written notice, Engineer will promptly:
 - 1. Review the subsurface or physical condition in question;

2. Determine necessity for Owner obtaining additional exploration or tests with respect to the condition;

- 3. Determine whether the condition falls within the differing site condition as stated herein;
- 4. Obtain any pertinent cost or schedule information from Contractor;

5. 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

6. Advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor 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.

ARTICLE 12 - CLAIMS AND DISPUTE RESOLUTION

12.01 Claims Process

A. The party submitting a claim shall deliver it directly to the other party to the Contract and the Engineer promptly (but in no event later than 10 days) after the start of the event giving rise thereto.

B. The party receiving a claim shall review it thoroughly, giving full consideration in good faith to its merits. The parties shall seek to resolve the claim through the exchange of information and direct negotiations. All actions taken on a claim shall be stated in writing and submitted to the other party.

C. 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 45 days, the claim is deemed denied.

D. All disputes and controversies that are not resolved to the satisfaction of the parties, arising out of or in connection with this contract or the breach thereof, including without limitation any dispute regarding the existence, construction, validity, interpretation or meaning, performance, nonperformance, enforcement, operation, continuance or termination of this contract, shall be resolved by binding arbitration under this provision

E. Any arbitration under this provision shall be conducted under the American Arbitration Association ("AAA") Construction Rules and Mediation Procedures as they then exist, regardless of the amount in controversy. The arbitration shall be conducted exclusively in Cortez, Colorado, and the arbitrator shall exclusively apply the law of the State of Colorado when making any decision or determination. Despite whatever may be provided by the applicable rules and procedures of the AAA, there shall be no discovery in any arbitration proceeding under this provision other than the exchange between the parties of information which will be provided to the arbitrator(s) by the parties.

F. The arbitrator(s) shall have authority only to award compensatory damages and shall not have authority to award punitive damages or other non-compensatory damages. The prevailing party in any arbitration shall be entitled to recover their reasonable costs and attorneys' fees associated with the arbitration proceedings; provided, however, that the costs of the arbitrator(s) shall be shared equally among the parties regardless of which party may prevail. The decision and award of the arbitrator(s) shall be final and binding, and a judgment on the award rendered by the arbitrator(s) may be entered in any court or competent jurisdiction.

G. All parties shall proceed in good faith to commence and conclude any arbitration proceedings under this provision within one hundred eighty (180) days after any dispute or controversy subject to arbitration under this provision first arises, and the arbitrator(s) shall be empowered to impose any appropriate sanctions for any party's failure to do so.

H. If any party files a judicial or administrative action asserting claims subject to arbitration under this provision, and another party successfully stays such action or compels arbitration, the party filing said action shall pay the other party's costs and expenses incurred in seeking such stay or compelling arbitration, including reasonable attorneys' fees.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION OF DEFECTIVE WORK

13.01 Tests and Inspections

A. Owner and Engineer will 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.

B. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections and tests organized by Contractor, and shall cooperate Engineer to schedule and facilitate required inspections and tests.

C. If any Work 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, inspection and/or testing. Such uncovering shall be at Contractor's expense.

13.02 Defective Work

A. Contractor shall ensure that the Work is not defective and fully complies with the Contract Documents.

B. Engineer has the authority to determine whether Work is defective, whether it complies with the Contract Documents, and to reject defective or non-compliant Work.

C. Prompt notice of all defective or non-compliant Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. The Contractor shall promptly correct all such defective or non-compliant Work.

E. When correcting defective or non-compliant Work, Contractor shall take no action that would void or otherwise impair any warranty or guarantee, if any, on said Work.

F. 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.

ARTICLE 14 - PAYMENTS TO CONTRACTOR

14.01 Progress Payments

A. The Contractor shall prepare a schedule of values based on unit prices, Construction Specifications Institute ("CSI") MasterFormat division codes, or another basis acceptable to Owner and Engineer, that will serve as the basis for progress payments. The schedule of values will be in a form of application for payment acceptable to Engineer. Any unit price breakdown submitted with the bid will be used for unit price work and lump sum items will be measured by estimated percentage of completion.

14.02 Applications for Payments:

A. Contractor shall submit an application for payment in a form acceptable to the Engineer, no more frequently than monthly, to Engineer. Applications for payment will be prepared and signed by Contractor. Contractor shall provide supporting documentation required by the Contract Documents. Payment will be paid for Work completed as of the date of the application for payment.

B. Beginning with the second application for payment, each application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior applications for payment and those of any subcontractors and material suppliers.

14.03 Retainage

A. The Owner shall retain 10% of each progress payment (the "Retainage"). The Retainage shall be held by the Owner until the Project is completed and finally accepted by the Owner and Engineer in accordance with the provisions of this contract.

14.04 Review of Applications

A. Within 10 days after receipt of each application for payment, the Engineer will either indicate in writing a recommendation for payment and present the application for payment to Owner or return the application for payment to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. The Contractor will make the necessary corrections and resubmit the application for payment.

B. Engineer will recommend reductions in payment (set-offs) which, in the opinion of the Engineer, are necessary to protect Owner from loss because the Work is defective and/or requires correction or replacement.

C. The Owner is entitled to impose set-offs against payment based on any claims that have been made against Owner on account of Contractor's conduct in the performance of the Work, incurred costs, losses, or damages on account of Contractor's conduct in the performance of the Work, or liquidated damages that have accrued as a result of Contractor's failure to complete the Work.

14.05 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 seven days after the time of payment by Owner.

14.06 Substantial Completion

A. The Contractor shall notify Owner and Engineer in writing that the Work is substantially complete and request the Engineer issue a certificate of substantial completion when Contractor considers the Work ready for its intended use. 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. Engineer will make an inspection of the Work with the Owner and Contractor to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor and Owner in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete or upon resolution of all reasons for non-issuance of a certificate identified in 14.06.B, Engineer will deliver to Owner a certificate of substantial completion which shall fix the date of substantial completion and include a punch list of items to be completed or corrected before final payment.

14.07 Final Inspection

A. Upon written notice from Contractor that the entire Work 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.

14.08 Final Payment

A. Contractor may make application for final payment after Contractor has satisfactorily completed all Work defined in the Contract, including providing all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents and other documents and having completed any punch list items identified during final inspections.

- B. The final application for payment shall be accompanied (except as previously delivered) by:
 - 1. All documentation called for in the Contract Documents;
 - 2. Consent of the surety under the Bonds to final payment;

3. 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;

4. A list of all disputes that Contractor believes are unsettled; and

5. 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.

C. 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.

14.09 Waiver of Claims

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor.

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.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 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 60 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, or both, directly attributable to any such suspension.

15.02 Owner May Terminate for Cause

A. Contractor's failure to perform the Work in accordance with the Contract Documents or other failure to comply with a material term of the Contract Documents will constitute a default by Contractor and justify termination for cause.

B. If Contractor defaults in its obligations, then after giving Contractor and any surety under any Bond ten 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 notice that the Contract is terminated; and

2. Enforce the rights available to Owner under any applicable Bond.

C. Owner may not proceed with termination of the Contract under Paragraph 15.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

D. Subject to the terms and operation of any applicable 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.

E. In the case of a termination for cause, if the cost to complete the Work, including related claims, costs, losses, and damages, exceeds the unpaid contract balance, Contractor shall pay the difference to Owner.

15.03 Owner May Terminate for Convenience

A. Upon seven days written notice to Contractor, 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 on account of loss of anticipated overhead, profits, or revenue, or other indirect or consequential economic loss arising out of or resulting from such termination.

15.04 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) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner, and provided Owner does not remedy such suspension or failure within that time, either stop the Work until payment is received, or terminate the Contract and recover payment from the Owner.

ARTICLE 16 - CONTRACTOR'S REPRESENTATIONS

16.01 Contractor Representations

A. Contractor makes the following representations when entering into this Contract:

1. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.

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

3. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

4. 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 Site-related

reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents 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.

5. 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.

6. 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.

7. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

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

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

ARTICLE 17 - MISCELLANEOUS

17.01 Cumulative Remedies

A. The duties and obligations imposed by this Contract 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.

17.02 Limitation of Damages

A. Neither Owner, 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.

17.03 No Waiver

A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.
17.04 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 or completion of the Contract or termination of the services of Contractor.

17.05 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.

17.06 Controlling Law

A. This Contract is to be governed by the law of the state in which the Project is located.

IN WITNESS WHEREOF, Owner and Contracto	r have signed this Contract.		
This Contract will be effective on	(which is the Effective Date of the Contract).		
OWNER:	CONTRACTOR:		
By:	Ву:		
Title:	Title:		
	(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)		
Attest:	Attest:		
Title:	Title:		
Address for giving notices:	Address for giving notices:		
	License No.:		
	(where applicable)		
(If Owner is a corporation attach evidence of auth	pority		

(If Owner is a corporation, attach evidence of authority to sign. If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Contract.) **SECTION 01 00 01**

PROJECT TITLE PAGE

GROUNDHOG DAM INTAKE STRUCTURE MODIFICATION

CONSTRUCTION SPECIFICATIONS

Groundhog Dam ID: 710107 SEO Construction File: C-0328B

Water Division 7, Water District 71, Dolores County

PREPARED FOR:

Montezuma Valley Irrigation Co. PO Box 1056 Cortez, CO 81321

PREPARED BY:

APPLEGATE GROUP, INC 1490 W 121st Ave., Ste. 100, Denver, CO 80234 PHONE: (303) 452-6611; FAX: (303) 452-2759

I hereby certify that these specifications for the Groundhog Dam Outlet Modification Project were prepared by me or under my direct supervision for the Montezuma Valley Irrigation Co. Approved on the _____ day of

_____, 2021

State Engineer

Craig M. Ullmann, Colo. PE No. 38551

Ву: ____

William T. McCormick III, CO PE 29127 Chief – Dam Safety Branch

SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Work covered by Contract Documents.
 - 2. Access to Site.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Groundhog Dam Intake Structure Modification Project consists of partial demolition of the existing inlet portion of the dam outlet structure. Following demolition a new concrete capsule will be constructed with a single 54"x54" guard gate on the outside of the structure and two new 36"(w)x48"(h) control gates. Associated infrastructure will include a concrete grade beam, air vents, staff gage, hydraulic lines, and a new trash rack.

1.03 ACCESS TO SITE

- A. Project is generally located at Groundhog Dam and Reservoir which is approximately 34 miles Northeast of the City of Cortez in Dolores County, Colorado.
- B. Project site is not a secured site.
- C. Access is by dedicated streets and land owned by Montezuma Valley Irrigation Co.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

SECTION 01 14 13

CONTRACTOR'S USE OF PREMISES

PART 1 GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Access to Site.
 - 2. Security Measures.
 - 3. Public Safety Measures.

1.2 ACCESS TO SITE

- A. Comply with security policies of OWNER.
- B. CONTRACTOR may use lands shown in Contract Documents and identified during Preconstruction Conference for staging, storage, lay down and employee parking.
 - 1. If available lands are not adequate, acquire use of additional land by lease or licensing with area property owners with OWNER prior approval, and provide OWNER with copies of lease or license.
- C. Operations shall be confined to those permitted by local laws, ordinance, and permits, and meet the following requirements:
 - a. Do not unreasonably encumber site with materials or equipment.
 - b. Assume full responsibility for protection and safekeeping of products stored on premises.
 - c. Move any stored products which interfere with operations of the OWNER or may impact public safety.
 - d. Obtain and pay for use of additional storage or work areas needed for operations.
- D. The CONTRACTOR must maintain all of his construction activities within the OWNER's property and/or construction easements and limits of the project, or other stated areas, unless permits and/or written permission are obtained by the CONTRACTOR, from appropriate authorities or private property owners, outside of these areas. CONTRACTOR may fence all easements and immediate work areas. The temporary permits must be secured and paid for by the CONTRACTOR at no extra cost to the OWNER. Any temporary permits secured must be in writing and a copy of same provided to the ENGINEER.
- E. CONTRACTOR must implement Good Housekeeping Practices for entire duration of construction.
- 1.3 SECURITY MEASURES
 - A. CONTRACTOR'S TOOLS AND EQUIPMENT
 - 1. Provide lockable storage container for tools that will be stored on site.
 - 2. OWNER is not responsible for lost or stolen tools.
 - B. OWNER is not responsible for any damage to CONTRACTOR's tools and equipment while left unattended.

- C. APPROVED PERSONS ON SITE
 - 1. All persons on site not directly employed by CONTRACTOR, OWNER, STATE DAM SAFETY, or ENGINEER must record the following information in a visitor's log stored in the construction trailer:
 - a. Name
 - b. Date
 - c. Organization
 - d. Time at entry
 - e. Time at exit
 - 2. Persons entering site are to carry valid, current, legal identification.
 - 3. Persons driving on site are to have valid, current driver's license.
- D. All persons on site
- 1.4 PUBLIC SAFETY MEASURES
 - A. Construction Vicinity
 - 1. Cones, signs, fencing, or other highly visible warnings shall be used during construction to prevent unauthorized public access in immediate vicinity of construction work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

SECTION 01 14 50

SEO NOTIFICATION

PART 1 GENERAL

1.1 REFERENCES

- A. State of Colorado, Department of Natural Resources, Division of Water Resources, Office of the State Engineer, Dam Safety
 - 1. Rules and Regulations for Dam Safety and Dam Construction

1.2 SEO NOTIFICATION

- A. The State Engineer's office (SEO) shall be notified by the OWNER's representative for any design or Specification changes in accordance with Rule 8.2.5 of the SEO's Rules and Regulations. Written approval will be required form the SEO for any significant changes to the Plans and Specifications. Minor changes, as determined by the State Engineer, may be approved verbally by the SEO.
- B. Approved Plans and Specifications shall not be materially changed, by any party, without written approval of the State Engineer.
- C. The OWNER's representative shall give the SEO at least five days advance notice of any work requiring inspection by the SEO as identified in the pre-construction meeting in accordance with Rule 8.2.4 of the SEO's Rules and Regulations.
- D. The State Engineer has the authority to require the material used and the work of construction to be accomplished according to the Rules and Regulations set forth by the SEO and that construction shall not be considered complete until the State Engineer has accepted the same in writing.
- E. The OWNER's ENGINEER will monitor the quality of construction as specified in Rule 8 of the SEO's Rules and Regulations. The ENGINEER monitoring the construction for the OWNER is responsible for the quality of construction, compliance with the approved design and specification, preparation of the necessary documentation for the State Engineer's review and approval of all construction change orders, and preparation of the project completion documents required in Rule 8.3.1.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

SECTION 01 29 00

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Measurement and payment criteria applicable to portions of the Work performed under a unit price payment method.
 - 2. Measurement and payment criteria applicable to portions of the Work performed under a lump sum payment method.
- B. Related Sections.
 - 1. 00 41 13 BID SHEET

1.02 SUBMITTALS

- A. Administrative Submittals
 - 1. Schedule of Values: Submit 14 days after notice of award.
 - 2. Monthly Payment Application: Submit with each application for payment.
 - 3. Final Payment Application: Submit after final acceptance of the work.

1.03 DEFINITIONS

A. Neat or Design Lines: Lines to which the Work is to be built or formed.

1.04 MEASUREMENT OF QUANTITIES

- A. Measurement by Volume Measured by cubic dimension using mean length, width, and height or thickness.
 - 1. Measurement will be made from the limit of the neat lines shown on the Drawings or to the approved limits of excavation.
- B. Measurement by Area Measured by square dimensions using mean length and depth, width, or radius as applicable.
- A. Linear Measurements.
 - 1. Measured by linear dimension at the item centerline or mean chord.
 - 2. Based on a horizontal projection of the actual length except where specified as a vertical measurement.
- D. Perform surveys, field measurement and calculations to measure installed quantities for all Unit Price pay items
- E. Notify OWNER in advance and obtain OWNER approval prior to exceeding any quantities specified in the schedule of values.
- G. Measurement by the CONTRACTOR is subject to review, verification, and approval by the OWNER.
- H. Round to the nearest whole unit for pay quantities

1.05 PAYMENT FOR UNIT PRICE ITEMS

- A. Unit Price Work.
 - 1. Estimated quantities shown on the Bid Sheet are approximate and are given only for a comparison of bids. OWNER does not either expressly or by implication warrant that the actual quantities will correspond to the estimated quantities. OWNER reserves the right to increase or decrease the amount of work.

01 29 00 - 1

- B. Final payment for Work governed by unit prices will be made based on the actual measurements and quantities accepted by the OWNER, multiplied by the unit price for Work that is incorporated in or made necessary by the Work.
- C. When excavation or trenching is involved, unit and lump sum price bid includes all costs. No direct payment shall be made for excavation or trenching, unless otherwise specified.
- D. Payment for unit price items covers all Work necessary to complete the line items in the Bid Sheet.

1.06 PAYMENT FOR LUMP SUM ITEMS

- A. Payment for lump sum Work shall be made in accordance with the accepted schedule of values.
- B. An unbalanced or front-end loaded schedule will not be acceptable.
- C. Payment for lump sum Work covers all Work required to complete the work as shown or specified that is not covered under the unit price items and shall be based on the breakdown included in the approved Schedule of Values.
- D. Summation of the complete Schedule of Values shall equal the Contract Price for the lump sum item.

1.07 PROGRESS PAYMENTS

- A. Submit progress payments monthly, in accordance with requirements of the Contract.
- B. Include accepted schedule of values for each portion of Work and the unit price breakdown for Work to be paid on unit price basis, and allowances.
- C. Preparation.
 - 1. List each Change Order and Written Amendment executed prior to date of payment request as separate line items.

1.08 PARTIAL PAYMENT FOR UNDELIVERED, PROJECT-SPECIFIC MANUFACTURED OR FABRICATED EQUIPMENT

- A. Notwithstanding the above provisions, partial payments for undelivered (not delivered to the site or stored on the vicinity of the site) equipment or products specifically manufactured for this Project, excluding off the shelf or catalog items, will be made when the following conditions are met:
 - 1. Partial payment request is supported by written acknowledgment from Suppliers that invoice requirements have been met.
 - 2. Equipment or product is adequately insured, maintained, stored, and protected.
 - 3. Each equipment or product item is clearly marked and segregated from other items to permit inventory and accountability.
 - 4. Authorization has been provided for access to storage site for ENGINEER and OWNER.
 - 5. Equipment or product meets applicable Specifications requirements.
- 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 deduced from final payment.

1.09 NONPAYMENT FOR REJECTED OR UNUSED ITEMS

- A. Payment will not be made for the following:
 - 1. Materials excavated and/or placed beyond the Design Lines shown on the Drawings,

except as specifically required by the ENGINEER.

- 2. Loading, hauling, and disposing of rejected material.
- 3. Quantities of material wasted or disposed of in a manner not called for under Contract Documents.
- 4. 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.
- 5. Material not unloaded from transporting vehicle.
- 6. Defective WORK not accepted by OWNER.
- 7. Material remaining on hand after completion of WORK.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

SECTION 01 32 00

CONSTRUCTION SCHEDULES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Prepare detailed schedule of all construction operations and procurements to be reviewed by parties attending the preconstruction conference in accordance with Rule 8.1.3.
 - 2. Schedule shall be approved by the OWNER and ENGINEER prior to Notice to Proceed.

1.2 FORMAT AND SUBMISSIONS

- A. Prepare construction and procurement schedules in a graphic format suitable for displaying scheduled and actual progress.
- B. Submit three-week look-ahead schedules throughout the entire construction period at frequency agreed upon during the pre-construction meeting.

1.3 CONTENT

- A. Construction Progress Schedule
 - 1. Show the complete work sequence of construction by activity and location.

1.5 OWNER'S RESPONSIBILITY

- A. OWNER's review is only for the purpose of checking conformity with the Contract Documents and assisting CONTRACTOR in coordinating the Work with the needs of the Project.
- B. It is not to be construed as relieving CONTRACTOR from any responsibility to determine the means, methods, techniques, sequences, and procedures of construction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

SECTION 01 32 10

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Construction photographs.
 - 2. Record Documents.
 - 3. Periodic site observation.
 - B. Related Sections:
 - 1. SECTION 01 77 00 CONTRACT CLOSEOUT
- 1.2 CONSTRUCTION PHOTOGRAPHS
 - A. Take photographs at major phases of construction to meet following requirements:
 - 1. Take with high-resolution digital camera (5 Megapixels, or higher).
 - 2. Filenames shall include date and component that photographs are depicting in the format below.
 - a. YYYY-MM-DD description.jpg
 - 3. Submit monthly in JPEG format via email.

1.3 RECORD DOCUMENTS

- A. Quality Assurance:
 - 1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
 - 2. Accuracy of Records:
 - a. Coordinate changes within record documents, make legible and accurate entries on each page of Specifications and each sheet of Drawings and other documents where such entry is required to show change.
 - b. Document factual information regarding aspects of Work, both concealed and visible, to enable future modification of Work to proceed without lengthy and expensive site measurement, investigation, and examination.
 - 3. Make entries within 24 hours after receipt of information that change in Work has occurred.
 - 4. Request ENGINEER's review and approval of current status of record documents, prior to submitting each request for progress payment.
 - 5. Failure to properly maintain, update, and submit record documents may result in deferral by ENGINEER to recommend approval of whole or any part of CONTRACTOR's application for progress payment, either partial or final.

1.4 PERIODIC SITE OBSERVATION

- A. ENGINEER will make site observation to verify that construction is in conformance with the approved construction plans and specifications.
- B. OWNER's personnel on official business may visit site to monitor progress.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 MAINTENANCE OF RECORD DOCUMENTS

- A. General:
 - 1. Promptly following commencement of Contract Time, secure from ENGINEER at no cost to CONTRACTOR, one complete set of Contract Documents.
 - 2. Label or stamp each record document with title, "Record Documents," in neat large printed letters.
 - 3. Record information concurrently with construction progress.
 - 4. Do not cover or conceal Work until required information is recorded.
- B. Preservation:
 - 1. Maintain documents in clean, dry, legible condition and in good order.
 - 2. Do not use record documents for construction purposes.
 - 3. Make documents available at all times for observation by ENGINEER.
- C. Entries on Drawings:
 - 1. Date entries.
 - 2. Use erasable colored pencil; clearly describe change by graphic line and note as required.
 - 3. Call attention to entry by "cloud" drawn around area or areas affected.
 - 4. Legibly mark to record actual changes made during construction, including, but not limited to:
 - a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
 - b. Horizontal and vertical locations of existing and new underground facilities and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
 - c. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - d. Location of existing facilities, piping, equipment, and items critical to interface between existing physical conditions or construction and new construction.
 - e. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, Written Amendment, and ENGINEER's written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.
 - f. Underground and embedded electrical, instrumentation and control conduits, and duct bank runs dimensioned from established building lines.
 - . Changes or departures from electrical, instrumentation and control
 - 5. Dimensions on Schematic Layouts: Show on record drawings, by dimension, centerline of each run of items such as are described in previous subparagraph above.
 - a. Clearly identify item by accurate note such as "cast iron drain," "galv. water," and like.
 - b. Show, by symbol or note, vertical location of item ("under slab," "in ceiling plenum," "exposed," and like).
 - c. Make identification so descriptive that it may be related reliably to Specifications.
 - 6. Specifications: Legibly mark and record for each product description of actual product installed if differs from that specified, including:
 - a. Manufacturer, trade name, and catalog model number of each product and item of equipment actually installed.

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Submittal procedures.
 - 2. Submittal schedule.
 - 3. Administrative submittals.
 - 4. Shop Drawings and Samples.
 - 5. Product data.
 - 6. Quality control submittals.
 - 7. Contract closeout submittals.
 - 8. Action on submittals.
- B. Related Sections:
 - 1. SECTION 01 77 00 CONTRACT CLOSEOUT
- C. Related Documents: 1. Transmittal of CONTRACTOR's Submittal

1.02 SUBMITTAL PROCEDURES

- A. Direct inquires to ENGINEER regarding procedure, purpose, or extent of Submittal.
- B. Schedule and make submissions in accordance with requirements of individual Specification Sections and in such sequence as to cause no delay in Work or in work of other Contractors.
- C. Identification of Submittals:
 - 1. Complete, sign, and transmit with each submittal package one Transmittal of CONTRACTOR's Submittal Form.
 - 2. Identify each submittal with following numbering system:
 - a. Sequentially number each submittal.
 - b. Number resubmittals with original number and an alphabetic suffix.
 - 3. Format submittals in an orderly manner, indexed with labeled tab dividers.
 - 4. Show date of submission.
 - 5. Show Project title and OWNER's contract identification and contract number.
 - 6. Show names of CONTRACTOR, Subcontractor or supplier, and manufacturer as appropriate.
 - 7. Identify Contract Document section and paragraph to which submittal applies.
 - 8. Identify submittal type; submit only one type in each Submittal package.
 - 9. Identify each deviation or variation from Contract Documents.
- D. Apply CONTRACTOR's stamp, signed or initialed certifying that:
 - 1. Submittal was reviewed.
 - 2. Products, field dimensions, and adjacent construction have been verified.
 - 3. Information has been coordinated with requirements of Work and Contract Documents.
- E. Revise and resubmit submittals when required; identify changes made since previous submittal.
- F. Submittals which do not clearly bear CONTRACTOR's specific written indication of CONTRACTOR review and approval of submittal or which are transmitted with an unsigned or uncertified submission form will be returned to CONTRACTOR unreviewed.
- G. For each submittal, allow 7 days for ENGINEER's review, excluding delivery time to and from CONTRACTOR, unless otherwise specified. Resubmittals will be subject to same review time.

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SUBMITTAL PROCEDURES

- H. Schedule submittals to expedite Project, and deliver to ENGINEER. Coordinate submittal of related items.
- I. Schedule Delays:
 - 1. Adjustment of Contract Times or Price due to ENGINEER's review of Submittals will only be allowed if all following criteria are met:
 - a. CONTRACTOR has notified ENGINEER in writing that timely review of submittal in question is critical to progress of Work, and has received ENGINEER's written acceptance to reflect such. Written agreement by ENGINEER to reduce submittal review time will be made only for unusual and CONTRACTOR-justified reasons. Acceptance of progress schedule containing submittal review times less than specified or less than agreed to in writing by ENGINEER will not constitute ENGINEER's acceptance of review times.
 - b. ENGINEER has failed to review and return first submission of submittal within agreed time indicated on current accepted schedule of submissions or, if no time is indicated thereon, within 20 days after receipt.
 - c. CONTRACTOR demonstrates that delay in progress of Work is directly attributable to ENGINEER's failure to return submittal within time indicated and accepted by ENGINEER.
 - 2. No adjustment of Contract Times or Price will be allowed due to delays in progress of Work caused by rejection and subsequent resubmission of submittals, including multiple resubmissions.

1.03 SUBMITTAL SCHEDULE

- A. Submit submittal schedule showing submittals proposed for project, including submittals listed as:
 - 1. Submittals for Review.
 - 2. Quality Control Submittals.
 - 3. Contract Closeout Submittals.
- B. Include following for each submittal:
 - 1. Specification Section number.
 - 2. Submittal identification number.
 - 3. Description of submittal.
 - 4. Type of submittal.
 - 5. Estimated submission date to ENGINEER.
 - a. For first 6-month period from start of Contract or following any update or adjustment of submissions, estimated submission date shall be week, month, and year; for submissions beyond 6-month time period, show closest month and year
 - 6. Requested ENGINEER review time, if shorter than that set forth herein.
- C. Submit to ENGINEER monthly:
 - 1. Updated submittal schedule if changes have occurred, otherwise submit written communication confirming existing submittal schedule.

1.04 ADMINISTRATIVE SUBMITTALS

- A. Description: Submittals that are not shop drawings, samples, or product data and do not reflect quality of product or method of construction.
- B. Number of Copies: One.
- C. Applications for Payment: Refer to SECTION 01 29 00.
- D. Provide submittals required by Laws, Regulations, and Governing Agencies:
 - 1. Promptly submit notifications, reports, certifications, payrolls, and other items as required, directly to applicable federal, state, or local governing agency or their representative.

2. Transmit to ENGINEER for OWNER's records one copy of correspondence and transmittals including enclosures and attachments between CONTRACTOR and governing agency. Do not include any correspondence or transmittals that would be an invasion of privacy between CONTRACTOR and its employees.

1.05 SHOP DRAWINGS AND SAMPLES

- A. Submit Shop Drawings and Samples to ENGINEER as required by individual Specification Sections.
- B. Present in clear and thorough manner and of sufficient detail to show kind, size, arrangement, and function of components, materials, and devices and compliance with Contract Documents.
- C. Number of Copies:
 - 1. Shop Drawings: One.
 - 2. Samples: One, unless otherwise specified in individual Specification Sections.
- D. Identify:
 - 1. Pertinent drawing sheets and detail numbers, products, units and assemblies, and system or equipment identification or tag numbers.
 - 2. Critical field dimensions and relationships to other critical features of Work.
 - 3. Samples: Source, location, date taken, and by whom.
 - 4. Each deviation or variation from Contract Documents.
 - 5. Equipment and Component Titles: Identical to title shown on Drawings.
 - 6. Manufacturer's standard schematic drawings and diagrams:
 - a. Modify to delete information that is not applicable to Work.
 - b. Supplement standard information to provide information specifically applicable to Work.
- E. Design Data: Show calculations, dimensions, assumptions, referenced standards, and codes upon which design is based.
- F. Foreign Manufacturers: Include following additional information:
 - 1. Names and addresses of at least two companies closest to Project that maintain technical service representatives.
 - 2. Complete inventory of spare parts and accessories for each piece of equipment.

1.06 PRODUCT DATA

- A. Clearly mark each copy to identify pertinent products or models and show performance characteristics and capacities, dimensions and clearances required, wiring or piping diagrams and controls, and external connections, anchorages, and supports required.
- B. Supplement manufacturers' standard data to provide information unique to this Project.
- C. Copies: Submit One.

1.07 QUALITY CONTROL SUBMITTALS

- A. Certificates:
 - 1. Manufacturer's Certificate of Compliance:
 - a. Submit prior to shipment of product or material to site.
 - b. Ensure that certificate is signed by product manufacturer certifying that materials, manufacture, and product conforms to or exceeds specified requirements and is appropriate for intended use.
 - c. Submit supporting reference data, test results, affidavits, and certifications as appropriate.
 - 2. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual

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Specification Sections.

- C. Statements of Qualification: Provide evidence of qualification, certification, or registration as required in Contract Documents.
- D. Field Samples: Provide as required by individual Specification Sections.
- E. Written Test and Inspection Reports; include following:
 - 1. Date of test and date issued, Project title and number, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
 - 2. Date and time of sampling or inspection and record of temperature and weather conditions.
 - 3. Identification of product and Specification Section, location of Sample, test or inspection in Project, type of inspection or test with referenced standard or code, certified results of test.
 - 4. Compliance with Contract Documents or identification of corrective action necessary to bring materials and equipment into compliance.
 - 5. Provide an interpretation of test results, when requested by ENGINEER.
- F. ENGINEER shall receive second receipt for all concrete deliveries.

1.08 CONTRACT CLOSEOUT SUBMITTALS

A. Submit in accordance with SECTION 01 77 00.

1.09 ACTION ON SUBMITTALS

- A. Distribution of reviewed submittals:
 - 1. One copy each to ENGINEER and Construction Project Manager.
 - 2. Remaining copies returned to CONTRACTOR.
- B. ENGINEER will review, mark, and stamp as appropriate and distribute marked-up copies as noted:
 - 1. No Exceptions Taken:
 - a. Final Unrestricted Release: Where submittals are marked as "No Exception Taken," Work covered by submittal may proceed provided it complies with Contract Documents. Acceptance of Work depends on compliance.
 - 2. Make Corrections Noted:
 - a. Final-but-Restricted Release: When submittals are marked as "Make Corrections Noted," Work covered by submittal may proceed provided it complies with Engineer's notations or corrections on submittal and Contract Documents. Acceptance of Work depends on compliance. Re-submittal not required.
 - 3. Revise and Resubmit:
 - a. Returned for Re-submittal: When submittals are marked as "Revise and Resubmit," do not proceed with Work covered by submittal. Do not permit Work covered by submittals to be used at Project site or elsewhere were Work is in progress.
 - 4. Submit Specific Item(s):
 - a. Submit Specific Item: When submittals are marked "Submit Specific Item(s)," do not proceed with work covered by submittal.
 - b. Prepare new submittal for specific item product or material.
 - 5. Other:
 - a. Perform requests as noted.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Regulatory Requirements.
 - 2. Workmanship.
 - 3. Responsibilities of CONTRACTOR.
 - 4. Coordination.

1.2 **REGULATORY REQUIREMENTS**

- A. American Concrete Institute:
 - 1. ACI 318 Building Code Requirements for Structural Concrete and Commentary
 - 2. ACI 350 Code Requirements for Environmental Engineering Concrete Structures and Commentary

1.3 WORKMANSHIP

- A. Perform work to highest level of workmanship and detail possible.
- B. Meticulous work and high attention to detail regarding mechanical components, measurements, assembly, and other activities covered by Contract Documents is expected.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 **RESPONSIBILITIES OF CONTRACTOR**

- A. Implement and conduct quality control program that will ensure timely and cost-effective completion of this project in conformance with Contract Documents.
- B. Cooperate with OWNER in accommodating OWNER-furnished material, furnishings, equipment and its installation and OWNER's construction review.
- C. Establish on-site lines of authority and communication.
 - 1. Attend meetings.
 - 2. Utilize sequentially numbered and dated forms to document requests for information and clarification.
- D. Provide and maintain competent staff of experienced construction, administrative and supervisory personnel in sufficient numbers to meet contract completion date.
- E. Provide and designate competent, experienced person to perform quality control reviews of Work.
- F. Responsibilities of quality control reviewer:
 - 1. Review work by CONTRACTOR.
 - 2. Verify that Work is ready for ENGINEER's review.
 - 3. Schedule reviews with ENGINEER.
 - 4. Be responsible in conjunction with CONTRACTOR's superintendent for correction of non-conforming work.
- G. If CONTRACTOR fails to provide competent and experienced person to perform quality control reviews, OWNER will retain services of required staff and deduct their fees from periodic progress payments due to CONTRACTOR.

- H. Furnish detailed time schedule of operations for work on Project. Monitor schedule as work progresses and revise schedule at appropriate intervals, or as requested by ENGINEER, to reflect actual progress.
- I. CONTRACTOR shall provide OWNER, ENGINEER, and STATE ENGINEER OFFICE PERSONNEL proper and safe access to the site for their observation, inspection, and testing. CONTRACTOR shall cooperate with inspection and testing personnel to facilitate any inspections and tests by the OWNER, ENGINEER, or STATE ENGINEER OFFICE PERSONNEL

3.2 COORDINATION

- A. Carefully review Contract Documents and report to ENGINEER any error, omission, conflict, inconsistency, or code violation discovered.
- B. Require Subcontractors to comply with requirements of Contract Documents.
- C. Await written instructions prior to correcting conflicts or problems identified.

SECTION 01 71 00

SITE CONDITIONS

PART 1 GENERAL

1.1 SUMMARY

- A. The CONTRACTOR acknowledges that they have satisfied themselves as to the nature and location of the work, the general and local conditions, particularly those bearing upon access to the site; handling, storage, and disposal of materials; availability of water, electricity and roads; uncertainties of weather, river stages, water flow rates and levels in irrigation ditches and canals or similar physical conditions at the site; the conformation and conditions of the ground; the equipment and facilities needed preliminary to and during the execution of the work; and all other matters which can in any way affect the work or the cost thereof under this Contract.
- B. The CONTRACTOR further acknowledges that they have satisfied themselves as to the character, quality, and quantity of surface and subsurface materials to be encountered from his inspection of the site and from reviewing any available records of exploratory work furnished by the OWNER or included in these Documents. Failure by the CONTRACTOR to acquaint themselves with the physical conditions of the site and all the available information will not relieve them from responsibility for properly estimating the difficulty or cost of successfully performing the work.
- C. The CONTRACTOR warrants that as a result of his examination and investigation of all the aforesaid data that they can perform the work in a good and workmanlike manner and to the satisfaction of the OWNER. The OWNER assumes no responsibility for any representations made by any of its officers or agents during or prior to the execution of this Contract, unless such representations are expressly stated in the Contract, and the Contract expressly provides that the responsibility therefore is assumed by the OWNER.

PART 2 PRODUCTS

2.1 INFORMATION ON SITE CONDITIONS

- A. Any information obtained by the ENGINEER regarding site conditions, subsurface information, groundwater elevations, existing construction of site facilities, and similar data will be available for inspection, as applicable, at the office of the ENGINEER upon request. Such information is offered as supplementary information only. Neither the ENGINEER nor the OWNER assumes any responsibility for the completeness or interpretation of such supplementary information.
 - 1. Differing Subsurface Conditions:
 - a. In the event that the subsurface or latent physical conditions are found materially different from those indicated in these Documents and differing materially from those ordinarily encountered and generally recognized as inherent in the character of work covered in these Contract Documents, the CONTRACTOR shall promptly, and before such conditions are disturbed, notify the ENGINEER in writing of such changed conditions.
 - b. The ENGINEER will investigate such conditions promptly and following this investigation, the CONTRACTOR shall proceed with the work, unless otherwise instructed by the ENGINEER. If the ENGINEER finds that such conditions do so materially differ and cause an increase or decrease in the cost of or in the time required for performing the work, the ENGINEER will recommend to the OWNER the amount of adjustment in cost and time they consider reasonable. The OWNER will

make the final decision on all Change Orders to the Contract regarding any adjustment in cost or time for completion.

- 2. Underground Utilities:
 - a. Known utilities and structures adjacent to or encountered in the work are shown on the Drawings. The locations shown are taken from existing records and the best information available from existing utility plans, however, it is expected that there may be some discrepancies and omissions in the locations and quantities of utilities and structures shown. Those shown are for the convenience of the CONTRACTOR only, and no responsibility is assumed by either the OWNER or the ENGINEER for their accuracy or completeness.

PART 3 EXECUTION

- 3.1 GENERAL
 - A. Where the CONTRACTOR's operations could cause damage or inconvenience to railway, telegraph, telephone, television, oil, gas, electricity, water, sewer, or irrigation systems, the operations shall be suspended until all arrangements necessary for the protection of these utilities and services have been made by the CONTRACTOR.
 - B. Notify all utility offices which are affected by the construction operation at least 48 hours in advance. Under no circumstances expose any utility without first obtaining permission from the appropriate agency. Once permission has been granted, locate, expose, and provide temporary support for all existing underground utilities.
 - C. The CONTRACTOR shall protect all utility poles from damage. If interfering power poles, telephone poles, guy wires, or anchors are encountered, notify the ENGINEER and the appropriate utility company at least 48 hours in advance of construction operations to permit the necessary arrangements for protection or relocation of the interfering structure.
 - D. The CONTRACTOR shall be solely and directly responsible to the owner and operators of such properties for any damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage which may result from the construction operations under this Contract.
 - E. Neither the OWNER nor its officers or agents shall be responsible to the CONTRACTOR for damages as a result of the CONTRACTOR's failure to protect utilities encountered in the work.
 - F. If the CONTRACTOR while performing the Contract discovers utility facilities not identified in the Drawings or Specifications, they shall immediately notify the OWNER, utility, and the ENGINEER in writing.
 - G. In the event of interruption to domestic water, sewer, storm drain, or other utility services as a result of accidental breakage due to construction operations, promptly notify the proper authority. Cooperate with said authority in the restoration of service as promptly as possible and bear all costs of repair.
 - H. The CONTRACTOR shall replace, at his own expense, any and all other existing utilities or structures removed or damaged during construction, unless otherwise provided for in these Contract Documents or ordered by the ENGINEER.

3.2 INTERFERING STRUCTURES

A. The CONTRACTOR shall take necessary precautions to prevent damage to existing structures whether on the surface, aboveground, or underground. An attempt has been made to show major structures on the Drawings. The completeness and accuracy cannot be guaranteed, and it is presented simply as a guide to avoid known possible difficulties.

3.3 FIELD RELOCATION

A. During the progress of construction, it is expected that minor relocations of the work will be necessary. Such relocations shall be made only by direction of the ENGINEER. If existing structures are encountered that prevent the construction, and that are not properly shown on the Drawings, notify the ENGINEER before continuing with the construction in order that the ENGINEER may make such field revision as necessary to avoid conflict with the existing structures. If the CONTRACTOR shall fail to so notify the ENGINEER when an existing structure is encountered, and shall proceed with the construction despite the interference, they shall do so at their own risk.

3.4 EASEMENTS

- Where portions of the work are located on public or private property, easements and Α. permits will be obtained by the OWNER. Easements will provide for the use of the property for construction purposes to the extent indicated on the easements. Copies of these easements and permits are available upon request to the OWNER. It shall be the CONTRACTOR's responsibility to determine the adequacy of the easement obtained in every case and to abide by all requirements and provisions of the easement. The CONTRACTOR shall confine his construction operations to within the easement limits or make special arrangements with the property owners or appropriate public agency for the additional area required. Any damage to property, either inside or outside the limits of the easements provided by the OWNER, shall be the responsibility of the CONTRACTOR as specified herein. The CONTRACTOR shall remove, protect, and replace all fences or other items encountered on public or private property. Before final payment will be authorized by the ENGINEER, the CONTRACTOR will be required to furnish the OWNER with written releases from property owners or public agencies where side agreements or special easements have been made by the CONTRACTOR or where the CONTRACTOR's operations, for any reason, have not been kept within the construction right-of-way obtained by the OWNER.
- B. It is anticipated that the required easements and permits will be obtained before construction is started. However, should the procurement of any easement or permit be delayed, the CONTRACTOR shall schedule and perform the work around these areas until such a time as the easement or permit has been secured.

3.5 LAND MONUMENTS

A. The CONTRACTOR shall notify the ENGINEER of any existing Federal, State, City, County, and private land monuments encountered. Private monuments shall be preserved or replaced by a licensed surveyor at the CONTRACTOR's expense. When Government monuments are encountered, the CONTRACTOR shall notify the ENGINEER at least two (2) weeks in advance of the proposed construction in order that the ENGINEER will have ample opportunity to notify the proper authority and reference these monuments for later replacement.

SECTION 01 71 23

CONSTRUCTION SURVEYING

PART 1GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Survey.
 - 2. Construction layout.
 - 3. Field Engineering.
 - 4. Reference and coordinate points.
 - 5. Construction lines and grades.
 - 6. Supplemental Information.

1.03 SURVEY

- A. Perform surveys that are necessary to lay out structure and pipeline lines, alignments, grades and elevations from control points.
- B. ENGINEER may review and or verify CONTRACTOR-established lines, grades, and elevations by surveys. Provide access to project work for these surveys.
- C. Reviews or surveys performed or requested by ENGINEER shall not relieve CONTRACTOR's responsibility for correct lines, grades, elevations and structure layout.

1.04 CONSTRUCTION LAYOUT

- A. Perform construction layout using qualified, competent personnel.
- B. Stake pipelines at horizontal points of intersection (PI's), grade changes and at 50 foot intervals or less.
- C. Make survey data available for review throughout construction time period.

1.05 REFERENCE AND COORDINATE POINTS

- A. Protect and preserve reference points and benchmarks.
- B. Report damaged or destroyed reference points and benchmarks to ENGINEER.
 - 1. ENGINEER will reestablish damaged, moved, altered, or destroyed reference benchmarks and coordinate points.
 - 2. If damaged, moved, altered, or destroyed by CONTRACTOR, cost of reestablishing such points shall be borne by CONTRACTOR.
 - 3. ENGINEER is not responsible for increased costs or delays to CONTRACTOR relating to reference points or benchmarks that are damaged, moved, altered, or destroyed by CONTRACTOR or its Subcontractors, suppliers, agents, or employees or other contractors working on site.
- C. Report potential errors in reference points or benchmarks to ENGINEER.
 - 1. Discontinue use of reference points or benchmarks alleged to be in error until accuracy of points can be verified.
 - 2. Claims for extra compensation for alteration or reconstruction allegedly due to errors in

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reference points or benchmarks will not be allowed unless original reference points and bench marks still exist or substantiating evidence proving error is furnished by CONTRACTOR, and unless CONTRACTOR has reported such errors to ENGINEER as specified hereinbefore.

D. Use of control monuments for construction surveying, other than those shown on Drawings or furnished by or approved by ENGINEER, is prohibited.

1.06 Submittals

A. CONTRACTOR shall perform an As-Built survey of all construction features including, but not limited to, dam crest geometry, embankment geometry, spillway invert, new outlet features, instrumentation, survey monuments, conduit inverts, drain inverts, and structure inverts. As-Built survey shall be submitted to the ENGINEER and OWNER and incorporated into the Record Drawings as appropriate.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CONSTRUCTION LINES AND GRADES

- A. CONTRACTOR:
 - 1. Make and maintain points and lines in connection with surveys required.
 - 2. Provide batter boards and string lines along centerline offset line from which line and grade of pipeline can be controlled and monitored.
 - 3. Preserve line and grade stakes and markers set by ENGINEER, until otherwise authorized.

SECTION 01 77 00

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Submittals
 - 2. Final cleaning
- B. Related Documents:
 - 1. General Conditions
- C. General:
 - 1. Upon completion of closeout activities, submit Application for Final Payment and completed Final Payment Release Form as provided in the Contract.
 - 2. Upon completion of closeout activities, ENGINEER will issue a Notice of Acceptability of Work (Final Completion).

1.2 **REFERENCES**

- A. State of Colorado, Department of Natural Resources, Division of Water Resources, Office of the State Engineer, Dam Safety
 - 1. Rules and Regulations for Dam Safety and Dam Construction

1.3 SUBMITTALS

- A. Quality Control Submittals: Written procedures for maintaining and markup of Record Documents.
 - 1. Submit in accordance with SECTION 01 33 00.
- B. Contract Closeout Submittals: Submit in accordance with the Contract and individual Specification Sections.
 - 1. Project Record Documents
 - 2. Red-lined as-built drawings (a.k.a. "Drawings of Record" or "Record Drawings")
 - 3. Approved Shop Drawings and Samples
 - 4. Operation and Maintenance Data
 - 5. Bonds, Warranties, and Service Agreements
 - 6. Consent of Surety to Final Payment
 - 7. Releases or Waivers of Liens and Claims
 - 8. Releases from Agreements
 - 9. Final Application for Payment
 - 10. Spare Parts and Special Tools

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CLOSING OUT THE PROJECT

A. CONTRACTOR advises the ENGINEER in writing that he has reached "Substantial Completion" and provides a list of items to be completed or corrected.

- 1. Closeout may be conducted by areas or portions of the work if requested by the OWNER.
- B. ENGINEER inspects the work to determine if it is substantially complete and issues a Certificate of Substantial Completion plus a "Punch List" of items to be completed or corrected.
 - 1. Substantial Completion Definition
 - a. All Work must be ready to serve its intended purpose.
- C. CONTRACTOR competes and/or corrects all punch list items and notifies the ENGINEER and SEO in writing that work is ready for final inspection. At this time, a final application for payment is submitted.
- D. ENGINEER and SEO PERSONNEL will make final inspection. When the work is found to be acceptable under the Contract Documents, and the Contract fully performed, the ENGINEER will issue a final Certificate for Payment.
 - 1. Final Completion Definition
 - a. All Work must be complete for Final Completion, including Final Cleaning.
 - 1) See 3.2 of this SECTION.
 - b. Contract Closeout Submittals must be received by ENGINEER
 - 1) See 1.3.B of this SECTION.
- E. Project will not be considered complete by the SEO until SEO PERSONNEL have performed final inspection in accordance with Rule 8.2.6 of the SEO's Rules and Regulations.
 - 1. See 3.1.D of this SECTION
- F. Storage of water shall not be permitted until ENGINEER has submitted construction completion documents to the SEO in accordance with Rule 8.3.1 of the SEO's Rules and Regulations.

3.2 FINAL CLEANING

- A. At completion of Work and prior to notice of Substantial Completion, remove tools, equipment, surplus materials, debris, and temporary construction from premises.
- B. Leave Work and adjacent areas in clean condition.
- C. Remove grease, dirt, dust, paint, stains, and other foreign materials resulting from Work under this Contract from street surfaces and surrounding areas.
- D. Repair damage to any surface or substrate caused by construction activities.
- E. Regrade Construction access routes to match adjacent, undisturbed areas.
- F. Remove Vehicle Tracking Control, regrade and reseed with native mix to match adjacent undisturbed areas.
- G. Repair, patch, and touch up marred surfaces to match adjacent surfaces.
- H. Leave watercourses, gutters, and ditches open and clean.
- I. Haul waste from job site to approved disposal area.

SECTION 03 10 00 CONCRETE FORMING

PART 1 GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Concrete formwork.
 - B. Related Sections:
 - 1. SECTION 03 30 00 CAST-IN-PLACE CONCRETE.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 117 Standard Specifications for Tolerances for Concrete Construction and Materials
 - 2. 318/318R Building Code Requirements for Structural Concrete and Commentary
 - 3. 347R Guide to Formwork for Concrete
 - 4. 350 Code Requirements for Environmental Engineering Concrete Structure and Commentary

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Custom, project-specific formwork, falsework, and shoring designs.
 - 2. Product Data:
 - a. Load tables, design data, supporting calculations, and assembly/erection instructions for pre-engineered forming systems.
 - b. Manufacturer's literature for taper ties, through-bolts, form ties, and forming systems.

1.4 SYSTEM DESIGN REQUIREMENTS

- A. Design formwork in accordance with ACI 318/318R and ACI 347R to provide concrete finishes specified in SECTION 03 30 00.
- B. Custom, project-specific formwork, falsework, and shoring designs shall be prepared and stamped by Engineer licensed in State of Colorado.
- C. Pre-engineered forming systems may be used if approved by ENGINEER.
- D. Make joints in forms mortar-tight.
- E. Limit panel deflection to L/360 of each component span to achieve tolerances specified.
- F. All components of the work shall conform to ACI 117.

PART 2 PRODUCTS

- 2.1 FORM MATERIALS
 - A. Wall Forms and Underside of Slabs and Beams:

1. Materials: Plywood, hard plastic finished plywood, overlaid waterproof particle board, or steel in new and undamaged condition, of sufficient strength and surface smoothness to produce specified finish.

2.2 ACCESSORIES

- A. Form Release Agent:
 - 1. Magic Kote by Symons Corp.
 - 2. Engineer Approved Equal
- B. Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.
- C. Form Ties:
 - 1. Material: Steel.
 - 2. Spreader Inserts:
 - a. Conical or spherical type.
 - b. Design to maintain positive contact with forming material.
 - c. Furnish units that will leave no metal closer than one inch to concrete surface when forms, inserts, and tie ends are removed.
 - 3. Tie wire form ties not permitted.
 - 4. Flat bar ties for panel forms, furnish plastic or rubber inserts with minimum one inch depth and sufficient dimensions to permit patching of tie hole.
 - 5. Waterstop Ties: For water-holding structures, furnish one of the following:
 - a. Ties shall include a hydrophilic waterstop placed along the tie at the midpoint of the wall. Waterstop shall have a minimum expansion ration of 400%.
 - b. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.
 - 6. Through-Bolts: Tapered minimum one inch diameter at smallest end.
 - 7. Elastic Vinyl Plug: Design and size of plug to allow insertion with tool to enable plug to elongate and return to original length, and diameter upon removal forming watertight seal.
 - a. Manufacturer and Product: Dayton Superior Co., Miamisburg, OH; Dayton Sure Plug.

PART 3 EXECUTION

- 3.1 FORM SURFACE PREPARATION
 - A. Thoroughly clean form surfaces in contact with concrete or previous concrete, dirt, and other surface contaminants prior to coating surface.
 - B. Exposed Wood Forms in Contact with Concrete: Apply form sealer as recommended by sealer material manufacturer.
 - C. Steel Forms: Apply form sealer to steel forms as soon as they are cleaned to prevent discoloration of concrete from rust.

3.2 ERECTION

- A. General:
 - 1. Unless specified otherwise, follow recommendations of ACI 347R.
 - 2. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure.

- 3. Construct formwork so concrete members and structures are correct size, shape, alignment, elevation and position.
- 4. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- 5. Formwork shall be mortar tight.
- B. Beveled Edges (Chamfer):
 - 1. Form 3/4-inch bevels at concrete edges, unless otherwise shown.
 - 2. Where beveled edges on existing adjacent structures are other than 3/4-inch, obtain ENGINEER's approval of size prior to placement of beveled edge.
 - 3. Do not chamfer at concrete surfaces below brick or concrete masonry.
- C. Wall Forms:
 - 1. Do not use forms with damaged surfaces.
 - 2. Where exposed to view, locate form ties and joints in uninterrupted pattern for smooth and uniform surface.
 - 3. Inspect form surfaces prior to installation to assure conformance with specified tolerances.
- D. Form Tolerances: Provide forms in accordance with ACI 318/318R and ACI 347R. See SECTION 03 30 00 and the following for finish tolerances specified:
 - 1. Wall Tolerances:
 - a. Plumb within 1/8-inch in 10 feet or within 1/2-inch from top to bottom for walls over 40 feet high.
 - 1) Depressions in Wall Surface: Maximum 1/8-inch when 10-foot straightedge is placed on high points in all directions.
 - b. Thicknesses: Maximum 1/4-inch minus or 1/2-inch plus from dimensions shown.
 - 2. Slab Tolerances:
 - a. Exposed Slab Surfaces: Comprise of flat planes as required within tolerances specified.
 - b. Slab Finish Tolerances and Slope Tolerances: Crowns on floor surface not too high as to prevent 10-foot straightedge from resting on end blocks, nor low spots that allow block of twice the tolerance in thickness to pass under supported 10-foot straightedge.
 - c. Slab tolerance:
 - 1) Finish Slab Elevation: within ¹/₄" of elevation specified on plans
 - 2) Thickness: Maximum 1/4-inch minus or 1/2-inch plus from thickness shown, except where thickness tolerance will not affect slope, drainage, or slab elevation.

3.3 FORM REMOVAL

- A. Formwork not supporting weight of concrete, (i.e., sides of beams, walls, columns, and similar parts of Work) may be removed after cumulatively curing at not less than 50°F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.
- B. Remove forms in manner which will ensure integrity of structure and its surfaces.
- C. Withdrawal of form ties through wall, column or beam will not be permitted.
- D. Form Removal for elevated slabs or beams:

- 1. Leave forms and shoring in place, in accordance with ACI 318/318R, Chapter 6, and until concrete has reached compressive strength equal to 80% of specified 28-day compressive strength as determined by test cylinders.
- Leave forms in place for 7 days, minimum.
- 2. 3. Strength shall be 100% prior to applying any loading condition.

SECTION 03 15 13.01 WATERSTOPS FOR CONCRETE STRUCTURES

PART 1 GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Polyvinyl chloride (PVC) Waterstop.
 - 2. Hydrophilic Waterstops.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. D 570 Standard Test Method for Water Absorption of Plastics
 - 2. D 624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer
 - 3. D 638 Standard Test Method for Tensile Properties of Plastics
 - 4. D 746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
 - 5. D 747 Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
 - 6. D 792 Standard Test Method for Density and Specific Gravity of Plastics by Displacements
 - 7. D 1203 Standard Test Method for Volatile Loss From Plastics Using Activated Carbon Methods
 - 8. D 2240 Standard Test Method for Rubber Property Durometer Hardness
- B. Corps of Engineers (COE): CRD-C-572 Corps of Engineers Specifications for Polyvinylchloride Waterstop.

1.3 QUALITY ASSURANCE

- A. The components and installation procedures shall be in accordance with the manufacturer's printed Specifications and recommendations.
- B. Installation shall be performed by skilled workers who are trained in procedures and methods required for proper performance of the waterstop.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver the waterstop materials to the project site in the manufacturer's unpacked containers with all labels intact and legible at time of use.
- B. Materials shall be stored in a secure, indoor, dry area. Maintain the waterstops in a dry condition during delivery, storage, handling, installation and concealment.

1.5 SUBMITTALS

- A. Submittals for Review:
 - 1. PVC Waterstop Data Sheets from Manufacturer
 - 2. Adhesive Data Sheets from Manufacturer

PART 2 PRODUCTS

2.1 MATERIALS

- A. Polyvinyl Chloride Waterstop:
 - 1. Physical Properties:

Property	Test Method	Average Value
Tensile Strength	ASTM D 638	2000 psi
Ult. Elongation	ASTM D 638	350
Tear Resistance	ASTM D 624	300 lbs./in.
Hardness. Shore A/15	ASTM D 2240	79 +/-3
Thickness	N/A	5/16" (min)
Width	N/A	as indicated on the Plans

- 2. Profile
 - a. Waterstop profile shall be ribbed with centerbulb
- 3. Fittings
 - a. Fittings shall meet physical properties described above.
 - b. Factory fabricate fittings such as tees, ells and crosses.
- 4. Approved Products
 - a. Sika® Greenstreak® Type 705, Type 717, or Type 732 PVC Waterstops
 - b. Durajoint® Type 5, Type 5A, Type 5BR, or Type 9 PVC Waterstops

B. Hydrophilic Waterstop

- 1. Approved Products
 - a. Adeka MC-2010MN
 - b. Adeka P-210
- 2. Adhesive
 - a. 3m, 3M-2141
 - b. Adeka P-201

PART 3 EXECUTION

- 3.1 PVC WATERSTOP INSTALLATION
 - A. PREPARATION FOR INSTALLATION
 - 1. Store waterstops protective tarps to keep free of oil, dirt and sun UV degradation; waterstops not protected will be rejected.
 - 2. Uncoil waterstops minimum 48 hours prior to installation and lay flat.
 - 3. Do not lay waterstop in mud or debris.
 - 4. Protect waterstop from punctures.
 - 5. Repair waterstop after shipping:

- a. Do any work necessary, including heating waterstop in range of 125°F to 150°F as recommended by manufacturer, to re-establish proper waterstop configuration, which may have been altered due to shipping in rolls; i.e., tear web or large bulb becoming flattened against waterstop "legs".
- b. Tear web bulbs shall be perpendicular to embed legs of waterstop and have proper shape.
- c. Circular bulbs shall be round and in proper alignment to embed legs.
- 6. Coordinate reinforcing placement and positioning for proper installation of waterstop.
- 7. Pre-fabricate waterstops for use in pipe slab penetrations to achieve proper shape and waterstop geometry including proper bulb configuration and alignment.
- B. PLACEMENT
 - 1. Locate waterstop in joint as shown in Drawings.
 - 2. When installed in expansion joints, place centerbulb or tear web bulb, depending on type of waterstop, un-embedded and centered in joint.
 - 3. Waterstop shape:
 - a. Bulbs shall conform to proper geometry, shape and orientation.
 - b. If the tear web bulb or bulb type waterstop is not in conformance with proper geometry, shape and orientation as detailed and illustrated by manufacturer and Drawings, remove waterstop and replace with waterstop that is in conformance with manufacturer's details and illustrations.
 - 4. Secure waterstop:
 - a. Securely tie waterstop to reinforcing steel using hog rings crimped between last two ribs or into end bulb at 12-inch maximum centers.
 - b. Tie both portions of waterstop that will be encased in concrete and portions initially un-encased to support at 12-inch centers to assist in maintaining waterstop alignment during concrete placement.

C. FIELD SPLICES

- 1. Splice PVC waterstops neatly and in accordance with manufacturer's directions.
- 2. Excessive PVC "weld splatter" is unacceptable.
- 3. Maximum one splice permitted in 50 linear feet of waterstop.
- 4. ENGINEER shall review splices for integrity.
- D. SPLICE JOINT IDENTIFICATION
 - 1. After concrete has hardened, mark location of splices on top surface of concrete for future reference in event of water seepage through joint in waterstop.

3.2 HYDROPHILIC WATERSTOP INSTALLATION

- A. PREPARATION FOR INSTALLATION
 - 1. Store hydrophilic waterstops per manufacturers recommendations
 - 2. Prepare and clean placement surfaces so that they are free of debris, dirt, grease, oil, or any other contaminates.
- B. PLACEMENT
 - 1. Locate hydrophilic waterstops as shown in drawings

- 2. Install hydrophilic waterstop according to manufacturers instructions.
- 3. Protect hydrophilic waterstops from moisture contamination until surrounding concrete has been placed.

3.3 CONCRETE PLACEMENT

- A. Thoroughly and systematically vibrate concrete around waterstops for positive contact between waterstop and concrete.
- B. Clean horizontal joints so dirt and construction debris do not interfere with direct contact of concrete with waterstop.
- C. When placing concrete, avoid deflecting or displacing waterstop out of its proper position.
- D. Bring concrete up in uniform lifts on both sides of waterstop as means of promoting proper waterstop alignment.

3.4 PLACEMENT TOLERANCE

A. Waterstop shall be no more than $\pm 1/2$ inch from designed horizontal alignment and within 1/4 inch vertically.

SECTION 03 21 00 REINFORCING STEEL

GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Reinforcing steel.
 - 2. Rebar Dowel Anchors

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 117 Standard Specification Tolerances for Concrete Construction and Materials
 - 2. ACI 315 Details and Detailing of Concrete Reinforcement
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM 615/A 615M Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - 2. ASTM D4435 08 Standard Test Method for Rock Bolt Anchor Pull Test
- C. Concrete Reinforcing Steel Institute (CRSI):
 - 1. CRSI Manual of Standard Practice
 - 2. CRSI Placing Reinforcing Bars
- D. American Welding Society (AWS):
 - 1. AWS D1.4 Structural Welding Code Reinforcing Steel

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop drawings:
 - a. Detail plans, sections, reinforcing bar sizes, grades, placement, spacing, splice lengths, tail and hook configurations, chair and bolster heights and development length where applicable.
 - b. Mechanical threaded splice devices.
 - 2. Samples:
 - a. Tie Wire.
 - b. Reinforcing bar support chairs and bolsters.
- B. Quality Control Submittals:
 - 1. Mill test reports.
 - 2. Mechanical thread connections:
 - a. Manufacturer's data sheets.
 - b. Verification that device threads have been checked and meet manufacturer's requirements for thread quality.
 - 3. Welding qualification.
 - 4. Test results for field welding.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Reinforcing steel:
 - 1. Store off ground.
 - 2. Protect from oil or other materials detrimental to steel or bonding capability of reinforcing bar.
 - 3. Protect from mechanical injury.
 - 4. Rust, seams, surface irregularities, or mill scale, will not be cause for rejection provided that weight and height of deformations of hand-wire-brushed test specimen are not less than applicable ASTM Specification.
- B. Do not drop or drag bars.
- 1.5 QUALIFICATIONS
 - A. Welding:
 - 1. Performed by welders and welding procedures certified to requirements of AWS D1.4.
 - 2. When welder or welding procedures certification tests are required, testing shall be performed by independent testing agency accepted by ENGINEER.

PART 2 PRODUCTS

- 2.1 REINFORCING STEEL
 - A. Bar steel reinforcement: Deformed type, ASTM A 615, (AASHTO M31) and grade [60].
- 2.2 TIE WIRE
 - A. Standard tie wire:
 - 1. Sources: American Wire Tie, Inc., Mar-Mac Wire Inc.
 - 2. Description: 16 gauge wire tie.
 - B. Tie wire in contact with inside face of water retaining structures: 16-gage stainless steel.

2.3 IDENTIFICATION

- A. Bundles of reinforcing bars and wire spirals:
 - 1. Tag with a metal tag.
 - 2. Show specification, grade, size, quantity and suitable identification to permit checking, sorting and placing.
 - 3. When bar marks are used to identify reinforcing bars in Drawings, show bar mark on tag.
 - 4. Remove tags prior to concrete placement.
- B. Tag bundles of flat sheets of welded wire fabric similar to reinforcing bars.
- 2.4 BAR SUPPORTS
 - A. General:
 - 1. Bar supports and spacing in accordance with CRSI Manual of Standard Practice, Chapter 3; maximum of four feet or as required by Drawings.
 - 2. Metal chairs: Stainless steel, zinc coated steel, or uncoated steel with approved plastic tipped legs with minimum 1/2-inch of lower end of legs plastic coated.
- B. Floor Slabs:
 - 1. Use coated steel chairs.
 - 2. Composite chairs are unacceptable.
 - 3. When required, staple chair on bearing pad:
 - a. 1/4-inch thick exterior grade plywood.
 - b. Approximately five inches square.
- C. Water and Wastewater Vaults, Water Storage Tank and Basin Walls, Columns and Roof Slabs:
 - 1. Securely staple supports to formwork.
 - 2. If accepted in writing, non-metallic composite chairs may be used.

2.5 MECHANICAL BAR SPLICES

- A. Approved mechanical threaded butt connectors may be used in lieu of lapped splices when approved.
- B. Mechanical connection: Capable of developing minimum of 125% of yield strength of reinforcing bar in both tension and compression.
- C. Manufacturers and Products:
 - 1. Erico Products, Inc., Cleveland, Ohio; Lenton Reinforcing Steel Couplers.
 - 2. Richmond Screw Anchor Co., Inc., Fort Worth, Texas; Richmond DB-SAE Dowel Bar Splicers.

PART 3 EXECUTION

- 3.1 FABRICATION
 - A. Fabrication tolerances for straight and bent bars: In accordance with requirements of Subsection 4.3, Tolerance, of American Concrete Institute Standard 315 and CRSI Manual of Standard Practice.

3.2 BENDING

- A. All reinforcing bars shall be bent cold to shapes shown on Drawings, and unless otherwise approved, bends shall conform to requirements of ACI 315. All bending dimensions shall be out to out of bar.
- B. Bars partially embedded in concrete shall not be field bent except as shown on Drawings.
- C. Bars shall not be bent or straightened in a manner that will injure material.

3.3 PLACING AND FASTENING

- A. Place, fasten, splice and support reinforcing steel and wire mesh or bar mat reinforcement in accordance with Drawings and CRSI Recommended Practice for Placing Reinforcing Bars.
- B. Place reinforcement within tolerances provided in ACI 117.
- C. When placed in the work, the reinforcing bars shall be free from dirt, loose mill scale, paint, oil, loose rust or other foreign substance.
- D. Accurately place steel reinforcement in positions shown on Drawings and hold firmly during placing and setting of concrete by means of spacer strips, stays, metal chairs or other approved devices or supports.

- 1. Precast concrete bricks or other types of bricks are not permitted for support of reinforcement in footings, slabs or any other part of Work.
- 2. Space chair and bolster supports for slabs and walls at maximum four-foot centers unless otherwise shown in Drawings.
- 3. Unless otherwise provided, use bar steel reinforcement to support top layers of reinforcing.
- 4. After form removal, clip staple tails from staples used to attach bar supports to wall and roof form.
- 5. Provide one row of continuous bar chairs for support under each row of bar splices.
- E. Tie bars securely at intersections, except where spacing is less than one foot in each direction, when alternate intersections shall be tied.
 - 1. Tying of steel by spot welding is not permitted.
 - 2. Bend tie wire to prevent tie wire from being closer than one inch from surface of concrete.
 - 3. Bundle bars: Tie together at maximum six-foot centers.
- F. Use snap or single ties unless tie fails to securely hold reinforcing steel. If tie fails, saddle or U tie as shown in Figure 1 at no additional expense to OWNER.



3.4 SPLICING

- A. Bar steel reinforcement shall be furnished in full lengths indicated on Drawings.
- B. Splicing of bars, except where shown on Drawings, will not be permitted without written acceptance.
- C. Stagger splices at minimum distance required for lapped splice in bar.
- D. When permission is granted to splice bars, other than those shown on Drawings, provide additional material required for lap at no additional expense to OWNER.
- E. Splices will not be permitted at points where section is not sufficient to provide minimum distance of 2 inches between splice and nearest adjacent bar or surface of concrete.
- F. Sheets of mesh or bar steel reinforcement shall overlap each other sufficiently to maintain uniform strength and securely fasten at ends and edges. Minimum edge lap: one mesh in width.

- G. Welding of reinforcement shall be done only if detailed on the Drawings or if authorized by the ENGINEER in writing.
 - 1. All welded splices shall be direct butt splices.
 - 2. Test 4% of the total number of splices per each bar size, but not less than four splices, by radiographic methods.
- H. When required or permitted in writing by the ENGINEER, a mechanical connection may be used to splice reinforcing steel bars or as substitution for dowel bars.
- I. All splices of lap reinforcement shall be full-contact splices.

3.5 PREPARATION

A. The placing and securing of the reinforcement in any unit or section shall be accepted by the ENGINEER before any concrete is placed in any such unit or section.

3.6 REINFORCING STEEL PLACEMENT REVIEW

- A. A minimum of 48 hours prior to concrete placement a final review of reinforcing steel placement for footings, slabs, columns, and walls of structures, will be performed by the ENGINEER.
- B. Perform a quality control review prior to the ENGINEER's final review to determine the acceptability, completeness and clean-up of any sub-contractors work and overall readiness of the Work for the final review.
- C. If the CONTRACTOR has proceeded to place forms prior to the final review, the CONTRACTOR will be required to remove sufficient forms to permit the visual review of the reinforcing steel and appurtenances such as reinforcing steel supports and chairs and ties at no cost to the OWNER.
- D. CONTRACTOR shall correct any deficiencies with reinforcing steel placement identified by the ENGINEER's at no additional cost to the OWNER.
- 3.7 REBAR DOWEL ANCHORS
 - A. Installation shall be in accordance with section 03 62 00 Nonshrink Grouting

END OF SECTION

SECTION 03 21 50 DOWELING FOR CONCRETE

GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Epoxy adhesives.
 - 2. Vinyl ester adhesives.
 - 3. Anchor rods.

B. Related Sections:

- 1. SECTION 03 21 00 REINFORCING STEEL
- 2. SECTION 03 30 00 CAST-IN-PLACE CONCRETE
- 3. SECTION 03 62 00 NONSHRINK GROUTING

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. C 881/C 881M Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 - 2. C 882/C 882M Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
 - 3. D 648 Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
 - 4. D 695 Standard Test Method for Compressive Properties of Rigid Plastics.
- B. International Conference of Building Officials (ICBO): 1997 Uniform Building Code (UBC-97).
- 1.3 DEFINITIONS
 - A. ICBO Reports: Published by ICBO for concrete anchor manufacturers.
 - B. Special Inspection: As governed by ICBO UBC-97.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data:
 - a. Product and technical data for adhesives, grouts, and bonding agents.
 - b. Current test data indicating cured adhesive meets or exceeds design loads required.
 - c. Mill certification reports for all thread anchors and reinforcing steel bars.
 - d. Material safety data sheets.
 - 2. Shop Drawings:
 - a. All thread anchor dimensions and attributes.
 - b. Reinforcing steel dimensions and attributes, including splice lengths.
- B. Quality Control Submittals:
 - 1. Manufacturer's specific instructions for preparation, placement, drilling of holes, installation of anchors and epoxy or vinyl ester, and handling of cartridges, nozzles, and equipment.
 - 2. Doweling system manufacturer's ICBO Reports.

- 3. Detailed step-by-step instructions for Special Inspection procedure in accordance with ICBO Reports and UBC.
- 4. Copy of manufacturer's operation and repair manuals for each type of equipment delivered to site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Epoxy Components:
 - 1. Store epoxy components on pallets or shelving in a covered storage area.
 - 2. Control temperature above 60°F and dispose of product if shelf life has expired.
 - 3. Dispose of product if stored at other than manufacturer's recommended conditions.
 - 4. Container Markings: Include manufacturer's name, product name, batch number, mix ratio by volume, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.
- B. Vinyl Ester Products:
 - 1. Store components on pallets or shelving in a covered storage area with locking door.
 - 2. Control temperature within 41°F to 77°F and dispose of product if shelf life has expired.
 - 3. Dispose of product if stored at other than manufacturer's recommended conditions.
 - 4. Container Markings: Include manufacturer's name, product name, batch number, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Acceptable Manufacturers:
 - 1. U.S. Anchor Corp.
 - 2. ITW Ramset/Red Head.
 - 3. Hilti, Inc.
 - B. Substitutions:
 - 1. Under provisions of Division 01.

2.2 MATERIALS

- A. Epoxy Adhesives:
 - 1. Source: Anchor-It Fastening Systems, HS 200 Epoxy Resin by U.S. Anchor Corp. or Epcon Ceramic 6 Epoxy Anchor System by ITW Ramset/Red Head.
 - 2. Requirements: Meet ASTM C 881, Type 1, Grade 3, Class A, B, or C, depending on site conditions.
 - 3. Description: Two-component, 100% solids, nonsag, paste, insensitive to moisture, designed to be used in adverse freeze/thaw environments, adequate for horizontal and vertical applications, gray in color.
 - 4. Cure Temperature, Pot Life, and Workability: Compatible for intended use and environmental conditions.
 - 5. Mixing: Follow manufacturer's instructions.
 - 6. Component "A" Base Resin: Modified biphenyl-A type epoxy.
 - a. Viscosity: Light paste, 350 cps maximum prior to mixing to ensure proper wetting of moist concrete surfaces.

- b. Fillers: 100% solids, fumed silica and selected annular micro silica powders. Do not use micro spheres, fly ash, or asbestos.
- c. Color: White.
- 7. Component "B" Hardener or Curing Agent:
 - a. Viscosity: Light paste.
 - b. Fillers: 100% solids, fumed silica and selected annular micro silica powders. Do not use micro spheres, fly ash, or asbestos.
 - c. Color: Black.
- 8. Mixed Epoxy Adhesive:
 - a. Nonsag light paste consistency with ability to remain in a one inch diameter overhead drilled hole without runout, holding the following properties:
 - 1) Slant Shear Strength, ASTM C 881/882, No Failure In Bond Line, Dry/Moist Conditions: 5,000 psi.
 - 2) Compressive Strength, ASTM D 695: 14,000 psi, minimum.
 - 3) Tensile Strength, ASTM D 695: 4,500 psi.
 - 4) Heat Deflection Temperature, ASTM D 648: 135°F, minimum.
- B. Vinyl Ester Adhesives
 - 1. Source: HIT Doweling Anchor System (HIT HY- 150), by Hilti, Inc.
 - 2. Materials:
 - a. Two-component, insensitive to moisture, designed to be installed in adverse freeze/thaw environments.
 - b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.
- C. Anchor Rods
 - 1. Reinforcing Bars: As specified in SECTION 03 21 00.

PART 3 EXECUTION

- 3.1 GENERAL
 - A. Dispensing, Metering, or Mixing Epoxy Adhesive Components: Use portable, automatic metering and mixing device or machine capable of maintaining prescribed mix ratio within deviation of 5% or less, by volume. Do not use epoxy where fire or temperatures above 100°F can occur.
 - B. Install in accordance with manufacturer's specific instructions.
 - C. Dispense components through specially designed static mixing nozzle that thoroughly mixes components and places mixed adhesive at base of predrilled hole.
 - D. Mixing Nozzles:
 - 1. Disposable, manufactured in several sizes to accommodate size of reinforcing dowels.
 - 2. Non-removable internal static mixer required to ensure proper blending of components.
 - E. Where large meter and mixing pumps are impractical, provide adhesive packaged as follows:
 - 1. Disposable, self-contained cartridge system capable of dispensing both components in the proper mixing ratio, and fit into a manually or pneumatically operated caulking gun.

- 2. Dispense components through specially designed static mixing nozzle that thoroughly mixes components and places adhesive at base of predrilled hole.
- 3. Mixing Nozzles:
 - a. Disposable, manufactured in several sizes to accommodate sizes of reinforcing dowels.
 - b. Non-removable internal static mixer required to ensure proper blending of components.

3.2 DOWEL SIZING AND INSTALLATION

- A. Follow adhesive manufacturer's instructions for installation.
- B. Clean each hole prior to epoxy adhesive installation as recommended by manufacturer.
- C. Drilling Equipment:
 - 1. Drilling Hammers for Dowel Holes: Electric or pneumatic rotary type with medium or light impact.
 - 2. Hollow drills with flushing air systems are preferred.
 - 3. Where edge distances are less than 2 inches or thickness is less than 6 inches, use lighter impact equipment to prevent microcracking and concrete spalling during or cracking drilling process.
 - 4. When existing reinforcing is encountered, core drill holes.
- D. Hole Diameter: As recommended by manufacturer. Use drill bit diameter meeting ICBO Report requirements and as recommended by manufacturer.
- E. Meet ICBO Report requirements and recommendations by manufacturer.
- F. Obstructions in Drill Path:
 - 1. When existing reinforcing steel is encountered during drilling, redrill hole one inch from original location, redirecting the drill to miss reinforcing steel.
 - 2. Fill misdrilled hole completely with nonshrink grout complying with SECTION 03 62 00, or patching mortar complying with SECTION 03 30 00.
 - 3. When using epoxy anchors, dowels may be bent prior to installation up to 15 degrees to align with other bars. Do not heat dowels to bend.
 - 4. If bars have fused epoxy coating and coating is damaged, recoat damaged area with epoxy.
 - 5. Bent Bar Dowels: Where edge distances are critical, and striking reinforcing steel is likely, drill hole at 10-degree angle or less and use prebent reinforcing bars.

3.3 FIELD QUALITY CONTROL

- A. Automatic Metering and Mixing Devices:
 - 1. Tests for Proper Ratio:
 - a. Retain small amount of dispensed adhesive for inspection after each time the pump is refilled.
 - b. Check these Samples for color change.
 - c. Should change in color occur, follow manufacturer's service instructions to obtain proper operation.
 - 2. Frequency of Tests: Make full ratio check after each 100 gallons of adhesive is dispensed or if color of mixed adhesive becomes noticeably darker or lighter.
 - 3. Ratio Check Procedure:
 - a. Disconnect dispensing head behind ON/OFF valve.
 - b. Place volume containers of the required proportions under the "B" and "A" component hose ends.

- Actuate the pump. C.
- d. Both cups should fill in an equal time, thereby verifying the proportion ratio by volume.
- Β. All Thread Anchors:
 - 1. Small scall pull test:
 - Size: 12 inches x 12 inches x 1/2 inch steel sheet assembly. a.
 - Test epoxy adhesive, plug weld and all thread anchor adequacy. b.
 - Perform two tests each in presence of ENGINEER; one set on flat floor C. and other set on sloped floor in approved locations.
 - Provide additional test on each surface if test results are not 1) within 10% of each other or if any component of test fails. 2)
 - Provide results for evaluation.
 - d. Install with predrilled and countersunk hole, epoxy adhesive and full size all thread anchor in properly drilled hole in existing concrete.
 - e. Finish with plug welding as required for full scale assembly.
 - Force: 3750 pounds for minimum of 5 minutes. f.
 - Provide approved devices, mechanism and gauges. g.
 - Provide written documentation: h.
 - Pressure exerted. 1)
 - 2) Location, date, ambient air temperature and surface conditions.
 - Cut, remove and dispose of assemblies after test. i.

END OF SECTION

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Cast-in-place concrete for slabs on grade, structured slabs.
- B. Related Sections:
 - 1. SECTION 01 45 16 MATERIALS TESTING
 - 2. SECTION 03 10 00 CONCRETE FORMING
 - 3. SECTION 03 39 00 CONCRETE CURING
 - 4. SECTION 03 68 00 CONCRETE CRACK REPAIR

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
 - 2. 301 Specifications for Structural Concrete.
 - 3. 302.1R Guide for Concrete Floor and Slab Construction.
 - 4. 304 Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 - 5. 305 Hot Weather Concreting.
 - 6. 306 Cold Weather Concreting.
 - 7. 309 Guide for Consolidation of Concrete.
 - 8. 318 Building Code Requirements for Reinforced Concrete.
 - 9. 350 Code Requirements for Environmental Engineering Concrete Structures and Commentary
- B. American Society for Testing and Materials (ASTM):
 - 1. C 31 Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. C 33 Standard Specification for Concrete Aggregates.
 - 3. C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. C 88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 - 5. C 94 Standard Specification for Ready-Mixed Concrete.
 - 6. C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate.
 - 7. C 143 Standard Test Method for Slump of Hydraulic Cement Concrete.
 - 8. C 150 Standard Specification for Portland Cement.
 - 9. C 192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
 - 10. C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 11. C 260 Standard Specification for Air-Entraining Admixtures for Concrete.
 - 12. C 295 Standard Guide for Petrographic Examination of Aggregates for Concrete.
 - 13. C 311 Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete.
 - 14. C 494 Standard Specification for Chemical Admixtures for Concrete.
 - 15. C 618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

- 16. C 1260 Standard Test Method for Potential Alkalai Reactivity of Aggregates (Mortar Bar Method).
- C. National Institute of Standards and Technology (NIST): Handbook No. 44, Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices.

1.3 DEFINITIONS

- A. Defective Areas: Surface defects that include honeycomb, rock pockets, indentations, cracks 0.015-inch wide and larger, and cracks that leak in water-holding basins, spalls, chips, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form popouts, texture irregularities, and stains that cannot be removed by cleaning.
- B. Field Test Data: Compressive strength data taken from concrete delivered and used for construction.
- C. Lab Test Data: Compressive strength data taken from trial mixes produced in a laboratory.
- D. New Concrete: Less than 60 days old.

1.4 SUBMITTALS

- A. Material Submittals:
 - 1. Product Data:
 - a. Portland cement.
 - b. Fly ash.
 - c. Cylinder test reports from field data.
 - d. Admixtures.
 - e. Bonding agent.
 - f. Bond breaker.
 - g. Patching materials.
 - 2. Design Data:
 - a. Concrete mix designs signed by qualified mix designer.
 - 3. Aggregate:
 - a. Gradation for coarse and fine aggregates in accordance with ASTM C 136.
 - 4. Placement Drawings:
 - a. Concrete, identifying location of each type of joint and placement sequence.
 - 5. Detailed work plans:
 - a. Cold weather curing and protection of concrete placed and cured in weather below 40°F.
 - b. Hot weather placements including curing and protection for all concrete placed in ambient temperatures over 80°F.
 - c. Pumping concrete, identifying pump location and placing sequence.
 - d. Methods to be used to limit free fall distance through wall forms to the requirements of this specification.
 - 6. Repair methods:
 - a. Water-holding structure.
 - b. Surface finish.
 - c. Honeycomb, rock pockets, and bug holes.
 - d. Application schedule and instructions for patching materials and blending to match adjacent concrete.

- B. Quality Control Submittals:
 - 1. Test Reports:
 - a. Admixtures: Test reports showing chemical ingredients and percentage of chloride in each admixture and fly ash.
 - b. Source test analysis report for fly ash.
 - c. For each trial mix design and signed by qualified mix designer.
 - d. Cylinder test results from laboratory mixes.
 - 2. Concrete Delivery Tickets: In accordance with ASTM C 94.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Mix Design: In accordance with ACI 301 and ACI 318.
 - 2. Epoxy Injection Installers: In accordance with SECTION 03 68 00.

PART 2 PRODUCTS

- 2.1 CONCRETE MATERIALS
 - A. Cementitious Materials:
 - 1. Cement:
 - a. Type II Portland cement conforming to ASTM C 150.
 - 2. Fly ash:
 - a. Class C or Class F fly ash conforming to ASTM C 618.
 - b. Make fly ash additions to mix on cement substitution basis in accordance with ASTM C 618.
 - c. Maximum allowable amount of fly ash: 20% by weight of total cementitious materials.
 - B. Aggregates:
 - 1. General:
 - a. Furnish from one source.
 - b. Natural aggregates:
 - 1) Free from deleterious coatings and substances in accordance with ASTM C 33, except as modified herein.
 - 2) Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
 - c. Alkalai reactivity of aggregates:
 - 1) In accordance with ASTM C 33, Appendix, paragraph X1.3.4.
 - 2) Tested for reactivity in accordance with ASTM C 1260.
 - 3) Maximum of 0.10% expansion for any aggregate product used in Portland cement concrete.
 - d. Aggregate soundness:
 - 1) Test fine and coarse aggregates per ASTM C 33.
 - 2) Test fine and coarse aggregates per ASTM C 88 using sodium sulfate solution.
 - 2. Fine aggregates:
 - a. Natural sand or blend of natural sand and crushed sand.
 - b. Crushed sand must be less than 50% of the total sand by dry weight.
 - c. Fine aggregates shall conform to the grading and quality requirements of ASTM C 33.
 - d. Except where otherwise designated or approved fine aggregates shall be between 36% and 44% by volume of the total aggregates in the concrete.
 - e. Total materials passing No. 200 sieve: 4% maximum.

- f. Deleterious substances:
 - 1) Table 1, ASTM C 33.
 - 2) 3% or less total deleterious material finer than No. 200 sieve.
 - 3) 0.5% or less coal and lignite.
- 3. Coarse aggregate:
 - a. Natural gravels or crushed stone.
 - b. Conform to grading and quality requirements of ASTM C 33 for size No. 57, No. 67, or No. 467.
 - c. Nominal maximum size of coarse aggregate: ACI 318/318R.
 - d. Limit deleterious substances in accordance with ASTM C 33, Table 3 for exposed concrete.
 - e. If aggregates used are known to be reactive with high alkali cement, as determined by ASTM C 295, or if reactivity of aggregates is not known, use low alkali cement as defined in ASTM C 150, Table 2 to ensure adequate protection from potential alkali-aggregate reaction.
- C. Admixtures:
 - 1. General:
 - a. Furnish from one manufacturer.
 - b. CONTRACTOR assumes responsibility for damage or difficulties occurring as result of use of admixtures; additional compensation due to such difficulties not permitted.
 - c. Use of admixtures does not relieve CONTRACTOR of responsibility for protection and curing of concrete.
 - d. Compatible with other admixtures.
 - e. Free of chlorides or other corrosive chemicals.
 - f. Do not use calcium chloride.
 - 2. Air entraining admixture:
 - a. ASTM C 260, nontoxic after 30 days.
 - b. Use air entraining agent in all concrete.
 - c. Add to batch in accordance with ASTM C 94.
 - d. Maintain air percentage as batched, within plus or minus 1.5%, for time required for placement into structure.
 - 3. Water reducing admixtures: ASTM C 494, Type A or D.
 - 4. High range water reducing admixtures:
 - a. Use only where specified or directed by ENGINEER.
 - b. ASTM C 494, Type F or G.
 - c. Furnish type recommended by manufacturer for allowable temperature ranges.
 - 5. Shrinkage reducing admixtures: Not permitted.
- D. Water: ASTM C 94.

2.2 ACCESSORIES

- A. Crack Repair Epoxy: Refer to SECTION 03 68 00 .
- B. Bonding Agent: 2-component type as recommended by manufacturer for surface finish, pot life, set time, vertical or horizontal application, and forming restrictions.
- C. Bond Breaker: Nonstaining type, providing positive bond prevention.
- D. Patching Material:
 - 1. Free from chlorides and other chemicals causing steel corrosion.
 - 2. Low pressure silica fume mortar or polymer modified mortar: EMACO as manufactured by Master Builders Co.
 - 3. No Liquid Storage: EMACO R-Series.

4. For Liquid Storage: EMACO S-Series.

2.3 CONCRETE MIX DESIGN

- A. Design:
 - 1. Submit mix designs in accordance with ACI 301, Section 4.
 - 2. Field test data for mix design proportions are acceptable; proportions based on trial mixtures are not acceptable.
 - 3. Water/cement plus pozzolans ratio (w/(c+p)): Control allowable water addition to mix; do not exceed w/(c+p) ratio.
- B. Mixes:
 - 1. Structural Concrete, Concrete Backfill (CDOT Class D):
 - a. Minimum 28 day compressive strength: 4,500 psi when molded and cured in compliance with ASTM C 31.
 - b. Minimum cement content: 615 to 660 pounds per cubic yard.
 - c. Maximum w/(c+p) ratio: 0.44.
 - d. Slump: 3-6 inches when measured per ASTM C 143, except 4.5 to 8 inches if high range water reducing admixture is used.
 - e. Air content: 5 to 8% of volume of batch, tested per ASTM C 231.
 - 2. Slush Grout
 - a. Slush grout shall consist of cement and water with a Minimum 28-day compressive strength: 1,500 psi.
 - b. Slush grout shall have a Marsh Funnel time between 26 and 30 seconds in accordance with API RP 1313-1.
 - c. Slush grout shall be composed of Portland cement, bentonite, sand and water.
 - d. The ratios of the materials may vary as approved by the ENGINEER, but the ratio of sand to cement shall not exceed 2 parts sand to 1 part cement. The ratio of bentonite to cement shall be approximately 2 pounds of 200-mesh bentonite per sack of cement.
 - e. Adequate water shall be mixed thoroughly into the grout to produce a workable mixture for proper placement as approved by the ENGINEER. The range of water cement ratio by volume will range from 0.6:1 to 1:1 depending on the width of cracks and joints requiring grouting.
 - f. The sand shall be well graded with 100% passing the No. 4 sieve and a maximum of 5% passing the No. 100 sieve.
 - g. The filling of cracks smaller than about ¼ inch shall be done with a mix only of cement, bentonite and water. The grout mixture shall be prepared by mechanical mixer and shall be used within ½ hour after mixing.
 - h. Use in Special Foundation Treatment. See SECTION 31 23 13
- C. Proportions:
 - 1. Design mix to meet aesthetic and structural concrete requirements.
 - 2. Proportion per ACI 211.1, unless specified otherwise.
- 2.4 CONCRETE MIXING
 - A. Ready Mixed Concrete: ASTM C 94.
 - B. Production inspection and field testing of approved mix will be made by ENGINEER.
 - C. Do not make changes in amounts or sources of approved mix ingredients without written approval of ENGINEER.

- D. Concrete mix temperatures: ACI 306R (cold weather) and ACI 305 (hot weather).
- E. Reverse rotation on drum of truck mixers to discharge wash water prior to charging mixer.
- F. Add admixtures in accordance to ASTM C 94 and manufacturer's instructions.
- G. Furnish electronically generated batch ticket with each truck; concrete delivered without a batch ticket will be rejected.
 - 1. Deliver batch tickets to ENGINEER.
 - 2. Provide access for ENGINEER to batch tickets at all times during placements, and retain copy for record.
- H. Include following minimum information on batch tickets:
 - 1. Supplier's name and date.
 - 2. Truck number.
 - 3. Project name and location.
 - 4. Concrete class designation.
 - 5. Cubic yards batched.
 - 6. Time batched.
 - 7. Mix design number.
 - 8. Type, brand, and quantity of each admixture.
 - 9. Type, brand, and quantity of cement and fly ash.
 - 10. Weights of fine and coarse aggregates.
 - 11. Moisture of fine and coarse aggregates.
 - 12. Gallons of water batched (including ice).
- I. Add following information to batch ticket at placement site:
 - 1. Gallons of water added by truck operator.
 - 2. Number of revolutions of drum at mixing speed.
 - 3. Discharge time.
 - 4. Location of batch in placement.
- 2.5 SOURCE QUALITY CONTROL
 - A. Test cement for total chloride content.
 - B. Test fly ash in accordance with ASTM C 311.
 - C. Batch Plant Inspection:
 - 1. Weighing scales: Tested and certified within tolerances per NIST Handbook No. 44.
 - 2. Batch plant equipment: Semiautomatic or fully automatic per ASTM C 94.
 - 3. Central mixed concrete only per ASTM C 94.

PART 3 EXECUTION

- 3.1 PREPLACEMENT PREPARATION
 - A. General
 - 1. Place concrete in presence of ENGINEER.
 - 2. Meet requirements and recommendations of ACI 304R and ACI 301, except as modified herein.
 - 3. Secure reinforcement in position before placing concrete.

- 4. Clean form surfaces and embedded items of foreign material prior to placing concrete.
- 5. Remove water and debris from spaces to be occupied by concrete.
- 6. Inspection:
 - a. Notify ENGINEER at least 24 hours in advance of concrete placement.
 - b. Do not place concrete until forms, reinforcing steel, and cleanup methods have been approved by ENGINEER.
 - c. Notify ENGINEER when reinforcing is ready for inspection and allow sufficient time for inspection prior to placing concrete.

3.2 CONCRETE PLACEMENT

- A. Discharge Time:
 - 1. Do not exceed 90 minutes after adding cementitious materials to water unless approved time delay admixtures are used.
 - 2. Coordinate information with admixture manufacturer and ENGINEER prior to placing concrete.
- B. Placement into Formwork:
 - 1. Concrete shall not be placed on frozen subgrade or into forms with temperatures less than 34°F.
 - 2. Prior to placement of concrete:
 - a. Dampen and densify subgrade under concrete to be placed on granular soils.
 - b. Dampen wood forms.
 - 3. Place concrete as soon as possible after leaving mixer.
 - 4. Place without segregation or loss of ingredients.
 - 5. Place without splashing forms or steel above.
 - 6. Place in layers not over 18 inches deep, except place slabs full depth.
 - 7. Place and consolidate successive layers prior to initial set of first layer to prevent cold joints.
 - 8. Place concrete so that plastic concrete flows readily between reinforcing steel and other embedded items.
 - 9. Do not place concrete that has partially hardened or is contaminated by foreign materials.
 - 10. Use placement devices, including chutes, pouring spouts, and pumps.
 - 11. Vertical free fall drop to final placement:
 - a. 5 feet in forms, 8 inches or less wide and 8 feet in forms wider than 8 inches, except as otherwise specified.
 - b. Self consolidating mixes: Up to 15 feet if slump is over 6 inches.
 - c. For placements where drops are greater than specified distance, use placement device so that free fall below placement device conforms to required value.
 - d. Limit free fall to prevent segregation caused by aggregates hitting reinforcing steel or other embedded items.
 - 12. Do not use aluminum conveying devices.
 - 13. Provide illumination of interior of forms so that interior spaces of forms are visible.
 - 14. Waterstop:
 - a. Ensure space beneath plastic waterstop completely fills with concrete.
 - b. During concrete placement, make visual inspection of entire waterstop area.
 - c. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, place remaining concrete to full height of slab.
 - d. Apply procedure to full length of waterstops.

- 15. Prevent accumulation of water on surface of concrete due to water gain or other causes during placement and consolidation by adjustments in mix design.
- 16. Round off top exposed edges of walls with a 1/4-inch radius steel edging tool.
- 17. Pipe encasement will not be poured all at once. Time allowed for shrinkage shall be determined by the ENGINEER based on the conditions during the time of the pour.
- C. Conveyor Belts and Chutes:
 - 1. Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system for concrete to pass without becoming segregated.
 - 2. Do not use chutes longer than 50 feet.
 - 3. Angle chutes to allow concrete to readily flow without segregation with as little slope as possible.
 - 4. Conveyor belts:
 - a. Approved by ENGINEER.
 - b. Wipe clean with device which does not allow mortar to adhere to belt.
 - c. Cover conveyor belts and chutes.
- D. Addition of Water at Site:
 - 1. Permitted only once and within 60 minutes of initial batching.
 - 2. Do not exceed w/(c+p) ratio of mix.
 - 3. If hydration stabilizing admixtures are used, submit brand, type and anticipated dosage rates to ENGINEER prior to placement.
 - 4. Provide accurate means to determine and measure volume of water added to mix.
- E. Consolidation and Visual Observation:
 - 1. Consolidate concrete in accordance with ACI 309R.
 - 2. Provide the proper size, type and number of vibrators to be used for each concrete placement.
 - 3. Consolidate concrete with internal vibrators with minimum frequency of 8,000 cycles per minute and amplitude required to consolidate concrete in section being placed.
 - 4. Provide minimum of one standby vibrator for every two vibrators in operable condition at placement site prior to placing concrete.
 - 5. Provide windows in forms or limit form height to allow for concrete placement through windows and for visual observation of concrete.
 - 6. Do not use vibration (consolidation) to move concrete laterally within forms.
 - 7. Vibrate concrete in vicinity of joints to obtain impervious concrete.
 - 8. Thoroughly work concrete around reinforcing steel and other embedded items, and into corners of forms.
 - 9. Supplement vibrators by spading, rodding or forking to eliminate honeycombing at form face and voids around embedded items.
 - 10. Penetrate vibrator minimum 6 inches into previous lift.
- F. Curing: Refer to SECTION 03 39 00.

3.3 GENERAL PLACEMENT SPECIFICATIONS

- A. Maximum Size of Concrete Placements:
 - 1. Limit size of each placement to allow for strength gain and volume change due to shrinkage.
 - 2. Construction joints:
 - a. Place joints at locations shown on Drawings as minimum.

- b. Where construction joints are not shown, provide where shown on ENGINEER-reviewed placement drawings and in accordance with Contract Documents.
- c. Location, size and configuration of construction joints will be subject to acceptance of ENGINEER.
- d. Space joints to limit size of placements to allow for volume change from shrinkage and to minimize potential of restraint and shrinkage cracking.
- e. No horizontal joints are permitted in walls of water retaining structures.
- f. Keyways:
 - 1) When shown in Drawings, key construction joints at right angle to direction of shear.
 - 2) Except where otherwise shown on Drawings, keyways shall be minimum 1-1/2 inches in depth over at least 25% area of section.
- 3. Consider beams, girders, brackets, column capitals, and haunches as part of floor or roof system and place monolithically with floor or roof system.
- 4. If placement sequence results in cold joint located below finished water surface, install waterstop in joint.
- B. Free fall of concrete placed in wall forms shall be limited to 5 feet or less. Tremies, pump hoses, or other Engineer Approved methods shall be used to limit the free fall height. CONTRACTOR proposed methods for limited free fall shall be discussed in the concrete placement plan submitted for review.
- C. Minimum Time between Adjacent Placements:
 - 1. Do not place adjacent concrete until previous placement has attained 70% of specified 28 day compressive strength or 7 days, whichever is shorter unless approved in writing by Engineer.
 - 2. Notify ENGINEER if adjacent placements are planned so that field cylinders can be taken from previous placement for verification of strength requirements.
- D. Hot Weather:
 - 1. Conform to ACI 305R.
 - 2. Maintain concrete temperature below 90°F at time of placement.
 - 3. Ingredients may be cooled before mixing. Method of cooling concrete to conform to ACI 305R and be approved by ENGINEER.
 - 4. When rate of surface evaporation approaches 0.20 pounds per square foot per hour for non-fly ash concrete mixes, and 0.15 pounds per square foot per hour for concrete mixes containing more than 15% fly ash as estimated by ENGINEER from ACI 305R, Figure 2.1.5, make provisions for windbreaks, shading, fog spraying, sprinkling, ice, or wet cover as required by ENGINEER before and during concrete placement
 - 5. If rate of evaporation approaches 0.20 pounds per square foot per hour as estimated by ACI 305R, precautions against plastic shrinkage are required.
 - 6. Provide recording thermometer, hygrometer and wind gage in operating condition on site 7 days prior to first concrete placement.
 - 7. Precautions against plastic shrinkage cracks may be required in conditions other than what is normally considered hot weather conditions.
 - 8. If reinforcement is in direct sunlight or is more than 20°F higher in temperature than concrete temperature before placement, wet reinforcement with water fog spray before placing concrete to cool reinforcement.
 - 9. Do not cool plastic concrete mixtures without approval of ENGINEER.
 - 10. Evaporation retardant: Refer to SECTION 03 39 00.
- E. Cold Weather:
 - 1. Do not place concrete against frozen earth or ice, or against forms and reinforcement with frost or ice present.

- 2. Prevent carbonation on unprotected new concrete surfaces.
- 3. Conform to methods in ACI 306, including maintaining temperature of concrete as specified.
- 4. Provide maximum and minimum thermometers placed on concrete surfaces spaced throughout Work to allow monitoring of concrete surface temperatures representative of Work.
- 5. Maintain concrete temperature above 55°F at time of placement.
- 6. Maintain concrete temperature between 55 and 70°F for entire curing period.
- 7. External heating units:
 - a. Provide heated enclosures when air temperatures are below 40°F.
 - b. Vent heating units to atmosphere, and do not locally heat or dry concrete. Where water cure is specified, maintain wet condition.
 - c. Do not exhaust flue gases directly into enclosed area.
 - d. Furnish external heating units as necessary at no additional cost to the OWNER.
- 8. Do not warm plastic concrete mixtures without approval of ENGINEER.
- 9. Maintain curing conditions as specified in SECTION 03 39 00.

3.4 CONSTRUCTION JOINTS

- A. Surface Preparation:
 - 1. Mechanically roughen concrete to produce minimum roughness profile of 1/4 inch.
 - 2. Do not roughen areas to which hydrophilic waterstops will be bonded.
 - 3. Clean surface of concrete construction joints and remove materials that inhibit bond.
 - 4. Wet existing concrete surfaces with clean potable water and saturate for 24 hours prior to placing new concrete.
 - 5. Remove standing water immediately before new concrete is placed.
 - 6. Expose clean aggregate by abrasive blast cleaning; wire brushing and air water jets may be used while concrete is fresh provided results are equal to abrasive blast cleaning.
 - 7. Apply bonding agent to existing concrete surfaces unless otherwise indicated in the DRAWINGS.
- B. Wall Horizontal Construction Joints: Prior to placing concrete, apply grout for horizontal construction joints per SECTION 03 62 00.
- C. Construction Review:
 - 1. ENGINEER shall review preparation of all construction joints prior to concrete placement.
 - 2. Notify and provide minimum 24 hours notice to ENGINEER for review.
 - 3. If joint placement is performed without ENGINEER's presence, Work will be deemed unacceptable and non-conforming.
 - 4. If ENGINEER determines that construction review of a particular activity is unnecessary, he will provide written direction to CONTRACTOR to proceed with that particular activity without construction review.

3.5 PIPE PENETRATIONS

A. Unless otherwise detailed in Drawings, completely remove coatings, such as tape coating or paint and other materials, that can inhibit bond from portion of pipe to be in contact with concrete.

3.6 PATCHING

- A. General:
 - 1. Where indicated, inject cracks with crack repair epoxy in accordance with SECTION 03 68 00.
 - 2. Prior to starting patching work, obtain quantities of color-matched patching material and manufacturer's detailed instructions for use.
 - 3. Provide structural patch with finish to match adjacent surface.
 - 4. Dress surface of patches that will remain exposed to view to match color and texture of adjacent surfaces by using supplemental materials furnished by manufacturer for such purposes or by rubbing area until match is obtained.
 - 5. Patch concrete to provide structurally sound surface finish, uniform in appearance.
 - 6. Repair surface defects including fins, tie holes and honeycombed areas down to solid concrete in accordance with ACI 301.
- B. Tie Holes:
 - 1. Fill with Category I or II grout per SECTION 03 62 00, except where sealant is shown; use only enough water to dry pack.
 - 2. For areas exposed to view and not receiving sack rubbed finish, blend to color and texture of adjacent concrete.
 - 3. Compact grout using steel hammer and steel tool to drive grout to high density.
 - 4. Cure grout for 7 days minimum.
- C. Alternate Form Ties-Through-Bolts:
 - 1. Seal through-bolt hole by sandblasting or mechanically cleaning and roughening entire interior surface of hole.
 - 2. Epoxy coat roughened surface.
 - 3. Drive elastic vinyl plug and then dry packing entire hole on each side of plug with Category II grout per SECTION 03 62 00. Use only enough water to dry pack grout.
 - 4. Dry pack while epoxy is still tacky or remove epoxy by mechanical means and reapply new epoxy.
 - 5. Compact grout using steel hammer and steel tool to drive grout to high density.
 - 6. Cure grout for 7 days minimum.
- D. Defective Areas:
 - 1. Remove defective concrete to a depth of sound concrete.
 - 2. Small infrequent shallow holes caused by air entrapment at surface of forms will not be considered defective.
 - 3. If chipping is required, make edges perpendicular or undercut to surface with minimum of 1/2 inch in depth. Do not feather edges. Obtain ENGINEER's approval of chipping work.
 - 4. Patch defective area to match appearance of adjacent concrete surfaces after cracks are filled.
- E. Blockouts at Penetrations:
 - 1. Conform to details indicated on Drawings, or submit proposed blockouts for review and approval of ENGINEER.
 - 2. Use nonshrink, nonmetallic grout, Category I or II as specified in SECTION 03 62 00.

3.7 CONCRETE WALL FINISHES

- A. Type W-1 (Ordinary Wall Finish):
 - 1. Patch tie holes.
 - 2. Knock off projections.
 - 3. Patch defective areas.
- B. Type W-2 (Finish for Waterbearing Surfaces):
 - 1. Fill cracks by epoxy injection.
 - 2. Patch tie holes.
 - 3. Knock off projections.
 - 4. Patch defective areas.
- 3.8 CONCRETE SLAB FINISHES
 - A. General:
 - 1. Finish slab concrete in accordance with ACI 302.1R.
 - 2. Do not use "jitterbugs" or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar to accumulate.
 - 3. Do not dust surfaces with dry materials.
 - 4. Round off edges of slabs with steel edging tool, except where cove finish is shown.
 - 5. Provide steel edging tool radius of 1/4 inch for slabs subject to wheeled traffic.
 - 6. Use evaporation retardant only where specifically approved by ENGINEER. Where approved for use, follow manufacturer's instructions and precautions.
 - 7. Do not apply water to concrete surface during any phase of finishing operations.
 - 8. Do not perform concrete finishing while water is present on surface.
 - B. Type S-1 (Steel Troweled Finish):
 - 1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation.
 - 2. While concrete is still green but sufficiently hardened to bear a person's weight without deep imprint, wood float to true, even plane without visible coarse aggregate.
 - 3. Use sufficient pressure on wood floats to bring moisture to surface.
 - 4. After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.
 - 5. Burnish surface with an additional troweling.
 - 6. Final troweling to produce ringing sound from trowel.
 - 7. Do not use dry cement or additional water during troweling, nor excessively trowel.
 - 8. Power finishing:
 - a. An approved power machine may be used in lieu of hand finishing in accordance with directions of machine manufacturer.
 - b. Do not use power machine when concrete has not attained necessary set to allow finishing without introducing high and low spots in slab.
 - C. Type S-3 (Underside Elevated Slab Finish): When forming is removed, grind off projections on underside of slab and patch defective areas.
 - D. Type S-5 (Broomed Finish): Finish as specified for Type S-1 floor finish except omit final troweling and finish surface by drawing fine-hair broom lightly across surface to surface finish acceptable to ENGINEER.
 - 1. Broom in same direction and parallel to expansion joints.

2. On inclined slabs, broom perpendicular to slope except for round slabs, broom surface in radial direction.

3.9 BACKFILL AGAINST WALLS

- A. Do not backfill against walls until concrete has obtained specified 28-day compressive strength.
- B. Place backfill simultaneously on both sides of wall, where required, to prevent differential pressures.

3.10 FIELD QUALITY CONTROL

A. General:

- 1. Field quality control will be performed by OWNER.
- 2. Provide access, cooperation, and incidental labor required by OWNER to obtain specimens, perform tests, and conduct inspections.
- 3. Provide facilities for safe storage and proper curing of concrete test cylinders onsite for first 48 hours, and for additional time as required before transporting to testing laboratory.
- 4. Provide concrete for testing of slump, air content, and for making cylinders from point of discharge into forms.
- 5. Evaluation will be per ACI 301, Chapter 17 and Specifications. Where term "building official" is used, term shall be redefined to ENGINEER.
- 6. Specimens will be made, cured, and tested in accordance with ASTM C 31 and ASTM C 39.
- 7. Pumped concrete: Take concrete samples for slump (ASTM C 143) and test cylinders (ASTM C 31 and C 39).
- 8. CONTRACTOR shall assist in obtaining samples and provide undisturbed testing areas with 120V AC power.
- B. Compression Test Specimens:
 - 1. Tests will be performed by ENGINEER.
 - 2. Specimens will be fabricated, cured, and tested per ASTM C 192.
 - 3. One specimen will be tested at 7 days and two at 28 days. One specimen will be retained for later break date.
- C. Testing Schedule and Frequency:
 - 1. Concrete field and laboratory testing will be performed by the ENGINEER according to the schedule shown in the following chart:

Test	Frequency	
Slump	One per truck	
Air Content	One per truck	
Compression Test Specimens	Every 50 cubic yards of concrete placed per mix, per day; minimum of one set per concrete placement	

- 2. If any air entraining admixtures or water is added at the site the mix will be retested. Compression test specimens shall be prepared after the addition of any such material at the site.
- 3. Frequency of testing may be changed at the discretion of the ENGINEER.
- D. Enforcement of Strength Requirements:

- 1. Should strengths shown by laboratory cured test cylinders made and tested in accordance with provisions of Standard Specifications and evaluated by methods per ACI 318/318R fall below specified values, ENGINEER may require changes in proportions of concrete mix used on remainder of Work.
- 2. ENGINEER may require CONTRACTOR to provide minimum of three cores drilled per ASTM C 42 and tested for compressive strength per ASTM C 39 for each portion of Work in which laboratory cured concrete test cylinders indicate failure to meet specified strength requirements within the specified time period.
- 3. ENGINEER may require CONTRACTOR to remove and replace areas determined to be defective.
- E. Tolerances:
 - 1. Walls: Measure and inspect walls for compliance with tolerances specified in SECTION 03 10 00.
 - 2. Slabs:
 - a. Floor flatness measurements will be made the day after floor is finished and before shoring is removed, to eliminate effects of shrinkage, curing, and deflection.
 - b. Support 10 foot long straightedge at each end with steel gauge blocks of thicknesses equal to specified tolerance.
 - c. Compliance with designated limits specified in SECTION 03 10 00 in four of five consecutive measurements is satisfactory unless defective conditions are observed.

3.11 MANUFACTURERS' SERVICES

- A. Provide following representatives at site in accordance with SECTION 01 44 33, for installation assistance, inspection and certification of proper installation for concrete ingredients, mix design, mixing, and placement.
 - 1. Batch Plant Representative:
 - a. Observe how concrete mixes are performing.
 - b. Observe first placement of each type of concrete mix.
 - c. Assist with concrete mix design, performance, placement, weather problems, and problems with concrete mix throughout Project.
 - d. Establish control limits on concrete mix designs.

3.12 PROTECTION OF INSTALLED WORK

- A. After curing as specified in SECTION 03 39 00, and after applying final floor finish, cover slabs with plywood or particle board or plastic sheeting or other material to keep floor clean and protect it from material and damage due to other construction work.
- B. Patch and repair defective areas and areas damaged by construction at no additional cost to the OWNER.

3.13 SCHEDULE OF CONCRETE FINISHES

A. Provide concrete finishes as scheduled:

Structure/Location	Type of Finish
Capsule Walls	W-2
Trashrack Walls	W-1
Grade Beam, sides	W-1
Grade Beam, top	S-5
Capsule roof, top	S-1, w/epoxy grouting of cracks

Capsule roof, underside	S-3
Main Structure Slab	S-5

END OF SECTION

SECTION 03 39 00 CONCRETE CURING

PART 1 GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Concrete Curing.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 305 Hot Weather Concreting.
 - 2. 306 Cold Weather Concreting.
 - 3. 308 Standard Practice for Curing Concrete.
- B. American Society for Testing Materials (ASTM):
 - 1. C 309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 2. C 1315, Standard Specification for Liquid Membrane Forming Compounds. Having Special Properties for Curing and Sealing Concrete.
 - 3. D 2103 Polyethylene Film and Sheeting.
- 1.3 SUBMITTALS
 - A. Submittals for Review:
 - 1. Product Data:
 - a. Evaporation retardant.
 - b. Curing compound.
 - c. Clear floor sealer/hardener.
 - 2. Shop Drawings: Show curing methods proposed.
 - B. Quality Control Submittals:
 - 1. Curing Compound: Manufacturer's Certificate of Compliance showing moisture retention requirements.

PART 2 PRODUCTS

- 2.1 MATERIALS
 - A. White burlap-polyethylene sheet (Burlene):
 - 1. Minimum weight: 10 ounces/linear yard.
 - 2. Minimum width: 40 inches.
 - 3. Polyethylene:
 - a. Securely bonded to burlap with no separation.
 - b. Minimum thickness: 0.004 inches in accordance with ASTM D 2103.
 - B. Curing Compound:
 - 1. Sources:
 - a. Kure 1315 by BASF Building Systems.
 - b. Super Diamond Clear VOX by Euclid Chemical Co.

- 2. Description: Water-based, high solids content, non-yellowing curing compound meeting requirements of ASTM C 309 and ASTM C 1315.
 - a. Moisture Loss: 0.55 kg/m² in 72 hours.
 - b. Capable of meeting moisture retention at manufacturer's specified application rate.
- C. Evaporation Retardant:
 - 1. Sources:
 - a. CONFILM by BASF Building Systems.
 - b. Eucobar by Euclid Chemical Co.
 - 2. Description: Fluorescent color tint that disappears completely upon drying.
 - 3. Use only with written approval.
- D. Clear floor Sealer/Hardener
 - 1. Sources:
 - a. Eucosil by Euclid Chemical Co.
 - b. Kure-N-Harden by BASF Building Systems.
 - 2. Description: Colorless, inorganic silicate-based compound manufactured specifically to harden, seal and dustproof concrete surfaces.
 - 3. Do not use sealer/hardener as curing compound. Prior to application, water cure concrete surfaces to receive sealer/hardener as specified.
- E. Water: Clean and potable, containing less than 50 ppm chlorides.

PART 3 EXECUTION

- 3.1 CURING OF CONCRETE
 - A. GENERAL
 - 1. Cure concrete in accordance with ACI 305, 306, and 308 as applicable.
 - B. Submit method for approval for each of the following:
 - 1. Walls, Beams, and Columns:
 - a. General: Where walls, beams or columns are to receive coatings, painting, cementitious material, or other similar finishes, or where solvent-based coatings are not permitted, use only water curing procedures.
 - b. Method 1:
 - 1) Leave concrete forms in place.
 - 2) Keep entire surfaces of forms and concrete wet for 7 days.
 - c. Method 2:
 - 1) Apply curing compound, where allowed, immediately after removal of forms.
 - d. Method 3:
 - 1) Continuously sprinkle with water 100% of exposed surfaces for 7 days starting immediately after removal of forms.
 - 2. Slabs and Curbs:
 - a. Commence concrete curing of slabs and curbs immediately after final finishing so as not to damage surface.
 - b. Method 1: Protect surface by water ponding with water maximum 25 degrees cooler than concrete surface temperature for 7 days.
 - c. Method 2: Cover with burlap or cotton mats and keep continuously wet for 7 days.

- d. Other approved method that will keep moisture present and uniform at all times on surface of slabs and curbs.
- e. Where water curing for slabs and curbs during cold weather is not possible, use approved curing compound at manufacturer's recommended coverage per gallon.
- f. Where curing compound cannot be used, gain approval for special methods using moisture prior to placing concrete for slabs and curbs.
- g. Protect slabs during cold weather with plastic sheets or other material inside required heated enclosure if foot traffic is permitted on slabs.
- C. Use only water curing where additional finishes such as sealer/hardener, painting, and other special coatings are required.
- D. Curing system must remain in place and be maintained for duration of 7 days following placement.
- E. No construction, dead, or live loads are to be applied to new concrete until field cylinders indicate a minimum compressive strength of 80% of design strength or 7 days minimum.

3.2 EVAPORATION RETARDANT APPLICATION

- A. Spray onto surface of fresh flatwork concrete immediately after screeding to react with surface moisture as directed by manufacturer.
- B. Reapply per manufacturer's requirement.
- 3.3 FIELD QUALITY CONTROL
 - A. Manufacturer's Field Services:
 - 1. At ENGINEER's request, provide manufacturer's representative at site in accordance with SECTION 01 44 33, for installation assistance, inspection, and certification of proper installation for products specified.
 - 2. Provide floor sealer/hardener manufacturer's representative to demonstrate proper application of product.
 - 3. Provide curing compound manufacturer's representative to demonstrate proper application of curing compound to show coverage in one coat.

END OF SECTION

SECTION 03 62 00 NONSHRINK GROUTING

PART 1 GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Nonshrink Grout Schedule
 - 2. Nonshrink Grout
 - 3. Horizontal Construction Joints in Reinforced Concrete Walls
 - 4. Manufacturer's Services
 - B. Related Sections:
 - 1. SECTION 03 30 00 CAST-IN-PLACE CONCRETE

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this Section:
 - 1. American Society for Testing and Materials (ASTM):
 - a. C 230, Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.
 - b. C 1018, Standard Test Method for Flexural Toughness and First-Crack Strength of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading).
 - c. C 1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 - d. C 1116, Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
 - e. D 4580, Standard Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding.
 - 2. Corps of Engineers (COE):
 - a. CRD-C-611, Test Method for Flow of Grout Mixtures (Flow-Cone Method).
 - b. CRD-C-621, Specification for Nonshrink Grout

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product data of grouts.
- B. Quality Control Submittals:

a.

- 1. Manufacturer's Written Instructions:
 - Mixing of grout.
- 1.4 QUALIFICATIONS
 - A. Nonshrink Grout Manufacturer's Representative:
 - 1. Authorized and trained representative of grout manufacturer.
 - 2. Minimum of one year of experience that has resulted in successful installation of grouts similar to those for this Project.

1.5 GUARANTEE

- A. Manufacturer's guarantee shall not contain disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products and materials furnished.
- B. Manufacturer guarantees participation with CONTRACTOR in replacing or repairing grout found defective due to faulty materials, as determined by industry standard test methods.

PART 2 PRODUCTS

2.1 NONSHRINK GROUT SCHEDULE

A. Furnish nonshrink grout for applications in grout type in the following schedule:

	Temperature Range	Max. Pla	cing Time
Application	40°F to 100°F	20 min	Greater than 20 min
Filling tie holes	Type 1	Type 1	Type 1
Patching concrete walls	Type 1	Type 1	Type 1

2.2 NONSHRINK GROUT

- A. Cement Based non-shrink grout (Type 1):
 - 1. Minimum 28-day compressive strength of 7,000 psi, when mixed at a fluid consistency.
 - 2. Meet the requirements of ASTM C 1107, Grade C, when tested using the amount of water needed to achieve the following properties:
 - a. Fluid consistency (20 to 30 seconds) per ASTM C 939.
 - b. At temperatures of 45, 70, and 90 degrees F.
 - c. The grout when tested shall not bleed or segregate at maximum allowed water.
 - 3. Expansion at 3 or 14 days shall not exceed the 28-day expansion.
 - 4. Non-shrink property is not based on gas production or gypsum expansion.
 - 5. Fluid grout shall pass through the flow cone, with a continuous flow, one hour after mixing.
 - 6. Grout shall be pretested per the specified grout test requirements.
 - 7. Manufacturers and Products: Masterflow 928 by BASF Building Systems.

PART 3 EXECUTION

- 3.1 NONSHRINK GROUT
 - A. General:
 - 1. Mix, place, and cure nonshrink grout in accordance with grout manufacturer's representative training instructions.
 - B. Form Tie or Through-Bolt Holes:
 - 1. Patch in accordance with SECTION 03 30 00.

3.2 MANUFACTURER'S SERVICES

- A. General:
 - 1. Coordinate demonstrations, training sessions, and applicable site visits with grout manufacturer's representative.
 - 2. Provide and conduct onsite, demonstration and training sessions for bleed tests, mixing, flow cone measurement, cube testing, application, and curing for each category and type of nonshrink grout.
 - 3. Coordinate necessary equipment and materials are available for demonstration.
- B. Training:
 - 1. Grout manufacturer's representative shall train CONTRACTOR to perform grout work.
 - 2. Establish location at site and schedule time for grout manufacturer's demonstration and training session of proposed nonshrink grouts.
 - 3. Mix nonshrink grouts to required consistency, test, place, and cure on actual Project, e.g., baseplates and tie holes to provide actual on-the-job training.
 - 4. Use minimum of five bags for each grout Category II and Category III.
 - 5. Use remaining grout for final Work.
 - 6. Training includes methods for curing grout.
 - 7. Mix sufficient grout Category I for minimum of 15 tie holes.

3.3 SUPPLEMENT

- A. The supplement listed below, following "END OF SECTION," is part of this Specification.
 - 1. 24-hour Evaluation of Nonshrink Grout Test Form.

END OF SECTION

SECTION 03 68 00 CONCRETE CRACK REPAIR

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete crack and spall repair.
 - 2. Concrete surface preparation.
 - 3. Polyurethane chemical grouts.
 - 4. Portland cement grouts.
 - 5. Polymer-modified portland cement mortar.
 - 6. Contraction joints.
- B. Related Sections:
 - 1. SECTION 03 10 00 Concrete Forming.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. C 109/C 109M Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
 - 2. C 191 Time of Setting of Hydraulic Cement by Vicat Needle.
 - 3. C 273/C 273M Shear Properties of Sandwich Core Materials.
 - 4. C293 Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading).
 - 5. C 309 Liquid Membrane-Forming Compounds for Curing Concrete.
 - 6. C 496/C 496M Splitting Tensile Strength of Cylindrical Concrete Specimens.
 - 7. C 580 Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings, and Polymer Concretes.
 - 8. C 666/C 666M Resistance of Concrete to Rapid Freezing and Thawing.
 - 9. C 827 Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
 - 10. C 882/C 882M Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
 - 11. C 884/C 884M Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay.
 - 12. C 920 Elastomeric Joint Sealants.
 - 13. C 1107/C 1107M Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 - 14. D 412 Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers Tension.
 - 15. D 624 Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - 16. D 1622 Apparent Density of Rigid Cellular Plastics.
 - 17. D1623 Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
 - 18. D 2126 Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 - 19. D 2240 Rubber Property Durometer Hardness.
 - 20. D 2842 Water Absorption of Rigid Cellular Plastics.
 - 21. D 5249 Backer Material for Use with Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints.
 - 22. G 3 Conventions Applicable to Electrochemical Measurements in Corrosion Testing.

- B. American Association of State Highway Transportation Officials (AASHTO): T-277 Rapid Chloride Ion Permeability.
- C. U.S. Army Corps of Engineers (CRD): CRD C 621 Grout.
- D. Federal Specifications (TT-S):
 - 1. TT-S-001543A Physical Test Requirements.
 - 2. TT-S-00230C Sealants.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Repair any crack whose width greater than or equal to 0.010 inches at any point along crack length.
 - 2. Repair of cracks using pressure or gravity grouting may be terminated when crack width is less than or equal to 0.050 inches or where applicable, visible leakage ceases.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data:
 - a. Manufacturer's Specifications, data sheets, recommendations, installation instructions, guarantees, test reports, and other pertinent data on all materials showing compliance with contract requirements.
 - b. List of items which have limited shelf life or require special handling, with description of limitations and requirements.
 - 2. Samples:
 - a. Upon request, submit representative samples of proposed products of sufficient quantity for independent examination and testing.
 - b. When requested, proposed samples shall be tested and certified by independent testing laboratory at no expense to OWNER.

1.5 QUALITY ASSURANCE

- A. Manufacturing qualifications: Have in existence, for minimum of 10 years, program of training, certifying, and technically supporting nationally organized Approved contractor Program.
- B. CONTRACTOR qualifications:
 - 1. Approved CONTRACTOR of manufacturer of specified product.
 - 2. Completed program of instruction in use of specified repair material.
 - 3. Provide notarized certification from manufacturer attesting to Approved CONTRACTOR status or, if approved by ENGINEER, provide 5 job references of successfully repaired concrete cracks with specified product.
- C. Provide notarized certificate stating that repair material meets specified requirements and have manufacturer's current printed literature on specified product.

1.6 DELIVERY, HANDLING AND STORAGE

- A. All equipment used for handling and transporting materials must be clean and in proper operating condition before any material is placed therein.
- B. Materials shall be stored and handled to insure the preservation of their quality and fitness for use and shall be located to facilitate prompt inspection.

PART 2 PRODUCTS

2.1 MATERIALS

- A. General:
 - 1. Use only approved materials, conforming to requirements of these Specifications.
 - 2. Materials are subject to inspection and tests at any time during progress of preparation or use.
 - 3. Obtain approval for source of supply of each material before delivery or use is started.
- B. Polyurethane Chemical Grout for Pressure Grouting
 - 1. Source: SikaFix HH by Sika Corporation, Lyndhurst, New Jersey.
 - 2. Description:
 - a. Non-flammable, high flash point (212°F) hydrophobic polymer of type which is applied in crack or open joint by use of packer. It shall be non-toxic.
 - b. When the grout is mixed with about 5% water, material will expand 20 times its original volume and cure to golden-yellow closed-cell polyurethane foam.
 - 3. Properties of mixed polyurethane chemical grout:
 - a. Pot life: approximately five hours providing no moisture enters the system.
 - b. Mixed viscosity: 300 cps.
 - c. Color: light amber.
 - 4. Properties of cured polyurethane chemical grout:
 - a. Tensile Properties (ASTM D 1623):
 - 1) Tensile strength: 15.5 psi at one day.
 - 2) Elongation: plus 25%.
 - b. Shear Strength (ASTM C 273): 11.7 psi at one day.
 - c. Shrinkage (ASTM D 2126): 0%.
 - d. Water absorption (ASTM C 2842): 0.09 psf at one day.
 - e. Density (ASTM D 1622):
 - 1) Free rise (number 10 cup): 1.64 pcf.
 - 2) Molded overall: 4.2 pcf.
 - 5. Accelerator:
 - a. Based on Stannous Octate.
 - b. Able to control reaction time from 3 to 30 seconds.
 - c. Catalyzed polyurethane chemical grout should not react until it contacts water.
- C. Epoxy Grout for Gravity Feeding for Concrete Slabs
 - 1. Source: DENEPOX I-40 by de neef Construction Chemicals, Inc.
 - 2. Description: Ultra low viscosity, two-component epoxy resin for gravity feeding or pressure injection of cracks in slabs.
 - 3. Properties:

	Part A – Resin	Part B - Hardener
Solids (%)	100	100
Color	Clear	Clear Amber
Viscosity (CPS)	125	25
Shelf Life (year)	1	1

Properties at 77°F	Typical Mixed Values	ASTM Method
Mix ratio (A:B by volume)	2.85:1	N/A
Viscosity (cps)	40	N/A
Potlife (3.5 oz.) (minutes)	80	N/A
Tensile Strength (psi)	9,000	D 638
Flexural strength (psi)	14,400	D 790
Compressive strength (psi)	15,250	D 695
Bond strength to dry concrete (psi)	870	C 321
Bond strength to wet concrete (psi)	520	C 321
Elongation (%)	9	D 638

- D. Portland Cement Grout:
 - 1. Source: SikaGrout 212 by Sika Corporation, Lyndhurst, New Jersey.
 - 2. Description:

a.

- a. Non-shrink, non-metallic composition containing blend of selected Portland cements, plasticizing/water-reducing admixtures and shrinkage compensating agents.
- b. Shrinkage agents shall compensate for shrinkage in both plastic and hardened state.
- 3. Properties of the mixed Portland cement grout:
 - a. Time of set (ASTM C 191)
 - 1) Initial set: 3.0 hours min.
 - 2) Final set: 6.5 hours max.
 - b. Color: concrete gray
 - c. The grout shall not exhibit bleeding
 - d. The grout shall not segregate
 - e. The grout shall be pumpable through standard grout pumping equipment
- 4. Properties of the cured Portland cement grout (flowable consistency):
 - Compressive Strength (CRD C 621):
 - 1) 3500 psi at one day
 - 2) 6200 psi at 28 days
 - b. Splitting Tensile Strength (ASTM C 496): 575 psi at 28 days
 - c. Flexural Strength (ASTM C 580): 1200 psi
 - d. Bond Strength (ASTM C 882 Modified): 1900 psi at 28 days under moist cure
 - e. Expansion (CRD C 621): plus 0.056% min. at 28 days
 - f. Not produce vapor barrier.
 - g. Exhibit positive expansion when tested in accordance with ASTM C 827
 - h. Conform to United States Army Corps of Engineers Specification CRD C 621.
 - i. Conform to ASTM C 1107
 - j. Approved by United States Department of Agriculture.
- E. Water:
 - 1. Potable water.
 - 2. Meet requirements of ASTM C 94.

- 3. Free from sewage, oil, acids, strong alkalis, vegetable matter, clay, loam, or other deleterious substance which might affect performance of grout.
- 4. If water is of questionable quality, test in accordance with AASHTO T-26 and submit results to ENGINEER.
- F. Polymer-modified Portland Cement Mortar:
 - 1. Source: SikaTop 123 by Sika Corporation, Lyndhurst, New Jersey.
 - 2. Description:
 - a. Liquid polymer emulsion of acrylic copolymer base and additives.
 - b. Particle size less than 0.1 micron.
 - 3. Component A:
 - a. Contain organic, migrating corrosion inhibitor:
 - 1) Independently proven to reduce corrosion in concrete via ASTM G 3.
 - 2) Not calcium nitrite.
 - 3) Minimum of seven years independent field testing to document performance on actual construction projects.
 - 4. Component B: Blend of selected Portland cements, specially graded aggregates, admixtures for controlling setting time, water reducers for workability, and accelerator.
 - 5. Ratio of Component A to Component B: 1:5.2 by weight.
 - 6. Non-combustible, either before or after cure.
 - 7. Supplied in factory-proportioned unit.
 - 8. Placeable from 1/8 to 1 1/2 inches in depth per lift.
 - 9. Properties of the mixed polymer-modified Portland cement mortar:
 - a. Working time: 10 to 15 minutes
 - b. Finishing time: 20 to 60 minutes
 - c. Color: concrete gray
 - 10. Properties of cured polymer-modified Portland cement mortar:
 - a. Compressive Strength (ASTM C 109 Modified):
 - 1) 3500 psi at one day
 - 2) 6500 psi at 7 days
 - 3) 8000 psi at 28 days
 - b. Splitting Tensile Strength (ASTM C 496): 900 psi at 28 days
 - c. Flexural Strength (Modulus of Rupture) (ASTM C 293): 2000 psi at 28 days
 - d. Rapid Freeze/Thaw Durability (ASTM C 666, Procedure A): passes test
 - e. Bond Strength (ASTM C 882 Modified): 2200 psi at 28 days
 - f. Thermal Compatibility (ASTM C 884 Modified): passes test
 - g. Abrasion (Taber Abrader with H-22 wheel, 1000 gm load, 1000 cycles): 8.0 gm weight loss in 7 days
 - h. Rapid Chloride Ion Permeability (AASHTO T-277): 1000 Coulombs max.
 - i. Not produce vapor barrier.

2.2 ACCESSORIES

- A. Curing Compounds:
 - 1. Satisfy requirements of ASTM C 309, Type ID.
 - 2. White pigmented or tinted.
 - 3. See SECTION 03 39 00.
- B. Polyurethane Sealant:
 - 1. Source: SikaFlex-15LM by Sika Corporation, Lyndhurst, New Jersey.
 - 2. Description:
 - a. One-component, gun-grade, low-modulus, polyurethane-base material.
 - b. It shall be applicable in vertical and overhead joints.

- c. Shall cure under influence of atmospheric moisture to form elastomeric substance.
- 3. Properties of uncured polyurethane sealant shall be as follows:
 - a. Initial cure (tack-free time): 6 to 8 hours
 - b. Consistency: non-sag
 - c. Color: limestone gray
 - Properties of the cured polyurethane sealant shall be as follows:
 - a. Tensile Properties (ASTM D 412)
 - 1) Tensile strength: 100 psi min. at 21 days
 - 2) Elongation at break: 600% min.
 - 3) Tensile stress at 100% elongation: 45 psi min.
 - 4) Tensile set after break: 20% max.
 - b. Hardness (ASTM D 2240): 25 max. at 21 days (Shore A)
 - c. Tear Strength (ASTM D 624): 25 lb/in min. at 21 days
 - d. Adhesion in Peel from Concrete (TT-S-00230C): 20 lb min. at 28 days
 - e. Service Range: minus 40°F to 170°F
 - f. The sealant shall conform to Federal Specification TT-S-00230C, Type II, Class A
 - g. The sealant shall conform to ASTM C 920, Type S, Grade NS, Class 25
 - h. The sealant shall be capable of plus 100% to minus 50% of the average joint width when tested in accordance to the durability bond test in Federal Specification TT-S-00230C
 - i. The sealant shall conform to the physical test requirements of Federal Specification TT-S-001543A
 - j. The sealant shall be non-staining
 - k. Final Cure: 7 to 10 days

PART 3 EXECUTION

4.

3.1 GENERAL

- A. Furnish labor, materials, and services necessary for, and incidental to, completion of Work as shown on Contract Drawings and specified herein.
- B. Use equipment of sufficient size to meet requirements of Work and to produce satisfactory work.
- C. All Work is subject to inspection and approval of ENGINEER.
- D. Employ, at all times, a sufficient force of workmen of such experience and ability that Work can be completed in satisfactory and workmanlike manner.
- E. Provide 24 hours notice to ENGINEER prior to performing repair work to permit the ENGINEER review of surface preparation and Work in progress.

3.2 REPAIR METHODS

- A. Cracks:
 - 1. Floor slabs:
 - a. Treat cracks in floor slab greater than 0.010 inches in average width by direct injection with polyurethane grout.
 - 2. Walls:
 - a. Form cracks 1/2 inch and greater in average width and either pour or pump using Portland cement grout.
 - b. Treat cracks greater than or equal to 0.010 inches in average width with polyurethane chemical grout.

- c. Seal the surface of cracks greater than or equal to 1/4 inch and less than 1/2 inch in average width shall in accordance with instructions for spalls below.
- 3. Roof slabs:
 - a. Prior to treatment, seal cracks in accordance with instructions for spalls below.
 - b. Treat cracks greater than 0.010 inches in average width by direct injection with polyurethane grout.
- B. Spalls:
 - 1. Repair spalls greater than 1/8 inch in depth which are designated for repair using polymer-modified portland cement mortar.

3.3 POLYURETHANE CHEMICAL GROUT REPAIRS

- A. Mix and apply in accordance with manufacturer's recommendations.
- B. Crack Preparation:
 - 1. Cracks and adjacent substrate shall be clean, sound and free of frost.
 - 2. Remove bond inhibiting materials from surface by mechanical means, i.e., sandblasting, high pressure water blasting, etc., as approved.
 - 3. Prior to application of chemical grout, moisture must be present in cracks.
 - 4. If concrete being injected contains insufficient moisture to activate grout, inject crack with small amount of water prior to application of chemical grout.
- C. Surface Sealing:
 - 1. For cracks in roof and walls greater than or equal to 1/4 inch in average width, seal surface of crack prior to grouting.
 - 2. Sealing may be accomplished by one of three methods:
 - a. Apply portland cement grout to surface of crack.
 - b. Use polyurethane chemical grout with additional accelerator (Component B) to form seal on surface of crack.
 - c. Install open-cell backer rod soaked with polyurethane chemical grout.
 - 3. Leave short segments of crack (one to two inches) open at regular intervals to facilitate venting of air and to allow visual verification of complete crack filling.
 - 4. Cracks in floor and walls less than 1/4 inch in average width may be injected directly with polyurethane chemical grout without surface sealing.
- D. Mixing:
 - 1. Slowly combine accelerator Component B with five gallons of Component A and mix thoroughly for about two minutes with low-speed (400-600 rpm) drill and paddle until uniform in color.
 - 2. Do not allow water to enter mix.
 - 3. Avoid "whipping" air into mix.
- E. Application:
 - 1. Drill 5/8-inch diameter holes along side of crack at 45 degree angles.
 - 2. Drill hole to intersect crack midway through substrate.
 - 3. Space devices to achieve travel of grout for pressure injection grouting between packers and to fill crack to maximum.
 - 4. Install injection packers in holes.
 - 5. Pumping grout:
 - a. Pump at minimum of 250 psi for 45 seconds and then pause to allow material to flow into cracks.
- b. Watch for material flow and water movement to appear on surface.
- c. When movement stops, begin injection into next packer.
- d. When sealing vertical cracks, begin injecting at bottom of crack and work vertically.
- 6. If faster reaction time is needed, or if grout is being pumped at cold temperature, add additional accelerator to base resin, Component A if approved.
- 7. Re-inject to assure voids are properly sealed off.
- F. Finished Surfaces:
 - 1. After grout has cured, use sharp-sided tools such as putty knife or trowel to remove excess material from injected surfaces.

3.4 EPOXY GROUT REPAIRS

- A. Mix and apply in accordance with manufacturer's recommendations.
- B. Surface Preparation:
 - 1. Surfaces to be repaired or sealed shall be clean and sound.
 - 2. Remove bond inhibiting contaminants from concrete.
 - 3. Apply material when ambient and surface temperature is greater than or equal to 50°F and rising.
 - 4. Use low-height sand or wood dams to confine grout, establish neat width of repair and make positive head to assist grout in penetrating crack.
- C. Mixing:
 - 1. Mix material on low speed with drill and paddle for approximately four minutes to ensure thorough mix.
 - 2. Use mixed material in 60 minutes or less.
- D. Placing:
 - 1. Place material incrementally using gravity to fill crack.
 - 2. As material penetrates crack, add additional material until "refusal"; several iterations may be required to fill crack to refusal.

3.5 PORTLAND CEMENT GROUT REPAIRS

- A. Mix and apply in accordance with manufacturer's recommendations.
- B. Surface Preparation:
 - 1. Concrete areas to be grouted shall be clean, sound and free of contaminants.
 - 2. Remove loose and deteriorated concrete by approved mechanical means.
 - 3. Saw cut perimeter of spalled areas 1/2 inch maximum.
 - 4. Chip concrete substrate to obtain surface profile of plus or minus 1/8 inch in depth.
 - 5. Remove minimum of 1/2 inch concrete behind exposed reinforcing steel without damaging steel.
 - 6. Sandblast reinforcing steel to remove corrosion.
 - 7. Prior to grouting, saturate concrete surface to receive grout and surface dry.
- C. Forms:
 - 1. Forms for placement of grout shall conform to SECTION 03 10 00.
 - 2. Construct forms so that they do not deflect during pumping of grout.
 - 3. Provide vents with caps in forms as recommended by grout manufacturer to release air during grouting.

- 4. Run a bead of polyurethane sealant around edge of form to prevent leakage of grout.
- 5. Check forms for watertightness by filling with water.
- D. Mixing:
 - 1. Either manually or mechanically mix.
 - 2. Manually mix in wheelbarrow or mortar box.
 - 3. Mechanically mix with low-speed (400-600 rpm) drill and jiffy paddle or in appropriate sized mortar mixer.
 - 4. Add appropriate quantity of water to mixing container to achieve desired consistency.
 - 5. While mixing, slowly add bag of powder to water.
 - 6. Mix to uniform consistency for minimum of two minutes.
 - 7. Mix temperature should be maintained at 70°F to 75°F using cold or warm water accordingly.
- E. Application:
 - 1. Either pour or pump grout into place.
 - 2. Begin application within 15 minutes of mixing.
 - 3. Vibrate form during placement of grout.
 - 4. Construct chip spot and pour box at top of form to direct grout behind wall.
 - 5. Begin pumping through lowest point in form with variable pressure pump.
 - 6. Pour or pump until there is steady flow of grout from bottom vent.
 - 7. Cap off bottom vent and continue pouring or pumping grout until there is steady flow of grout from adjacent vent.
 - 8. Continue capping vents as soon as steady flow of grout appears.
 - 9. Continue pumping until there is three to five psi increase in normal line pressure.
- F. Form Removal:
 - 1. After grout has achieved final set, remove any forms.
- G. Curing and Protection:
 - 1. Curing and protection of grout shall conform to SECTION 03 39 00.
- H. Finished Surfaces:
 - 1. Finishing of formed surfaces shall conform to SECTION 03 30 00.
 - 2. Remove defective Work disclosed after forms have been removed immediately and replace at no cost to OWNER.
 - 3. Drypack anchor holes with portland cement grout in accordance with manufacturer's recommendations.
- I. Contraction Joints
 - 1. Create sawed contraction joints in each area designated for portland cement grout repairs. Form joints in accordance with this Section.

3.6 POLYMER-MODIFIED PORTLAND CEMENT MORTAR REPAIRS

- A. Mixed and apply in accordance with manufacturer's recommendations.
- B. Surface Preparation:
 - 1. Spalled concrete areas to be repaired shall be clean, sound and free of contaminants.
 - 2. Remove loose and deteriorated concrete by approved mechanical means.

- 3. Saw cut perimeter of spalled areas 1/2 inch maximum.
- 4. Chip concrete substrate to obtain a surface profile of $\pm 1/8$ inch in depth.
- 5. Remove minimum of 1/2 inch concrete behind exposed reinforcing steel without damaging steel.
- 6. Sandblast reinforcing steel to remove corrosion.
- 7. Prior to repair, saturate concrete surface to receive mortar and surface dry.
- C. Mixing:
 - 1. Either manually or mechanically mix.
 - 2. Manually mix in wheelbarrow or mortar box.
 - 3. Mechanically mix with low-speed (400-600 rpm) drill.
 - 4. Pour approximately four to five gallons of Component A into mixing container.
 - 5. Add Component B while continuing to mix.
 - 6. Mix to uniform consistency for maximum of three minutes.
 - 7. Add remaining Component A to mix if more loose consistency is desired.
 - 8. If manual mixing takes more than three minutes, mix small quantities.
 - 9. Should smaller quantities be needed, ensure components are dosed in correct ratio and Component B is uniformly pre-mixed before batching.
- D. Application:

6.

- 1. Apply scrub coat to substrate, filling all pores and voids.
- 2. While scrub coat is still plastic, force material against edge of repair, working toward center.
- 3. After filling, consolidate, then screed.
- 4. Allow mortar to set to desired stiffness.
- 5. Finish with trowel to obtain smooth surface.
 - Where depth of repair to sound concrete is greater than 1 1/2 inches:
 - a. Make areas in lifts of 1 1/2 inch maximum thickness.
 - b. Score top surface of each lift to produce roughened surface for next lift.
 - c. Allow preceding lift to reach final set before applying fresh material.
 - d. Scrub fresh mortar into preceding lift.
- E. Curing and Protection: Curing and protection of Portland cement grout shall conform to SECTION 03 39 00.
- F. Contraction Joints:
 - 1. Create sawed contraction joints in each areas designated for polymer-modified portland cement mortar repairs when transverse cracking of concrete is present.
 - 2. Form joints shall be formed in accordance with Portland Cement Grout Repair, Forms, outlined in this Section.

3.7 CONSTRUCTION OF CONTRACTION JOINTS

- A. Create contraction joint on surface of concrete in plane of crack in each area designated for portland cement grout and areas of spall repair when transverse cracking is present.
- B. Form joints by sawing 1/4 inch grooves 1/2 inch deep in surface of repair with approved concrete saw.
- C. Commence sawing of joint as soon as portland cement grout or polymer-modified portland cement mortar has hardened sufficiently to permit sawing without excessive raveling, usually 6 to 24 hours.
- D. Saw joints to full depth before uncontrolled shrinkage cracking takes place.
- E. After contraction joint is sawed, thoroughly clean joint and adjacent concrete surface.

- F. Insert1/4-inch diameter closed-cell backer rod to full depth of joint.
- G. Apply polyurethane sealant:
 - 1. Before sealant is applied, clean joint and adjacent substrate.
 - 2. Install between backer rod and concrete surface in accordance with manufacturer's recommendations.
 - 3. Place gun nozzle, either hand-, air-, or electric-powered, into bottom of joint and fill entire joint.
 - 4. Keep tip of nozzle in sealant, and continue with steady flow of sealant proceeding from nozzle to avoid air entrapment.
 - 5. Avoid overlapping sealant to eliminate entrapment or air.
 - 6. Tool as required to properly fill joint.

3.8 FIELD QUALITY CONTROL

- A. General:
 - 1. Samples of material submitted for inspection and possible testing shall be obtained from stock on hand provided or proposed for use on this Project.
- B. Sampling and Testing of Grouts:
 - 1. Grouts shall be sampled and tested by CONTRACTOR's testing laboratory to assure that materials are properly mixed and proper ingredients are incorporated.
 - 2. Frequency of tests will be as required in ACI 301, Chapter 16, but may be increased by ENGINEER.
- 3.9 CLEANUP
 - A. Leave finished Work and Work area in neat, clean condition without evidence of spillovers onto adjacent areas.

SECTION 05 10 00 STRUCTURAL STEEL, MISCELLANEOUS METALWORK AND EMBEDMENTS

PART 1 GENERAL

1.1 WORK INCLUDED

- A. This Section describes materials, fabrication, and installation of structural steel, miscellaneous metalwork and embedded metalwork.
- 1.2 RELATED SECTIONS
 - A. SECTION 03 30 00 CAST-IN-PLACE CONCRETE

1.3 DESIGN CRITERIA

A. Structural Connections and Framing: AISC Specification for Structural Steel Buildings.

1.4 SUBMITTALS

- A. Submit Drawings detailing fabrication and erection of each metal fabrication indicated. Reproductions of Construction Drawings will not be accepted for this purpose.
- B. Include plans, elevations, sections and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Indicate welded connections using standard AWS welding symbols. Clearly indicate net weld lengths, sizes and welding sequences.
- D. Provide manufacturer's design and calculations for gratings, including load tables.
- E. Provide manufacturer's data sheets, handling and installation instructions for concrete anchors.

1.5 QUALIFICATION OF WELDERS AND WELDING OPERATORS

- A. Certify that the qualification of welders and welding operators and tack welders who will perform structural steel welding have been qualified for the particular type of work to be done in accordance with the requirements of AWS D1.1/D1.1M, Section 5, or ASME BPVC SEC IX, Section IX, prior to commencing fabrication.
- B. The certificate shall list the qualified welders by name and shall specify the code and procedures under which qualified and the date of qualification. Prior qualification will be accepted if welders have performed satisfactory work under the code for which qualified within the preceding 3 months.
- C. Require welders to repeat the qualifying tests when their work indicates a reasonable doubt as to proficiency. Those passing the requalification tests will be recertified. Those not passing will be disqualified until passing. All expenses in connection with qualification and requalification shall be borne by the CONTRACTOR.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Unless otherwise indicated, materials shall meet the requirements in Table 05 10 00-1 and the following paragraphs:
- B. Table 05 10 00-1 Structural Steel, Miscellaneous Metalwork and Embedments:

ITEM	SPECIFICATION
Steel Shapes and Plates:	
Steel Plate for Lifting Lugs	ASTM A 242
Other Shapes and Plates	ASTM A 36 or ASTM A 992
Steel Pipe	ASTM A 501 or A 53, Type E or S, Grade B
Structural Steel Tubing	ASTM A 500, Grade B
Stainless Steel:	
Bars and Shapes	ASTM A 276, AISI Type 316
Steel Plate, Sheet and Strip	ASTM A 240 or A 666, AISI Type 316
Bolts and Threaded Rods	ASTM A 193, AISI Type 316, B8M, B8MN, B8M2 or B8M3
Expansion Bolts	ASTM A 582, Type 303
Nuts	ASTM A 194, AISI Type 316, 8M, 8MN, 8M2 or 8M3
Steel Bolts, Nuts and Washers:	
Carbon Steel	ASTM A 307 or A 36
High-Strength	ASTM A 325, Type 1
Galvanized Steel Bolts and Nuts	ASTM A 307 or A 36, with ASTM A 153 zinc coating and ANSI B1.1
	Federal Specification FF-B-575, Grade 5
Machine Bolts	ASME B18.21.1
Lag Bolts	ASTM A 489
Eyebolts	ASTM A 36
Threaded Rods	ASTM F 844; use A 153 zinc coating
Flat Washers (Unhardened)	ASTM F 436
Flat Washers (Hardened)	Federal Specification FF-W-84A
Lock Washers (Helical Spring Type, Carbon Steel)	
Steel Sheet:	
Uncoated, Structural, Cold- Rolled	ASTM A 1008, Grade A, unless otherwise indicated or required by design loading
Uncoated, Nonstructural, Cold- Rolled	
Galvanized, Structural Quality	by design loading, with G-90 coating

- C. Drilled Anchors:
 - 1. Unless otherwise indicated on the Construction Drawings, drilled anchors shall be hot-dipped galvanized steel threaded rod adhesive anchors. Epoxy adhesive shall comply with ASTM C 881, Type IV, Grade 3, Class B or C. Adhesive shall

be Rawl Power-Fast, Hilti HSE 2411, Simpson Epoxy-tie. Epoxy anchor assemblies shall be ICBO approved.

- 2. Where indicated on the Construction Drawings, drilled anchors shall be hotdipped galvanized steel wedge anchors as manufactured by ITW Ramset/Redhead, Hilti, or equal. Anchors shall have ICBO-approved testing.
- 3. Where indicated on the Construction Drawings, drilled anchors shall be Type 304 stainless-steel heavy-duty wedge anchors suitable for dynamic loading. Anchors shall be HSL heavy-duty wedge anchor by Hilti, Power-Bolt by Rawlplug Company.
- D. Welding Electrodes:
 - 1. Welding electrodes for structural steel shall conform to AWS D1.1 Standards AWS A5.1 or A 5.5 E70XX Series Electrodes.
 - 2. Welding electrodes for aluminum shall be ER4043 filler metal.
 - 3. Welding electrodes for stainless steel shall conform to AWS A 5.4. Use electrodes E308 for Type 304 stainless steel and E316 for Type 316 stainless steel.

PART 3 EXECUTION

3.1 STORAGE OF MATERIALS

A. Store material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.2 FABRICATION AND ERECTION

- A. Fabricate miscellaneous metal items to straight lines and true curves. Drilling and punching shall not leave burrs or deformations.
- B. Continuously weld permanent connections along the entire area of contact.
- C. Exposed work shall have a smooth finish with welds ground smooth. Joints shall have a close fit with corner joints coped or mitered and shall be in true alignment. Unless specifically indicated on the Construction Drawings, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections.
- D. Conceal fastenings wherever possible. Built-up parts shall be free of warp. Exposed ends and edges of metal shall be slightly rounded.
- E. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease and other foreign substances before placing concrete.
- F. Set embedded metalwork accurately in position when concrete is placed and support rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with SECTION 03 30 00.

3.3 GALVANIZING FOR STEEL PLATES, PIPE, AND TUBING

A. Zinc coating shall be in accordance with ASTM A 123.

3.4 WELDING

- A. Perform welding on steel by the shielded metal arc welding (SMAW) process. Welding shall conform to the AWS Structural Welding Code-Steel, D1.1, except as modified in AISC Section J2.
- B. Perform welding on aluminum by the gas metal arc (MIG) or gas tungsten arc (TIG) process. Welding shall conform to the AWS Structural Welding Code-Aluminum, D1.2-90.
- C. Perform welding on stainless steel by the gas tungsten arc (TIG) process. All welds shall be full penetration and smooth unless otherwise indicated on the Construction Drawings. Provide inert gas on the inside of pipe during welding to reduce oxidation.
- D. Provide a minimum of two passes for metal in excess of 5/16-inch thickness.
- E. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully penetrating. Accomplish repair, chipping, and grinding of welds in manner that will not gouge, groove, or reduce the base metal thickness.

3.5 INSTALLING BOLTS

A. Bolts shall be of the length that will extend entirely through but not more than 1/4 inch beyond the nuts. Draw boltheads and nuts tight against the work. Tap boltheads with a hammer while the nut is being tightened.

3.6 INSTALLING ANCHOR BOLTS

- A. Preset bolts and anchors by the use of templates. For mechanical equipment, do not use concrete anchors set in holes drilled in the concrete after the concrete is placed.
- B. For static items, use preset anchor bolts where shown on the Construction Drawings or drilled anchors with ICBO report data.
- C. After anchor bolts have been embedded, protect projecting threads by applying grease and having the nuts installed until the time of installation of the equipment or metalwork.
- D. Minimum depth of embedment of drilled mechanical anchors shall be as recommended by the manufacturer, but no less than that shown on the Construction Drawings and no less than six and one-half bolt diameters.
- E. Minimum depth of embedment of adhesive anchors shall be as recommended by the manufacturer, but no less than that shown on the Construction Drawings and no less than 12 bolt diameters.

3.7 ANCHORING SYSTEMS FOR CONCRETE

- A. Begin installation only after concrete or masonry receiving anchors has attained design strength.
- B. Do not install an anchor closer than six times its diameter to either an edge of concrete, or to another anchor, unless shown otherwise.
- C. Install anchors in accordance with manufacturer's instructions. Hole diameters are critical to installation, use only drills recommended by anchor manufacturer.
- D. Follow specific manufacturer's safe handling practices when handling and installing anchors.

3.8 CONTROL OF FLAME CUTTING

A. Do not use a gas-cutting torch in the field for correcting fabrication errors on any member in structural framing. Use a gas-cutting torch only on minor members when the member is not under stress.

3.9 REPAIR OF GALVANIZED SURFACES

A. Repair or replace metal with damaged galvanized surfaces at no additional cost to the OWNER. Accomplish repair of galvanized surfaces by use of DRYGALV by the American Solder and Flux Company, Paoli, PA; Cold Galvanizing Repair Compound by Rust-Oleum; or equal. Prepare surfaces and apply in accordance with the manufacturer's instructions.

SECTION 31 23 13 FOUNDATION PREPARATION

PART 1 GENERAL

- 1.1 WORK INCLUDES
 - A. Preparing the finished excavated surface for placement of overlying fill or structures.
 - B. Protection of subgrade until foundation preparation is completed and placement of overlying fill, backfill, or structures begins.
 - C. Correction of foundation defects for placement of overlying fill or structures.

1.2 DEFINITIONS

- A. Refer to applicable definitions of SECTION 31 23 16.
- B. Bedrock: Bedrock of the Denver Formation; including claystone, siltstone, or sandstone, irrespective of the degree of weathering or cementation.
- C. Prepared Foundation: Subgrade surface after completion of foundation preparation activities as specified and prior to placement of overlying fill, backfill, or structure.
- D. Protective Coating: Concrete or shotcrete designed by CONTRACTOR and approved by ENGINEER, and used to protect bedrock foundation surfaces from deterioration caused by wetting, drying, physical disturbance including CONTRACTOR's operations, or other causes until overlying concrete or fill is placed.
- E. Slush Grout: Cement grout used to seal fractures, joints, open holes, cracks or other defects at the surface of the bedrock foundation to mitigate seepage flows. Place slush grout in local areas of the bedrock foundation underlying structures, concrete backfill, and embankment material.
- F. Subgrade: Ground surface after completion of required clearing, grubbing, stripping, and excavation prior to placement of fill or structure.
- G. Temporary Cover: Native material left in place over subgrade of bedrock foundation to protect subgrade from damage by wetting, drying, freezing, erosion, and physical disturbance by construction equipment traffic and personnel until the time of final foundation excavation and preparation.

1.3 SUBMITTALS

- A. Proposed procedures and sequence for performing foundation preparation including procedures for structure foundations on bedrock.
- B. Protective Coating Plan, detailing:
 - 1. Protective coating composition and mix design.
 - 2. Method and equipment for application.
 - 3. Curing requirements, as applicable.
- C. Slush Grout Mix Design.
- D. Submit the above concurrently with Excavation Plan, as specified in SECTION 31 23 16.
- E. Conform to Related Sections:
 - 1. 03 30 00 Cast in Place Concrete

- 2. 03 37 00 Concrete Curing
- F. Quality Control:
 - 1. Foundation Cross Sections:
 - a. Composite cross section of the final excavated subgrade for structure foundation.

1.4 QUALITY ASSURANCE

- A. ENGINEER and STATE DAM SAFETY ENGINEER will conduct visual inspection of the subgrade after removal of temporary cover and before placement of concrete slab. Provide notice to ENGINEER at least 24 hours prior to starting final foundation excavation, including removal of temporary cover, for a particular area so that ENGINEER can make arrangements for visual observation.
- B. Install survey control points and cut stakes prior to final excavation to control excavation work and provide reference points for cross section surveys and inspection.
- C. Notify ENGINEER when excavation has reached the designated subgrade elevation.
- D. Notify ENGINEER when soft, loose, or wet subgrade zones are encountered.

1.5 SEQUENCING AND SCHEDULING

- A. Perform foundation preparation only when subgrade is unfrozen, and free of ice, snow, and surface water.
- B. Perform foundation preparation only during daylight hours.
- C. Coordinate foundation preparation with related work in SECTION 31 23 16: and SECTION 31 23 23, and perform Work in discrete areas of limited size such that final excavation of temporary cover, inspection, preparation of the excavated foundation surface, and placement of overlying fill or protective coating on bedrock is completed within the time limit specified in this Section.

PART 2 PRODUCTS

- 2.1 SLUSH GROUT
 - A. Conform to the requirements for slush grout mix as specified in SECTION 03 30 00.

PART 3 EXECUTION

- 3.1 GENERAL
 - A. Prior to the placement of concrete, the foundation shall be observed and approved by the Engineer and observed by a representative of the Colorado State Engineer's Office (SEO).
 - B. Shape excavation to produce as uniform and regular profile as possible, with no abrupt changes in slope, sharp projections, steps, overhangs, or benches except as shown on the Drawings.
 - C. Preserve the foundation below and beyond the lines of excavation in the best possible condition. Repair any damage from CONTRACTOR's operations, including fracturing of bedrock materials, and as directed by ENGINEER.
 - D. Keep subgrade dry and free of ponded water and deleterious materials during foundation preparation.

- E. Protect prepared foundation from traffic. Prepared foundation that is damaged by construction traffic shall be repaired as directed by the ENGINEER and at no cost to the Owner.
- F. Maintain prepared foundation in finished condition until protective coating, or structure is placed.

3.2 PREPARED FOUNDATIONS ON SOIL (GRADE BEAM)

- A. Temporary Cover and Protective Coating Requirements: None.
- B. Subgrade Compaction: Scarify, moisture condition, and compact top 8 inches of subgrade in accordance with requirements of SECTION 31 23 23, as specified for the overlying fill type.
- C. Where subgrade cannot be compacted as specified, or in areas identified by ENGINEER that display yielding or excessive rutting or pumping during construction activities, overexcavate soft, loose or pumping material, and replace with backfill of same type and compaction requirements as overlying material. Provide and maintain dewatering to mitigate against pumping of subgrade caused by shallow ground water conditions.
- D. Where the natural foundation subgrade under fill materials is found to contain frozen or natural soft areas, as determined by the ENGINEER, frozen or soft materials shall be excavated and the excavation backfilled with compacted embankment material fill.
- E. Where natural foundation subgrade is loosened or disturbed by the CONTRACTOR, proof-roll the loosened or disturbed subgrade at the direction of the ENGINEER and replace unsuitable soil with approved compacted fill material at no additional cost to the OWNER.

3.3 PREPARED FOUNDATIONS ON BEDROCK (CAPSULE)

- A. Subgrade Protection: Protect subgrade from damage during final excavation of temporary cover, foundation cleanup, and placement of overlying fill, backfill, and protective coating. Protect from physical damage due to construction equipment, as well as from deterioration due to wetting, drying, freezing or erosion.
- B. Cleanup: Clean subgrade of all loose material, dirt, mud, standing water, and other deleterious materials. Clean subgrade using a power broom, hand tools, stiff hand broom, compressed air, vacuum, or other suitable methods, as approved by ENGINEER. Obtain ENGINEER's approval of subgrade after cleaning prior to placement of overlying fill, backfill, or protective coating.
- C. Special Foundation Treatment: Apply in areas designated by ENGINEER, and as specified in this Section.

3.4 SPECIAL FOUNDATION TREATMENT

- A. Defects in sedimentary formations will require slush grouting to fill open joints, fissures, or holes in bedrock. Slush grout the following:
 - 1. Joints wider than 0.125 inch exposed in bottom of the core trench excavation.
 - 2. Other locations determined by ENGINEER.
- B. ENGINEER will determine location and extent of foundation surfaces requiring slush grouting.
- C. Obtain ENGINEER's approval of surface to be slush grouted after cleaning before placing necessary treatment.

- D. Where possible, a pipe will be set to the bottom of the joint or crack and grout pumped in until the joint or crack is completely filled. The slush grout shall be brushed into small cracks or joints.
- E. Place slush grout in a manner acceptable to ENGINEER. Work slush grout into foundation surface using brooms.
- F. Slush grout shall not be placed at temperatures below 35 degrees Fahrenheit or when the temperature is 40 degrees Fahrenheit and falling and is reasonably expected to reach freezing.
- G. Slush grout disturbed, broken-up or removed prior to placement of the concrete or embankment upon it, shall be replaced at no additional expense to the OWNER.
- H. Slush grouted surfaces shall be left with a roughened, broomed finish.
- I. Document the location, limits, and methods of foundation treatment for record drawing purposes.

3.5 QUALITY CONTROL

A. Perform testing of concrete backfill, slush grout and protective coating as specified in SECTION 03 30 00.

SECTION 31 23 16 EXCAVATION

PART 1 GENERAL

- 1.1 WORK INCLUDES
 - A. Required excavation of the foundation for capsule structure and grade beam.

1.2 DEFINITIONS

- A. Unclassified Excavation All materials encountered in excavations, including soil, gravel, cobbles, boulders, and bedrock, regardless of hardness, composition, or moisture content.
- B. Fill and backfill as defined by Section 31 23 23.

1.3 QUALITY CONTROL

A. Provide adequate survey control to control and document limits of excavation.

1.4 BLASTING

- A. No blasting will be allowed.
- 1.5 DEWATERING
 - A. Conform to Section 31 23 19

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

- 3.1 EXCAVATION FOR STRUCTURE FOUNDATIONS
 - A. Take all necessary precautions to preserve the material below and beyond the established limits of excavation in the soundest possible condition. Repair any damage to foundation material beyond the required excavation lines due to frost, wetting, drying, erosion, physical disturbance, ineffective dewatering, or CONTRACTOR's operations.
 - B. Where foundation is on bedrock:
 - 1. No ripping or track-mounted equipment shall be allowed within 3 feet horizontally or 2 feet vertically from the finished grade unless otherwise approved by ENGINEER.

3.2 PERMANENT EXCAVATION SLOPES

- A. Shape, trim, and finish cut slopes to conform with lines, grades, and cross sections shown, with proper allowance for topsoil or slope protection, where shown.
- B. Remove stones and rock that exceed 6-inch diameter and that are loose and may roll down slope. Remove exposed roots from cut slopes.
- C. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend offsite or outside easements and rights-of-way, or adversely impact existing facilities, adjacent property, or completed work.

3.3 DISPOSAL OF EXCAVATED MATERIAL

A. Excavated material shall be disposed of in the reservoir area where it will not interfere with the work or future access.

31 23 19

WATER CONTROL AND DEWATERING

PART 1 - GENERAL

1.01 SUMMARY

A. The WORK of this section consists of controlling groundwater, site drainage, and storm flows during construction.

1.02 REFERENCES

- A. State of Colorado, Department of Natural Resources, Division of Water Resources, Office of the State Engineer, Dam Safety
 - 1. Rules and Regulations for Dam Safety and Dam Construction

1.03 SUBMITTALS

A. CONTRACTOR must submit a Water Control and Dewatering plan to the ENGINEER and STATE ENGINEER OFFICE for review and approval prior the pre-construction meeting in accordance with Rule 8.1.1 of the SEO's *Rules and Regulations for Dam Safety and Construction*.

PART 2 - PRODUCTS

- 2.01 MATERIALS
 - A. On-site materials may be used within the limits of construction to construct temporary dams and berms if desired by CONTRACTOR.
 - B. Materials such as plastic sheeting, sand bags, and storm sewer pipe may also be used if desired by CONTRACTOR.
 - C. CONTRACTOR shall provide a diesel pump capable of a minimum 2,250 gallons per minute flow rate on site at all time during the construction period.

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

- A. General.
 - 1. For all work, CONTRACTOR shall provide suitable equipment and labor to remove water, and he shall keep the site dewatered so that construction can be carried on under dewatered conditions.
 - 2. Water control shall be accomplished such that no damage is done to adjacent channel banks or structures.
 - 3. CONTRACTOR is responsible for investigating and becoming familiar with all site conditions that may affect the work including surface water, potential flooding conditions, level of groundwater and the time of year the work is to be done.
 - 4. All excavations made as part of dewatering operations shall be backfilled with the same type material as was removed and compacted to ninety percent (90%) of Maximum Standard Proctor Density (ASTM D698) except where replacement by other materials and/or methods are required.
 - 5. CONTRACTOR shall conduct operations in such a manner that storm, or other waters may proceed uninterrupted along their existing drainage courses.
 - 6. By submitting a bid, CONTRACTOR acknowledges that CONTRACTOR has investigated the risk arising from such waters and has prepared his bid accordingly, and assumes all of said risk.

- 7. At no time during construction shall CONTRACTOR affect existing surface or subsurface drainage patterns of adjacent property. Any damage to adjacent property resulting from CONTRACTOR's alteration of surface or subsurface drainage patterns shall be repaired by CONTRACTOR at no additional cost to OWNER.
- 8. CONTRACTOR shall remove all temporary water control facilities when they are no longer needed or at the completion of the PROJECT.
- B. Surface Water Control.
 - 1. Surface water control generally falls into the following categories:
 - a. Normal flows into Groundhog Reservoir. The OWNER and ENGINEER have estimated a normal flow of 5 cubic feet per second (~2,250 gallons per minute) for dewatering during the PROJECT.
 - b. Storm/flood flows into Groundhog Reservoir. The ENGINEER has identified a 50% Annual Exceedance Probability Storm for determining a safe reservoir level during the PROJECT. The ENGINEER has estimated a corresponding flood volume of 175 acre feet.
 - c. Flows from existing storm drain pipelines; and
 - d. Local surface inflows not conveyed by pipelines
 - 2. CONTRACTOR shall coordinate, evaluate, design, construct, and maintain temporary water conveyance systems. These systems shall not worsen flooding, alter major flow paths, or worsen flow characteristics during construction. CONTRACTOR is responsible to ensure that any such worsening of flooding does not occur. CONTRACTOR is solely responsible for determining the methods and adequacy of water control measures.
 - 3. At a minimum, CONTRACTOR shall be responsible for diverting 2,250 gallons per minute of surface flow around the construction area so that the site will remain free of surface water for the time it takes to install these materials, and the time required for curing of any concrete or grout.
 - 4. At a minimum, CONTRACTOR shall be responsible for maintaining a reservoir level 2 feet below structure foundation material so that the site will remain free of storm/flow flows for the time it takes to install these materials, and the time required for curing of any concrete or grout.
 - 5. CONTRACTOR is cautioned that the minimum quantity of water to be diverted and the minimum reservoir level is for erosion control and construction purposes and not for general protection of the construction-site. It shall be CONTRACTOR's responsibility to determine the quantity of water which shall be diverted to protect the WORK from damage caused by surface water flows.
 - 6. CONTRACTOR shall, at all times, maintain a flow path for all channels. Temporary structures such as berms, sandbags, pipeline diversions, etc., may be permitted for the control of channel flow, as long as such measures are not a major obstruction to flood flows, do not worsen flooding, or alter historic flow routes.
- C. Groundwater Control.
 - 1. CONTRACTOR shall install adequate measures to maintain the level of groundwater at least 12" below prepared subgrade and foundation elevations and maintain sufficient bearing capacity for all structures, pipelines, earthwork, and rock work. Such measures may include, but are not limited to, installation of perimeter subdrains, pumping from drilled holes or by pumping from sumps excavated below the subgrade elevation.
 - 2. Dewatering from within the foundation footprint shall not be allowed. The foundation bearing surfaces are to be kept dewatered and stable until the structures or other types of work are complete and backfilled. Disturbance of foundation subgrade by CONTRACTOR

operations shall not be considered as originally unsuitable foundation subgrade and shall be repaired at CONTRACTOR's expense.

3. Any temporary dewatering trenches or well points shall be restored following dewatering operations to reduce permeability in those areas as approved by OWNER'S REPRESENTATIVE.

SECTION 31 23 23 FILL AND BACKFILL

PART 1 GENERAL

1.1

- A. Section Includes: Fill adjacent to grade beam and concrete structures
- B. Related Sections:
 - 1. 03 30 00 Cast-in-Place Concrete
 - 2. 31 23 13 Foundation Preparation
 - 3. 31 23 16 Excavation

1.2 REGULATORY REQUIREMENTS

A. Meet all local, state, and federal regulations and codes pertaining to excavation, air quality, water quality, wetlands, and any other environmental issues.

1.3 REFERENCES

A. Site Specific Geotechnical Report as part of the Project Contract Documents

1.4 DEFINITIONS

- A. Refer to applicable definitions of Section 31 23 16: EXCAVATION and Section 31 23 13 FOUNDATION PREPARATION.
- B. Backfill: Fill materials placed in trenches, over excavated areas, and around structures, pipes, and other facilities.
- C. Deleterious Materials: Organic matter, trash, rubbish, debris, oversize materials, and soluble materials.
- D. Lift: Loose (uncompacted) layer of material.
- E. Processed Backfill: Native backfill material that is physically modified by CONTRACTOR to derive a material that is suitable for a specific use.

PART 2 MATERIALS

- 2.1 NATIVE BACKFILL:
 - A. Material removed during excavation shall be processed and re-used as native backfill unless otherwise directed by the ENGINEER.
 - B. Shall be free of deleterious materials as determined by ENGINEER.

PART 3 EXECUTION

- 3.1 GENERAL
 - A. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of native fill materials.
 - B. Place and spread fill and backfill materials in horizontal lifts of uniform thickness in a manner that avoids segregation.

- C. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.
- D. Place native fill in 12-inch loose lifts or less.
- E. During backfilling around grade beam or concrete structures, keep level of fill even on all sides of structure.
- F. Grade beam and concrete structures shall not be backfilled until they have achieved 80% of the design strength as specified in SECTION 03 30 00.
- G. Do not place fill that is frozen, or if surface upon which fill or backfill is to be placed is frozen.

3.2 COMPACTION

- A. Compact native backfill a minimum of two passes of a walk behind sheep's foot roller or a sheep's foot roller excavator.
- B. Operate compaction equipment in strict accordance with manufacturer's instructions and recommendations. Maintain equipment in such condition that it will deliver the manufacturer's rated compactive effort.
- C. Operate sheepsfoot and tamping foot rollers to maintain the spaces between the individual feet clear of adherent materials that impair the effectiveness of the roller.
- D. Provide suitable numbers of equipment to keep pace with fill and backfill placement activities. Restrict material placement rates if compaction equipment cannot keep pace with fill and backfill placement.

SECTION 31 63 33 MICROPILES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Micropiles Materials and Installation
 - 2. Quality assurance testing of micropiles
- B. Related Sections
 - 1. 03 30 00 Cast-in-Place Concrete
 - 2. 03 62 00 Nonshrink Grouting

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. A 36 Standard Specification for Carbon Structural Steel
 - 2. A 775 Standard Specification for Epoxy-Coated Steel Reinforcing Bars
 - 3. A 934 Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
 - 4. C 94 Standard Specification for Ready-Mixed Concrete.
 - 5. C 109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
 - 6. C 150 Standard Specification for Portland Cement.
 - 7. D 3689 Standard Test Methods for Deep Foundations Under Static Axial Tensile Load

1.3 DEFINITIONS

- A. Micropile: A friction pile less than 12 inches in diameter formed by removing material with drilling methods to create a cased cylindrical open hole in the ground, which is filled with grout and steel reinforcement.
- B. Non-production Pile: A pile that is not part of the substructure which is typically installed for testing and then abandoned.
- C. Tremie Grouting: A method of placing grout in a saturated bore that involves placing a grout tube at the bottom of a bore and then pumping grout through it to fill the bore. Water within the bore is displaced as the bore is filled with grout.

1.4 SUBMITTALS

- A. Material Submittals:
 - 1. Grout Mix Design
 - 2. Steel Reinforcement Manufacturer Data Sheet
 - 3. Centralizer or Spacer Manufacturer Data Sheet
- B. Micropile Installation Plan:
 - 1. Equipment required for installation of micropiles
 - 2. Drilling Methods
 - 3. Procedures, techniques, methods, and schedules required to install micropiles

PART 2 PRODUCTS

- 2.1 GROUT MIX DESIGN
 - A. Minimum 28 day compressive strength: 5,000 psi when molded and cured in compliance with ASTM C109
 - B. Cement: ASTM C 150, Type I or III Portland Cement
 - C. Minimum water to cement ratio: 0.45
 - D. Water per ASTM C 94
- 2.2 STEEL
 - A. Reinforcing Steel Bars: ASTM A615, Grade 75 or Grade 80
 - B. Steel Bearing Plates: ASTM A36, Grade 420 or Grade 520
 - C. Nuts: Shall meet or exceed strength requirements of threaded bar on which they are threaded.
- 2.3 EXPOXY COATING
 - A. Epoxy coating shall conform to ASTM A775 or ASTM A934
 - B. Minimum thickness: 0.01 inches

2.4 CENTRALIZERS

- A. Shall be of PVC or steel construction that is non-detrimental to reinforcing steel.
- B. Centralizers shall not interfere with structural capacity of micropiles as determined by ENGINEER.

PART 3 EXECUTION

- 3.1 GENERAL
 - A. Piles shall be oriented as shown in the DRAWINGS.
 - B. Piles shall be installed under the supervision of a qualified ENGINEER retained by the OWNER.
 - C. CONTRACTOR shall protect site and equipment during pile installation.
 - D. One non-production pile shall be installed at a location determined by the ENGINEER.

3.2 MICROPILE INSTALLATION

- A. Drilling
 - 1. Bore holes shall be drilled to depth shown in the DRAWINGS.
 - 2. Drilling equipment and methods shall be suitable for advancing through sandstone foundation material with unconfined compressive strength of at least 14,000 pounds per square inch.
 - 3. The use of bentonite drilling fluid is not allowed.
 - 4. Use water or air to clean boring prior to placing grout.

- B. Reinforcing Steel Bar Placement
 - 1. Reinforcing steel bar shall be cleaned and free of soil, mud, grease, oil, or other contaminates prior to placement.
 - 2. Reinforcing steel bar may be spliced with couplers with prior approval from ENGINEER.
 - 3. Any nicks and damage to the bar coating shall be repaired prior to installation using a material recommended by the bar supplier at no additional cost to the OWNER. Any repairs shall be fully cured prior to installation.
 - 4. Reinforcing steel bars shall be centered within bore hole with centralizers.
 - 5. Reinforcing steel bars may either be placed prior to grouting or after grout is placed.
 - a. Reinforcing steel bar placed after grouting shall be inserted into the bore hole to the required depth without difficulty. Reinforcing steel bars shall not be driven or forced into the bore hole.
 - b. If previous requirement is not met, CONTRACTOR shall redrill bore hole and replace reinforcing steel bar at no additional cost to the OWNER.
- C. Centralizer Placement
 - 1. Centralizers shall be cleaned and free of soil, mud, grease, oil, or other contaminates prior to placement.
 - 2. Centralizers and spacers shall be provided at a maximum spacing of 10 feet on centers.
 - 3. Upper and lower most centralizers shall be located a maximum of 5 feet in from the top and bottom of bore hole.
- D. Grouting
 - 1. Bore hole shall be tremie grouted the full length in such a manner that results in continuous placement.
 - 2. Tremie pipe shall always extend below existing grout within the bore hole.
 - 3. Placed grout shall be free of lumps and undispersed cement.
 - 4. CONTRACTOR shall provide means and methods to measure grout pressure and quantity during grout operations.
- E. Tolerances
 - 1. Angle: 4% of vertical
 - 2. Horizontal Location: shall be within 3 inches of locations shown on DRAWINGS.
 - 3. Micropiles shall be installed to at least the minimum depth from competent foundation material shown on the DRAWINGS.

3.3 FIELD QUALITY CONTROL

- A. General:
 - 1. Field quality control will be performed by OWNER.
 - 2. CONTRACTOR shall provide access, cooperation, and incidental labor required by OWNER to obtain specimens, perform tests, and conduct inspections.
 - 3. CONTRACTOR shall provide facilities for safe storage and proper curing of grout test cubes onsite for first 48 hours, and for additional time as required before transporting to testing laboratory.
 - 4. CONTRACTOR shall provide grout for making test cubes from grout plant.

- B. Compression Test Specimens:
 - 1. Specimens will be fabricated, cured, and tested per ASTM C109 at frequency of no less than one set of grout cubes per day.
- C. Micropile Load Testing
 - 1. Tension load testing shall be performed per ASTM D3689
 - 2. Non-production micropile shall be tension load tested to failure with a load of at least 200% of the design load as determined by the ENGINEER but no more than 80% of the yield strength of the reinforcement steel bar. Testing of this pile shall be completed prior to drilling and installation of other piles.
 - 3. Production micropoiles shall be proof tested in tension according to the following schedule:

Test Load	Hold Time
0.25 x Design Load	1 minute
0.50 x Design Load	1 minute
0.75 x Design Load	1 minute
1.00 x Design Load	1 minute
1.30 x Design Load	10 or 60 minute creep test
1.60 x Design Load	1 minute

- 4. Acceptance criteria for micropile proof load test are as follows:
 - a. Micropile must sustain tension of 1.0 x Design Load with no more than ¹/₄ inch total vertical movement at the top of the micropile, relative to the top of micrpile prior to testing.
 - b. Creep rate of micropile at end of 1.30 x Design Load testing shall not exceed 1 mm/log cycle time for 10 minute creep test or not exceed 2mm/log cycle time for 60 minute creep test.
 - c. Micropile shall not fail during 1.60 x Design Load test.
- 5. Load testing may be adjusted at the discretion of the ENGINEER.
- D. Enforcement of Testing Requirements
 - 1. ENGINEER may require CONTRACTOR to remove and replace micropiles determined to be defective at no additional cost to the OWNER.

SECTION 33 11 00

PIPING - GENERAL

PART 1 GENERAL

1.01 SUMMARY

- A. General
 - 1. This Section includes general requirements for piping and shall supplement the material specification for the type of pipe specified.
 - 2. In case of any conflict between AWWA, ASTM, AASHTO, ANSI, PPI, Uni-Bell, or NRCS Standards or other references and the Specifications and drawings, the Specifications and drawings shall govern.
- B. Provide, install, and test pipe and fittings, complete as shown on the Drawings and as specified herein.
- C. Related Sections:
 - 1. SECTION 03 15 13 WATERSTOPS FOR CONCRETE STRUCTURES
 - 2. SECTION 03 30 00 CAST-IN-PLACE CONCRETE
 - 3. SECTION 05 10 00 STRUCTURAL STEEL, MISCELLANEOUS METAL WORK AND EMBEDMENTS
 - 4. SECTION 35 20 19 HYDRAULIC VALVES

1.02 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ASME B36.10M Welded and Seamless Wrought Steel Pipe
 - 2. ASME B36.19M Stainless Steel Pipe
- B. Plastics Pipe Institute, PPI
 - 1. PPI Handbook of Polyethylene Pipe 2009 (2nd Edition)
 - 2. PPI TN-42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects (2009)
- C. American Society for Testing and Materials (ASTM):
 - 1. A269 Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
 - 2. D2241 Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)
 - 3. D1784 Standard Specification for Rigid PVC Compounds and Chlorinated PVC Compounds
 - 4. F477 Standard Specification for Elastometric Seals (Gaskets) for Joining Plastic Pipe
- D. Society of Automotive Engineering (SAE):
 - 1. J514 Hydraulic Tube Fittings

1.03 DEFINITIONS

- A. Deflection: Decrease in the vertical diameter of a pipe as a result of backfill and loading. Deflection is measured as the change in vertical diameter divided by the nominal pipe diameter, expressed as a percentage.
- B. Initial Deflection: Deflection occurring on the day the backfilling over the pipe, as shown in the Construction Drawings, is complete
- C. Joint Deflection: Deflection occurring at pipe joints in order to obtain horizontal alignment curvature or vertical profile curvature, expressed in degrees.

1.04 PIPE DESIGN CRITERIA

- A. General:
 - 1. Drawings: Shall mean the Contract Drawings issued for the Project.
 - 2. The pipe, fittings, and specials shall be designed and manufactured to meet the strength requirements given and to conform when laid with line and grades including outlets, connections, test bulkheads, and appurtenances as shown on the Drawings.

33 11 00 - 1 PIPING - GENERAL 3. The pipe shall be furnished to the sizes, dimensions, and pressure classification required and shall be installed in such places as shown on the Drawings or as designated by the ENGINEER, in accordance with these specifications and in conformity with the lines and grades given.

1.05 SUBMITTALS

- A. Certified Manufacturer Technical Specification Sheets of Pipe Materials:
 - 1. Furnish certified technical specifications sheets from manufacturer of any proposed piping materials
- B. Certified Drawings of Valves and Appurtenances:
 1. Furnish certified dimensional Drawings of all valves, fittings, and appurtenances.
- C. Pipe Floatation Prevention / Anchoring Plan
 - 1. Plan shall address measures that will be taken to prevent pipe floating during concrete placement.
 - 2. Furnish specification sheets for anchoring materials to be used as part of the Pipe Floatation Prevention/Anchoring Plan
- D. Stainless Steel Tube Hydraulic Line Layout Plan
 - 1. Provide plan detailing proposed layout, fittings, and installation methods to connect hydraulic lines between hydraulic pressure unit and hydraulic gates.
 - 2. Furnish schedule of proposed fittings

1.06 QUALITY CONTOL SUBMITTALS

A. Repair methods for sections of pipe that fail testing.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Pipe sections and fittings shall be transported and handled with care in accordance with the manufacturer's recommendations.
- B. Support stockpiled pipe on sand or earth berms free of rock exceeding 3 inches in diameter. Secure pipe to prevent rolling.
- C. Handle plastic pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2 using approved strapping and equipment rated for the loads encountered. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe or endanger persons or property. Field storage is to be in compliance with AWWA Manual of Practice M55 Chapter 7.
- D. If any gouges, scrapes, or other damage to pipe results in loss of 10% of the pipe wall thickness, cut out that section or do not use.
- E. Check deflection of pipe and relocate struts, if any, or provide additional struts to keep the deflections within that specified in this Section and to maintain the pipe in a round condition.

PART 2 PRODUCTS

2.01 PIPING

- A. Stainless Steel Tube Hydraulic Lines
 - 1. Tubing shall be furnished to the sizes shown on the Drawings.
 - 2. Tube shall have a minimum pressure rating of 3,000 psi.
 - 3. Pipe shall be seamless conform to ASTM A269 Grade 304 or 316.
- B. Solid Wall HDPE Conduit
 - 1. Pipe shall be furnished to the diameter, sizes, and dimensions shown in the Drawings.
 - 2. Pipe shall have a maximum dimension ratio of 17.
 - 3. Pipe shall conform to ASTM F714.
 - 4. HDPE resin shall meet the material designation code of PE4710 with a minimum Cell Classification of PE445574C according to ASTM D3350.
 - 5. Pipe shall be supplied in rolls to avoid any fusion beads inside the pipe or all internal fusion beads shall be removed during installation.
- C. Polyvinyl Chloride (PVC) Pipe SDR Series

- 1. Pipe shall be furnished to the diameters, sizes, and dimensions shown in the Drawings.
- 2. Pipe shall be the pressure rating shown on the plans.
- 3. Pipe shall conform to ASTM D1785 and ASTM D2241
- 4. PVC compounds shall meet or exceed requirements of ASTM D1784 Cell Class 12454
- 5. Pipe end finishes shall consist of gasketed joints conforming to ASTM F477.
- D. Schedule Steel Pipe
 - 1. Pipe shall be furnished to the diameters, sizes, and dimensions shown in the Drawings.
 - 2. Pipe shall be Schedule 80 or 40 as noted on the plans.
 - 3. Pipe shall conform to ASTM A53, A106, or A312.
 - 4. Pipe dimensions shall meet standards of ANSI/ASME B36.10/19.

2.02 FITTINGS AND SPECIALS

- A. Stainless Steel Tube Hydraulic Lines
 - 1. Fitting shall be provided as necessary to make a complete connection between Hydraulic Pressure Unit and associated Hydraulic Gate Cylinders.
 - 2. Fitting shall be SAE Straight Thread O-Ring Port/Boss (SAE ORB) compression fittings conforming to SAE J514.
 - 2. Fitting shall have a minimum pressure rating of 3000 pound per square-inch.
 - 3. Fittings shall be made of steel conforming to ASTM A269 Grade 304 or 316.
- C. Polyvinyl Chloride (PVC) Fittings
 - 1. Fittings shall be furnished to the diameters, sizes, and dimensions shown in the Drawings.
 - 2. Fittings shall conform to ASTM D2241 and have a pressure rating equal to or greater than the pipe to which it is joined.
 - 3. PVC compounds shall meet or exceed requirements of ASTM D1784 Cell Class 12454
 - 4. Fitting end finishes shall consist of integral solvent weld compatible bell ends.
- D. Schedule Steel Pipe
 - 1. Fittings shall be furnished to the diameters, sizes, and dimensions shown in the Drawings.
 - 2. Fitting Schedule Class shall match the pipe on which it will be used.
 - 3. Fitting shall be made of materials conforming to ASTM A53, A106, or A312.

2.03 ANCILLARY MATERIALS

- A. Solvent Weld Cement: As supplied by pipe manufacturer; no substitute or "or-equal" will be allowed.
- B. Tube Clamps: Shall match the material of the tubing on which they will be used.
- C. O-Ring Lubricant: As recommended by fitting manufacturer.

2.04 PIPE AND FITTING IDENTIFICATION

- A. General
 - 1. Pipe and fittings shall be marked in accordance with manufacturer's process and method.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General
 - 1. Join pipe, tube, and fittings in accordance with manufacturer's instructions, unless otherwise shown or specified.
 - 2. Pipe and tube cuts shall be made perpendicular to their centerline.
 - 3. Inspect pipe and fittings before installation, clean ends and remove foreign matter and dirt from inside. With special attention to the joint area
 - 4. Close and block open end of last laid pipe section when placement operations are not in progress and at close of day's work.
 - 5. Prevent damage to pipe during placement.
 - 6. Contractor is responsible for ensuring that pipe and tubing is adequately anchored in order to prevent floatation during concrete placement. ENGINEER shall inspect pipe floatation anchoring prior to

concrete placement.

- 7. Raising or Lowering Pipe: Where necessary to raise or lower the pipe, the ENGINEER may change the alignment and/or the grades by the deflection of joints, by the use of bevel adapters or by the use of additional fittings. The deflection of the joint shall not exceed the maximum deflection recommended by the pipe manufacturer. No joint shall be deflected any amount which, in the opinion of the ENGINEER, will be detrimental to its strength and water tightness.
- B. Stainless Steel Tube Hydraulic Lines
 - 1. CONTRACTOR is responsible for furnishing and installation of materials required to make hydraulic connections between the hydraulic control unit and hydraulic gates shown in the DRAWINGS.
 - 2. Hydraulic tubing and fittings shall be assembled per the manufacturer's recommendations.
 - 3. Hydraulic tubing shall be arranged vertically or horizontal as far as possible in an orderly fashion that results in the shortest run with the fewest bends as feasible.
 - 4. A minimum separation of 1-inch shall be maintained for hydraulics lines that are laid parallel except when placing within a conduit.
 - 5. Two continuous beads of hydrophilic waterstops shall be placed are hydraulic tubing penetrating through concrete walls prior to casting of concrete. Hydrophilic waterstops shall be placed 6 inches in from either side of the wall. Place hydrophilic waterstops according to SECTION 03 15 13.
 - 6. Bends in hydraulic tubing can be made with SAE ORB type compression fittings or mechanical tube bends.
 - 7. Bending:
 - a. Use a mechanical or hydraulic pipe bender to bend hydraulic tubing in a cold state.
 - b. Bending radius shall not be less than 6 times the tube diameter.
 - c. Tubing shall be bent in a manner that does not result in flattened, kinked, or wrinkled tubing. Tube bends that are flattened, kinked, or wrinkled shall be replaced by the CONTRACTOR at no additional cost to the OWNER.
 - 8. Fittings:
 - a. O-rings shall be lubricated with a lubricant approved by the manufacturer prior to installation.
 - b. Tighten fittings according to manufacturer's recommendations.
 - 9. Cutting:
 - a. A wire wheel cutter shall be used to cut hydraulic tubing. Cutting pipe with a hack saw, plasma cutter, snips, or any other means is not permitted.
 - b. Cut tube ends shall be deburred and cleaned prior to assembly.
 - 10. Clamping:
 - a. Hydraulic lines shall be fastened to concrete with clamps spaced every 2 feet along hydraulic line alignments but not less than 1 clamp in between bends.
 - b. Clamps shall be fastened to concrete per SECTION 05 10 00.
- C. Fusion Welded Solid Wall HDPE
 - 1. Fusion welding of any kind shall not occur during or when periods of precipitation are expected unless performed in an enclosed/cover area approved by the ENGINEER.
 - 2. Pipe shall be joined by the butt fusion procedure outlined in ASTM F2620 or PPI TR-33.
 - 3. Fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations.
 - 4. Fusion joints shall be made by qualified fusion technicians per PPI TN-42
 - 5. Internal fusion beads shall be removed during prior to installation
- D. Polyvinyl Chloride Pipe (PVC)
 - 1. Install per manufacturer's recommendations.
 - 3. Solvent welded joints
 - a. Store solvent cement indoors.
 - b. Prior to solvent welding, remove fittings and couplings from their cartons and expose them to the air for at least one hour to the same temperature conditions as the pipe.
 - c. Wipe away loose dirt and moisture from the ID and OD of the pipe end and the ID of the fitting before applying solvent cement. Do not apply solvent cement to wet surfaces.
 - d. Make up solvent welded joints per ASTM D 2855.
 - e. Allow at least 8 hours of drying time before moving solvent welded joints or subjecting the joints to any internal or external loads or pressures.

- E. Schedule Steel Pipe
 - 1. Install per manufacturer's recommendations.
 - 2. Pipe and fitting connections shall be screwed with National Pipe Straight threads.
 - 3. Cut pipe ends shall be reamed to remove burrs and cleaned before making threaded connection.

F. Tolerances

- 1. Vertical tolerance shall be 0.05 feet of grades shown on the Construction Drawings
- 2. Horizontal tolerance shall be 0.50 feet of lines shown on the Construction Drawings
- 3. Initial Deflection shall not exceed 7 percent
- 4. Joint deflection shall not exceed 1 degree

3.03 CLEANING

A. Clean in-place from inside by brushing and sweeping, then flush or blow line with air.

SECTION 35 22 26.1 INSTALLATION OF CAST IRON SLIDE GATES

PART 1 GENERAL

- 1.1 SUMMARY
 - A. Section includes:
 - 1. Installation of slide gate.
 - 2. CONTRACTOR's responsibilities.

1.2 GENERAL

- A. Furnish all tools, supplies, materials, equipment and labor necessary for the installation, testing, and placing into operation the slide gates and appurtenances, complete and operable, in accordance with the requirements of the Contract Documents. It will be necessary to supply a generator to operate the actuators on the gates for testing.
- B. The provisions of this Section shall apply to all equipment specified, except where otherwise indicated in the Contract Documents.
- 1.3 CONTRACTOR'S RESPONSIBILITY FOR COMPLETE SYSTEM
 - A. All necessary storing, handling, installing, adjusting, and maintaining of the slide gates shall be the CONTRACTOR's responsibility once slide gates are provided to the CONTRACTOR by the OWNER.
 - B. Assist the Manufacturer with the pre-startup procedures, and operational startup of slide gates.
 - C. Provide and coordinate the construction of interconnecting structures, equipment, piping, and appurtenances to achieve installation and operation of the slide gates as shown and specified and as required to provide a complete and functional system.
 - D. Conduct all field tests, as specified herein, and correct all issues related to installation only.

1.4 MANUFACTURER'S RESPONSIBILITY FOR OWNER SUPPLIED PRODUCTS

- A. The Manufacturer of the cast iron slide gates will be responsible for providing the following to the OWNER and CONTRACTOR:
 - 1. Complete manufacturer testing of gates prior to shipment.
 - 2. Factory testing and certification of test results.
 - 3. O&M manual, including installation and storage instructions.
 - 4. Inspection, acceptance and certification of CONTRACTOR'S gate installations.
 - 5. Field Services, to include inspection and certification of proper installation, startup and testing assistance.
 - 6. Training of OWNER's personnel.
- B. After completion, the Manufacturer will furnish written guarantees to the ENGINEER that the equipment will operate as required.

1.5 MANUFACTURER'S SERVICE REPRESENTATIVE:

- A. Installation, Testing and Startup Assistance specified in Manufacturer's documents will be used.
 - 1. Three visits to the job site for installation inspection, startup, testing, and training.

1.6 EQUIPMENT INSTALLATION

A. All work associated with the equipment installation shall be performed by the CONTRACTOR. The field quality control work including the recording of all field measurements, assistance with equipment start-up, and conducting the functional and performance testing shall be performed by the CONTRACTOR.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide products required to complete the Work under this Section as described in this section.

2.2 PRODUCTS PROVIDED BY OWNER

- A. Products to be provided to the CONTRACTOR by the OWNER include the following:
 - 1. Two 36 inch x 48 inch Series HG560 Slide Gates including Yoke Mounted Hydraulic Cylinders.
 - 2. One 54 inch x 54 inch Series HG560 Slide Gate including Yoke Mounted Hydraulic Cylinder.
 - 3. Two 36 inch x 48 inch Type F Wall Thimbles
 - 4. One 54 inch x 54 inch Type F Wall Thimble
 - 5. Hydraulic Pressure Unit

2.3 MISCELLANEOUS PRODUCTS

- A. General: CONTRACTOR shall furnish incidental products, such as gaskets, supports, bolts, stainless steel tubing, hydraulic lines, valves, fittings, hydraulic fluid, and miscellaneous lubricants, as shown and as required for proper operation of equipment installed under this Section. Products shall conform to applicable Sections of these Specifications for the intended service.
- B. Installation of Anchor Bolts: Contractor shall provide sleeves, templates and other installation materials needed for installation of equipment. Locate anchor bolts for gate frames in accordance with Manufacturer's Shop Drawings and installation instructions.

PART 3 EXECUTION

- 3.1 GENERAL
 - A. Maintain complete inventory on all products after their transfer to CONTRACTOR.
 - B. Installation Work shall conform to Manufacturer's recommended procedures, instructions, and Shop Drawings, provided by the ENGINEER.

3.2 INSPECTION OF EQUIPMENT

- A. Before transfer of products to the CONTRACTOR, jointly inspect the condition of equipment.
- B. Damage to or loss of equipment and materials shall be immediately reported to the ENGINEER.
- 3.3 STORAGE AND PROTECTION
 - A. Store and maintain equipment to prevent damage.

- B. Damage to or loss of products shall be repaired to original condition, or replaced with new identical products, as reviewed and accepted by ENGINEER.
- C. The Manufacturer shall inspect the equipment for signs of patterns, rust decay, or other deleterious effects of improper storage just before installation, and shall notify ENGINEER of the results of the inspection. CONTRACTOR shall make site accessible for equipment inspection.

3.4 CORROSION PROTECTION

- A. Products will be delivered with prime and finish coats. Protect these finishes during unloading, storage, and installation.
- B. Touch up or repair damage to coatings that results from unloading, storage, installation, testing, and startup in accordance with Manufacturer's recommendations. If finish coats are damaged extensively after transfer, completely repaint.
- C. Touch up, repair, or complete repainting shall match color of original paint, and shall be fully compatible with primers and finish applied by equipment Manufacturer.

3.5 EQUIPMENT INSTALLATION:

- A. Install equipment in accordance with approved procedures submitted with the manufacturer's printed instructions and as shown.
- B. Provide supervision, labor, tools, construction equipment, incidental materials, and necessary services required to install the products.
- C. Installation of equipment shall not begin prior to satisfactory completion of the supporting structures.
- D. Coat bolt thread projections with an anti-sealing lubricant to facilitate future nut removal.

3.6 MAINTENANCE

A. Follow Manufacturer's instructions for maintenance during storage, after installation but prior to testing and startup, and after startup but prior to OWNER's acceptance.

3.7 FIELD QUALITY CONTROL

A. General: Give full access to Work by, and cooperate with, Manufacturer during testing to enable gathering of data and information necessary to evaluate performance and develop recommendations for acceptable operation and maintenance instructions.

3.8 PREPARATION

- A. Cleaning and Checking: Prior to beginning functional testing, inspect and clean equipment, devices, connecting piping, and structures to ensure they are free of foreign material.
- B. Ready-to-test determination will be by ENGINEER based on the following:
 - 1. Notification by CONTRACTOR of equipment readiness for testing. Piping and valves shall be ready for service.
 - 2. Receipt of Manufacturer's Certificate of Proper Installation, if so specified.
 - 3. Adequate completion of Work adjacent to, or interfacing with, equipment to be tested.
 - 4. Availability and acceptability of manufacturer's representative.
 - 5. Satisfactory fulfillment of other specified manufacturer's responsibilities.

3.9 STARTUP AND FIELD TESTS:

- A. Coordinate the following:
 - 1. Verify that proper mechanical connections have been made.
 - 2. If, in the opinion of the ENGINEER, the system meets the requirements specified, the Startup and Field Testing will be conducted.
 - 3. The following field testing shall be performed:
 - a. Hydraulic lines shall be tested for leaks and deficiencies
 - b. Complete system test shall be performed upon substantial completion. Gates shall be fully cycled open to closed a minimum of 3 times.
 - 4. If system fails field test, make such adjustments, changes, and/or additions as are necessary to correct the system and retest.
 - 5. The ENGINEER and Manufacturer or its representative shall participate in the startup and testing. In the event any of the equipment fails to meet the above test requirements as a result of CONTRACTOR'S work, the work shall be modified and re-tested in accordance with the requirements of these Specifications.

3.10 SUPPLEMENTAL INFORMATION

- A. The Supplements listed below is a part of this Specification.
 - 1. Supplement A: Form: Certificate of Acceptable Delivery, Unloading and Storage
 - 2. Supplement B: Hydrogate Shop Drawings for Products Provided by OWNER
 - 3. Supplement C: Hydrogate Installation, Operation, & Maintenance Manual for HG560 Cast Iron Slide Gates

CERTIFICATE OF ACCEPTABLE DELIVERY, UNLOADING, AND STORAGE

To:	ENGINEER		
Attentic	on:		
Regard	ling:		
The u CONTF accorda equipm	undersigned representing, hereinafter called the RACTOR, certifies that the slide gates and operators were delivered, unloaded, and stored in ance with the recommended procedures and precautions; and accepts the transfer of the above tent, with observed defects noted as follows (if any):		
Signed	this day of, 20		
Ву:			