

DOCUMENTS FOR THE CONSTRUCTION OF
PARADISE IRRIGATION DISTRICT
EQUALIZER TANK REPLACEMENT PROJECT
JOB NUMBER 22-098
BID SCHEDULE NUMBER _____

TECHNICAL SPECIFICATIONS
(DIVISIONS 00-46)

March 2024

BID DOCUMENTS



03/25/2024

ENGINEER:



WATERWORKS
ENGINEERS

WATER WORKS ENGINEERS, LLC.

CONTACT:

Sheila Nilsen
(530) 314-7541

TABLE OF CONTENTS

SECTION	TITLE
---------	-------

DIVISION 0

00 11 13	ADVERTISEMENT FOR BIDS
00 21 13	INSTRUCTIONS TO BIDDERS
00 41 03	BID FORM
00 43 03	BID BOND FORM
00 43 36	LIST OF SUBCONTRACTORS
00 43 93	BIDDER'S CHECKLIST
00 52 03	AGREEMENT FORM
00 61 03	PERFORMANCE BOND FORM
00 61 06	PAYMENT BOND FORM
00 72 03	GENERAL CONDITIONS
00 73 03	SUPPLEMENTARY CONDITIONS

DIVISION 1

01 11 03	SUMMARY OF WORK
01 14 03	SPECIAL PROJECT CONSTRAINTS
01 29 03	MEASUREMENT AND PAYMENT
01 31 19	PROJECT MEETINGS
01 32 13	PROGRESS SCHEDULE
01 33 03	SUBMITTAL PROCEDURES
01 33 03.13	O&M MANUAL REVIEW CHECKLIST
01 33 13	CERTIFICATES AND REFERENCE FORMS
01 42 03	REFERENCE STANDARDS AND ABBREVIATIONS
01 45 03	QUALITY CONTROL
01 51 03	TEMPORARY CONSTRUCTION FACILITIES AND UTILITIES
01 61 03	GENERAL PRODUCT REQUIREMENTS
01 66 00	TRANSPORTATION AND HANDLING OF GOODS
01 66 10	PRODUCT STORAGE HANDLING AND DELIVERY
01 71 13	MOBILIZATION
01 74 03	CLEANING
01 75 06	TESTING, TRAINING AND STARTUP
01 77 03	OPERATIONAL COMPLETION AND PROJECT CLOSEOUT
01 78 36	PRODUCT WARRANTY

DIVISION 2

02 41 03	DEMOLITION
----------	------------

SECTION	TITLE
DIVISION 3	
03 11 03	CONCRETE FORMWORK
03 15 16	CONCRETE JOINTS
03 21 03	CONCRETE REINFORCING
03 30 03	CAST-IN-PLACE CONCRETE
03 60 03	GROUT
DIVISION 4	NOT USED
DIVISION 5	
05 05 03	MISCELLANEOUS METALS
05 05 06	ANCHORS, INSERTS AND DOWELS
05 05 09	STRUCTURAL STEEL
05 52 13	ALUMINUM HANDRAILS AND RAILINGS
05 53 03	GRATING AND CHECKERED PLATE
DIVISION 6	NOT USED
DIVISION 7	NOT USED
DIVISION 8	NOT USED
DIVISION 9	
09 91 03	PAINTING
DIVISION 10	
10 05 03	IDENTIFICATION DEVICES
10 42 03	SAFETY EQUIPMENT
DIVISION 12	NOT USED
DIVISION 13	NOT USED
DIVISION 21	NOT USED

SECTION	TITLE
---------	-------

DIVISION 22	NOT USED
-------------	----------

DIVISION 23	NOT USED
-------------	----------

DIVISION 26	
-------------	--

26 05 03	GENERAL ELECTRICAL PROVISIONS
26 05 19	WIRES AND CABLES (600 VOLT MAXIMUM)
26 05 23	CONTROL AND INSTRUMENTATION CABLES
26 05 26	GROUNDING AND BONDING
26 05 30	HANGERS AND SUPPORTS
26 05 33	OUTLET, PULL, AND JUNCTION BOXES
26 05 35	RACEWAYS, FITTINGS, AND SUPPORTS
26 05 43	UNDERGROUND DUCTS AND RACEWAYS
26 05 45	MANHOLES AND HANDHOLES
26 05 53	ELECTRICAL IDENTIFICATION
26 18 03	WIRING DEVICES
26 43 13	LIGHTNING PROTECTION FOR STRUCTURES
26 51 03	LIGHTING SYSTEMS

DIVISION 31	
-------------	--

31 05 03	EARTHWORK
31 11 03	SITE PREPARATION
31 23 17	ROCK AND BOULDER EXCAVATION

DIVISION 32	
-------------	--

32 31 13	CHAIN LINK FENCES AND GATES
32 92 03	HYDROSEEDING

DIVISION 33	NOT USED
-------------	----------

DIVISION 40	
-------------	--

40 05 06	PIPING SPECIALTIES
40 05 07	PIPING SUPPORT SYSTEMS
40 05 10	PIPE AND FITTINGS
40 05 10.01	PIPE SCHEDULE
40 05 19	PSDS - DUCTILE IRON PROCESS PIPE (DIP)
40 05 24.02	PSDS - GALVANIZED STEEL PIPE (GSP)
40 05 24.03	PSDS - WELDED STEEL PIPE (WSP)

TOC-3
Table of Contents

Washwater Equalizer Tank Replacement Project

SECTION	TITLE
40 05 31.01	PSDS - SOLVENT WELDED POLYVINYL CHLORIDE PIPE (PVC1)
40 05 33.01	PSDS - HDPE DRAINAGE PIPE (HDPE1)
40 05 51	VALVES
40 05 51.13	VALVE SCHEDULE
40 05 58	FABRICATED SLIDE GATES
40 05 91	TESTING OF PRESSURE PIPING SYSTEMS
40 42 13	PIPING INSULATION
40 61 13	PROCESS CONTROL SYSTEMS GENERAL REQUIREMENTS
40 61 96	PROCESS CONTROL DESCRIPTIONS
40 68 66	PROGRAMMING AND CONFIGURATION
40 70 03	PROCESS CONTROL SYSTEM PRIMARY SENSORS AND FIELD INSTRUMENTS
40 70 06	MISCELLANEOUS DEVICES
40 75 00	PROCESS CONTROL SYSTEM INSTRUMENTATION INDEX

DIVISION 41 NOT USED

DIVISION 43 NOT USED

DIVISION 44 NOT USED

DIVISION 46 NOT USED

++ END OF SECTION ++

SECTION 01 11 03

ADVERTISEMENT FOR BIDS

Sealed Bids for construction of the Paradise Irrigation District Zone A Pump Station and Transmission Main Project, addressed to ATTN: Georgeanna Borrayo, Paradise Irrigation District, 6332 Clark Road, Paradise, CA 95969 shall be received until **1:00 p.m.**, local time, on **DAY, MONTH DATE, YEAR.** Bids will be opened immediately thereafter and read aloud.

Bids will be publicly opened, examined and declared by the Construction Manager on said day and hour, and will be referred to Paradise Irrigation District (OWNER) for subsequent action. Any Bids received after the specified time and date will not be considered.

The Work is located in Paradise CA, at the Paradise Water Treatment Plant (13888 Pine Needle Drive).

The Project contemplated consists of the construction of one bifurcated cast-in-place concrete tank and performing related required work. The project includes the following major components as identified on the Bid Form:

1. Mobilization and Demobilization to the site, including all temporary construction facilities
2. Trenching, sheeting, shoring, and bracing as required by Section 6707 of the California Labor Code
3. Water Pollution Control Plan
4. Tie-Back Soil Anchor Design
5. Demolition
6. Civil Site Work and Grading
7. Phase 1 Tank 2 Construction
8. Phase 2 Tank 1 Construction
9. Retaining Wall Construction (walls not associated with Tank structures)
10. Existing Slab Repair
11. Yard Piping
12. Site Finishing (including gravel surfacing, sidewalk and driveway concrete, asphalt and road repair within the limits of the WTP)
13. Electrical and Instrumentation installation
14. SCADA Integration
15. All remaining work

Project shall be substantially complete in **130** working days. All Work shall be completed within **150** working days from the date established in the Notice to Proceed. At this time, Notice to Proceed is expected prior to **MONTH DATE, YEAR.** Refer to Section 01130, Special Project Constraints in the Technical Specifications for project constraints.

The engineer's estimate for this project is \$2,080,000.

A **mandatory** pre-bid meeting is scheduled between ENGINEER, OWNER and interested bidders on **DAY, MONTH DATE at TIME a.m.** Interested bidders should meet at Paradise

00 11 13-1
Advertisement For Bids

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

Irrigation District's Reservoir Water Treatment Plant located at *13888 Pine Needle Drive, Magalia, California 95954*. At this time the project will be reviewed, followed by a tour of the facilities and work areas. It is a mandatory requirement that each prime contractor must have a representative at the pre-bid meeting to be allowed to submit a bid. Potential sub-contractors and suppliers are not required to attend the pre-bid meeting but are encouraged to attend.

Bidding Documents include the following:

- Volume 1 – Bid Requirements and Specifications
- Volume 2 – Drawings (11-inch by 17-inch)
- Volume 3 – Geotechnical Report

Bidding Documents and addenda may be obtained at CIPLIST.com at no charge. Supporting documents as required (i.e., geotechnical reports, etc.) will also be posted on this site. Supporting and informational documents are for informational purposes only and for the convenience of the bidders and are not considered a part of the Bidding Documents.

Bidding Documents are provided electronically and free of charge. It is the responsibility of each prospective bidder to verify the completeness of their printed Bidding Documents before submitting their Bid and accompanying completed forms. Users are cautioned that OWNER and ENGINEER do not assume any liability or responsibility based on any defective or incomplete copying, excerpting, scanning, faxing, downloading, or printing of the Bidding Documents.

The Bidding Documents shall supersede any information posted or transmitted by CIPLIST.com.

Be advised that the information contained on CIPLIST.com may change and without notice to prospective bidders. It is the responsibility of each prospective bidder to check CIPLIST.com on a daily basis through the close of bids for any applicable addenda or updates. CIPLIST.com sends email notifications to ONLY those registered for the project.

Submit all bidder's questions in writing to the ENGINEER. Last day to submit questions is **MONTH DATE, YEAR**. All questions will be answered by end of day on **MONTH DATE, YEAR**.

Each Bid must be submitted on the prescribed Bid Form and accompanied by Bid security as prescribed in the Instructions to Bidders, payable to the OWNER in an amount not less than 10 percent of the amount Bid.

The Successful Bidder will be required to furnish the additional Bond(s) prescribed in the Bidding Documents.

In order to Bid and perform public work, the Bidder and Subcontractors shall hold or obtain such licenses as required by State Statutes, and federal and local Laws and Regulations. **Bids will be accepted only from Bidders holding a Class A California Contractors' License.**

For information concerning the proposed Work or to arrange to visit the project site, contact Sheila Nilsen via phone at 530-314-7541 or email at sheilan@wwengineers.com.

00 11 13-2
Advertisement For Bids

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

OWNER's right is reserved to reject all Bids or any Bid not conforming to the intent and purpose of the Bidding Documents.

Dated this _____ day of _____, 20__.

Paradise Irrigation District

By _____
Tom Lando, District Manager

++ END OF SECTION ++

00 11 13-3
Advertisement For Bids

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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00 11 13-4
Advertisement For Bids

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

PART 1 - DEFINED TERMS

Terms used in these Instructions to Bidders have the meanings assigned to them in the General Conditions.

Certain additional terms used in the Bidding Documents have the meanings indicated below which are applicable to both the singular and plural thereof.

1.1 Bidder—one who submits a Bid to OWNER as distinct from a subbidder, who submits a Bid to a Bidder.

1.2 Apparent Low Bidder—that Bidder whose Bids as offered in the Bid Form represents the lowest total as determined by the Base Bid.

1.3 Base Bid:

1.3.1 Base Bid—Includes Bid for all Lump Sum and Unit Price Work.

1.4 Successful Bidder—lowest, responsible and responsive Bidder to whom OWNER (on the basis of OWNER's evaluation as hereinafter provided) makes an award.

PART 2 - BIDDING DOCUMENTS

2.1 The Bidding Documents consist of the following volumes:

- Volume 1 – Bid Requirements and Specifications
- Volume 2 - Drawings
- Volume 3 – Geotechnical Report

2.2 Complete sets of Bidding Documents obtained from CIPLIST.com must be used in preparing Bids. Neither OWNER nor ENGINEER assume any responsibility for errors or misinterpretations resulting from use of incomplete sets of Bidding Documents.

2.3 The Drawings included in the Bidding Document are half-size reductions of the original full-size drawings. The amount of reduction is indicated by a note or scale bar on the Drawings.

2.3 Bidding Documents made available on the above terms are only for the purpose of obtaining Bids for the Work and shall not be used for any other purpose.

00 21 13-1
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

PART 3 - QUALIFICATIONS OF BIDDERS

3.1 To demonstrate qualifications to perform the Work, each Bidder must be prepared to submit within 5 days after Bid opening and upon OWNER's written request evidence, such as financial data, previous experience, present commitments, and other such data as may be called for below. Each Bid must contain evidence of Bidder's qualification to do business in the state of California or covenant to obtain such qualification prior to contract award.

3.2 Nothing indicated herein will prejudice OWNER's right to seek additional pertinent information as is provided in Article AWARD OF CONTRACT.

PART 4 - LICENSE REQUIREMENTS

4.1 The classification of Contractor's License a Bidder must hold to be eligible for an award of a contract for the Work is listed in the Advertisement for Bids.

PART 5 - EXAMINATION OF BIDDING DOCUMENTS AND SITE

5.1 It is each Bidder's responsibility, before submitting a Bid, to:

5.1.1 Examine thoroughly the Bidding Documents and other related data identified in the Bidding Documents (including "technical data" referred to below).

5.1.2 Inspect the site to become familiar with and satisfy Bidder as to the general, local, and site conditions that may affect cost, progress, performance, or furnishing of the Work.

5.1.3 Consider federal, state, and local Laws and Regulations that may affect cost, progress, performance, or furnishing of the Work.

5.1.4 Study and carefully correlate Bidder's knowledge and observations with the Bidding Documents and such other related data.

5.1.5 Promptly notify ENGINEER of all conflicts, errors, ambiguities, or discrepancies which Bidder has discovered in or between the Bidding Documents and such other related documents.

5.2 Reference is made to the Supplementary Conditions for identification of:

00 21 13-2
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

5.2.1 Those reports, if any, of explorations and tests of subsurface conditions at the site which have been utilized by ENGINEER in preparation of the Bidding Documents.

5.2.2 Those drawings, if any, of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are at or contiguous to the site which have been utilized by ENGINEER in preparation of the Bidding Documents.

Copies of such reports and drawings that are not included with the Bidding Documents may be examined at the office of OWNER or ENGINEER during regular business hours.

5.3 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders on subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in paragraphs 4.02 and 4.03 of the General Conditions.

5.4 Before submitting a Bid, each Bidder will be responsible to make or obtain such additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the site or otherwise and which may affect cost, progress, performance, or furnishings of the Work and which Bidder deems necessary to determine its Bid.

5.5 On request, OWNER will provide each Bidder access to the site to conduct such examinations, investigations, explorations, tests, and studies as each Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.6 Reference is made to the Summary of Work for identification of the general nature of work that is to be performed at the site by OWNER or others and that relates to Work for which a Bid is to be submitted. On request, OWNER will provide to each Bidder, for examination, access to or copies of Bidding Documents (other than portions thereof related to price) for such work by others.

5.7 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this article; that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying the specific means, methods, techniques, sequences, or procedures of construction (if any) that may be shown or indicated or expressly required by the Bidding Documents; that Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by ENGINEER is acceptable to Bidder; and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work and for preparing the Bid.

00 21 13-3
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

PART 6 - INTERPRETATIONS AND ADDENDA

6.1 All questions about the meaning or intent of the Bidding Documents are to be directed to ENGINEER in writing. Interpretations or clarifications considered necessary by ENGINEER in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by the office issuing documents as having received the Bidding Documents. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

6.2 Addenda may also be issued to modify the Bidding Documents as deemed advisable by OWNER or ENGINEER.

PART 7 - BID SECURITY

7.1 Each Bid must be accompanied by Bid security made payable to OWNER in an amount of 10 percent of Bidder's maximum Bid price and in the form of a certified or cashier check or completed Section 00400, Bid Bond, issued by a surety meeting the requirements of paragraph 5.01 and 5.02 of the General Conditions.

7.2 Each bid must be accompanied by a power-of-attorney for the Surety's agent to execute the Bid Bond.

7.3 The Bid security of Successful Bidder will be retained until such Bidder has executed the Agreement, furnished the required Performance and Payment Bond(s), certificates of insurance, and met the other conditions of the Bidding Documents. If the Successful Bidder fails to sign and deliver the Agreement and furnish the required Bond(s) and certificates of insurance within the time period specified in Article EXECUTION OF AGREEMENT, OWNER may annul the award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom OWNER believes to have a reasonable chance of receiving the award may be retained by OWNER until the earlier of the 10th day after the execution of the Agreement by the Successful Bidder or the rejection of all Bids by OWNER. Bid security submitted with Bids which are not competitive will be returned within 15 days after the Bid opening.

PART 8 - CONTRACT TIMES

8.1 Contract Times are set forth in the Agreement.

PART 9 - LIQUIDATED DAMAGES

00 21 13-4
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

9.1 Provisions for liquidated damages are set forth in the Agreement.

PART 10 - SUBSTITUTE AND "OR EQUAL" ITEMS

10.1 The contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used if acceptable to ENGINEER, application for such acceptance will not be considered by ENGINEER until after the Effective Date of the Agreement. The procedure for submission of any such application and consideration by ENGINEER is set forth in General Conditions paragraph 6.05 and may be supplemented in Section 01610, GENERAL EQUIPMENT REQUIREMENTS.

PART 11 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.1 Bidder shall submit with its Bid the names and business addresses of each proposed Subcontractor who will perform Work under these Bidding Documents in excess of 1/2 of 1 percent of the amount of the total Bid and shall list the portion of the Work (discipline and subcontract dollar amount) which will be done by such Subcontractor. If the Bidder fails to specify a Subcontractor for any portion of the Work to be performed under the Bidding Documents, the Bidder agrees to perform that portion of the Work itself, and further agrees that it is qualified to perform that portion of the Work.

11.2 Subcontractors, business addresses, and the portion of work each subcontractor will perform shall be listed in the table provided in Section 00310, List of Subcontractors, which shall be submitted with each Bid. Failure to submit this List of Subcontractors will be grounds for rejection of the Bid.

11.3 Subletting and Subcontracting Fair Practices Act:

Contractor shall comply with the requirements of the Subletting and Subcontracting Fair Practices Act, Chapter 4, Part 1, Division 2 of the Government Code, which include the following:

1. Contractor shall, in its bid or proposal, set forth:
 - a. The name, the location of the place of business, the California contractor license number, and public works contractor registration number issued pursuant to Section 1725.5 of the Labor Code of each subcontractor who will perform work or labor or render service to Contractor in or about the construction of the work or improvement, or a subcontractor licensed by the State of California who, under subcontract to Contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications, in an amount in excess of one-half of 1

00 21 13-5
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

percent of Contractor's total bid or proposal.

b. The portion of the work that will be done by each subcontractor under this act. Contractor shall list only one subcontractor for each portion as is defined by the Contractor in its bid.

2. If Contractor fails to specify a subcontractor or specifies more than one subcontractor for the same portion of work to be performed under the Contract in excess of one-half of 1 percent of the Contractor's total bid, Contractor agrees that it is fully qualified to perform that portion itself, and that Contractor shall perform that portion itself.

3. Contractor may not substitute a person as subcontractor in place of the subcontractor listed in the original bid, except as provided in the Act.

PART 12 - MBE/WBE UTILIZATION AND DOCUMENTATION REQUIREMENTS

12.1 Bidders, including prospective Subcontractors, are required to follow certain procedures to ensure compliance with the affirmative action requirements set forth in these Bidding Documents and are hereby advised to familiarize themselves with the requirements and to initiate the compliance procedures at the earliest time possible. State and federal regulations require that certain notices be given and procedures be completed within specific minimum periods of time; compliance with the affirmative action requirements might not be achievable if there is any delay in starting the compliance procedures.

00 21 13-6
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

PART 13 - WAGE RATES

13.1 The Work under these Bidding Documents is to be paid for with a variety of State and Federal funds. Therefore, both State and Federal prevailing wage rates are applicable. Where a conflict occurs between the State and Federal prevailing wage rates for any job description, the higher rate shall be used.

13.2 Federal prevailing wage rates information is available at <http://www.wdol.gov/dba.aspx>. The successful Bidder agrees upon execution of the Agreement to post a copy at the site.

13.3 State of California prevailing wage rates information is available at <http://www.dir.ca.gov/OPRL/PWD/>. The successful Bidder agrees upon execution of the Agreement to post a copy at the site.

PART 14 - BID FORM

14.1 The Bid Form and other attachments are included with the Bidding Documents. No substitution of forms will be allowed.

14.2 All blanks on the Bid Form must be completed by typing or printing with black ink. All price information shall be shown in both words and figures where required. No changes shall be made in the phraseology of the forms.

14.3 Bids by corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown above the signature.

14.4 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear on the line below the signature.

14.5 All names must be typed or printed on the line with the signature.

14.6 The Bid shall contain an acknowledgement of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).

14.7 The address and telephone number for communications regarding the Bid must be shown.

00 21 13-7
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

PART 15 - SUBMISSION OF BIDS

15.1 Bidders must bid on all schedules for their Bid to be considered responsive.

15.2 Bid Form and attachments may be photocopied for submission of Bids.

15.3 Submit Bids not later than the time prescribed, at the place, and in the manner set forth in the Advertisement for Bids. Enclose Bids in an opaque sealed envelope, marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted) and name and address of Bidder and accompanied by the Bid security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it. Bids must be made on the prescribed Bid Form provided and submitted with the attachments listed below.

15.4 Bidders shall complete and submit the following attachments with its Bid:

- Bid Form
- Authority to sign bid if signature is by agent other than officer of corporation, partner, or owner
- List of Subcontractors
- DWSRF Required Forms:
 - Certification of Nonsegregated Facilities
 - DBE Subcontractor Performance Form
 - DBE Subcontractor Utilization Form
 - Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion
 - Nondiscrimination Clause
 - Non-Collusion Affidavit
 - Equal Employment Opportunity Certification
 - Lobbying Certification
 - Drug-Free Workplace Certification
- American Iron and Steel Acknowledgement
- Bid Bond
- Power of Attorney for Surety's Agent to execute Bidder's Bond

15.5 Only one Bid from any individual, firm, partnership, or corporation, under the same or different names, will be considered. Should it appear to OWNER that any Bidder is interested in more than one Bid for Work contemplated, all Bids in which such Bidder is interested will be rejected.

PART 16 - MODIFICATION AND WITHDRAWAL OF BIDS

16.1 Bids may be modified or 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 at any time prior to the opening of Bids.

00 21 13-8

Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

16.2 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, that Bidder may withdraw its Bid and the Bid security will be returned. Thereafter, that Bidder will be disqualified from further consideration on the Work to be provided under the Contract Documents.

PART 17 - OPENING OF BIDS

17.1 Bids will be opened and (unless obviously nonresponsive) read aloud publicly. A summary of the amounts of the Base Bids will be made available to Bidders within 7 days after the date of Bid opening.

PART 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.1 All Bids will remain subject to acceptance for 90 days after the date of the Bid opening, but OWNER may, in its sole discretion, release any Bid and return the Bid security prior to that date.

18.2 NOTICE OF INTENT TO AWARD – The OWNER will submit a Notice of Intent to Award within three days of the closing of the bidding period.

PART 19 - BASIS OF AWARD; AWARD OF CONTRACT

19.1 If the contract is to be awarded, OWNER will give Successful Bidder a Notice of Award within 90 days after the day of the Bid opening.

19.2 OWNER reserves its right to reject any or all Bids, including without limitation the rights to reject any or all nonconforming, nonresponsive, unbalanced or conditional Bids, and to reject the Bid of any Bidder if OWNER believes that it would not be in the best interest of the Project to make an award to that Bidder, whether because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by OWNER. OWNER also reserves the right to waive all informalities not involving price, time, or changes in the Work. Discrepancies in the quantity multiplied by unit price and the extended total amount will be resolved in favor of the quantity multiplied by unit price. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

00 21 13-9
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

19.3 In evaluating Bids, OWNER will consider the qualifications of Bidders, whether or not 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. OWNER shall have the right to accept alternates in any order or combination unless otherwise provided in the Bidding Documents.

19.4 OWNER may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work for which the identity was required. OWNER also may consider the operating costs, maintenance requirements, performance data, and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data are required to be submitted prior to the Notice of Award.

19.5 OWNER may conduct such investigations as OWNER deems necessary to assist in Bid evaluation and to establish responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, and other persons and organizations to execute Work in accordance with the Bidding Documents to OWNER's satisfaction within the prescribed time.

19.6 If, at the time this contract is to be awarded, the total of the lowest acceptable Bid exceeds the funds then estimated by OWNER as available, OWNER may reject all Bids or take such other action as best serves OWNER's interests.

19.7 If the contract is to be awarded, it will be awarded to lowest Bidder whose evaluation by OWNER indicates to OWNER that the award will be in the best interests of OWNER.

19.8 In the event of failure of the Successful Bidder to sign the Agreement and provide an acceptable Performance and Payment Bond(s), insurance certificate(s), and other required documents, OWNER may award the contract to the next lowest responsive, responsible Bidder.

PART 20 - EXECUTION OF AGREEMENT

20.1 When OWNER gives a Notice of Award to Successful Bidder, it will be accompanied by unsigned copies of the Agreement and other appropriate documents. Within 15 days thereafter, CONTRACTOR shall sign and deliver the copies of the Agreement and attached documents to OWNER with the required Bonds. Within 10 days thereafter, OWNER shall deliver two fully executed copies to CONTRACTOR.

PART 21 - RETAINAGE

21.1 Provisions concerning retainage and CONTRACTORS' rights to deposit securities in lieu of retainage are set forth in the Agreement.

00 21 13-10
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

PART 22 - SALES AND OTHER TAXES

22.1 All taxes, as required by the laws and statutes of the state and its political subdivisions, shall be paid by CONTRACTOR. Prices quoted in the Bid Form shall include all taxes.

PART 23 - PROTESTS

23.1 Any party with a direct financial interest adversely affected by any alleged bid irregularity at the Bid opening may file a protest with OWNER, where such protest is based on alleged violations of federal, state, or local law or ordinance, or alleged bid irregularity. A protest must:

23.1.1 be written

23.1.2 state the specific basis of the appeal.

23.1.3 request a determination of the protest issue, and

23.1.4 be filed no later than 72 hours before the scheduled Award of Contract by OWNER, as determined by the published agenda of the PARADISE IRRIGATION DISTRICT'S BOARD OF DIRECTORS. Any protest filed after this time will not be considered.

23.2 The party filing the protest must concurrently transmit a copy of all protest documents and any attachments to all other parties with a direct financial interest which may be adversely affected by the determination of the protest appeal.

23.3 OWNER will review the protest and make a determination.

PART 24 - PARADISE IRRIGATION DISTRICT'S PROCUREMENT POLICY

24.1 Refer to Paradise Irrigation District's Procurement Policy Chapter 12.1 for General Provisions and 12.3 for information pertaining to Construction and Capital Improvement Contracts (Link: <https://pidwater.com/docs/district-operations/policy-procedures-manual/405-chapter-12-procurement-policy-2017/file>)

00 21 13-11

Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

+ + END OF SECTION + +

00 21 13-12
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

NOTE TO BIDDER: Use BLACK ink for completing this Bid Form.

SECTION 00 41 03

BID FORM

To: Paradise Irrigation District

Address: 6332 Clark Road,
Paradise, CA 95969

Project Identification: Equalizer Tank Replacement Project

1. BIDDER'S DECLARATION AND UNDERSTANDING.

1.1 This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm, or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.

1.2 In submitting this Bid, Bidder acknowledges and accepts CONTRACTOR's representations as more fully set forth in the Agreement Form.

1.3 In submitting this Bid, Bidder certifies Bidder is qualified to do business in the state where the Project is located as required by laws, rules, and regulations or, if allowed by statute, covenants to obtain such qualification prior to contract award.

2. CONTRACT EXECUTION AND BONDS.

2.1 The undersigned Bidder agrees, if this Bid is accepted, to enter into an Agreement with OWNER on the form included in the Bidding Documents to perform and furnish Work as specified or indicated in the Bidding Documents for the Contract Price derived from the Bid and within the Contract Times indicated in the Agreement and in accordance with the other terms and conditions of the Bidding Documents.

2.2 Bidder accepts the terms and conditions of the Bidding Documents.

3. INSURANCE.

3.1 Bidder further agrees that the Bid amount(s) stated herein includes specific consideration for the specified insurance coverages.

00 41 03-1
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

4. CONTRACT TIMES.

4.1 Bidder agrees to accept Contract Times set forth in the Agreement Form.

5. LIQUIDATED DAMAGES.

5.1 Bidder accepts the provisions in the Agreement Form as to liquidated damages.

6. ADDENDA.

Bidder hereby acknowledges that it has received Addenda Nos. _____,

_____ (Bidder shall insert number of each Addendum received) and agrees that Addenda issued are hereby made part of the Bidding Documents, and Bidder further agrees that this Bid includes impacts resulting from said Addenda.

7. SUBCONTRACTORS.

7.1 Bidder agrees to submit with their Bid a listing of all subcontracting firms or businesses that will be awarded subcontracts for portions of the Work which equal or exceed one-half of one percent of the Total Contract Price.

8. SALES AND USE TAXES.

8.1 The Bidder agrees that all federal, state, and local sales and use taxes are included in the stated Bid prices for the Work.

9. BID

9.1 Bidder agrees to accept as full payment for the proposed Work within the Bidding Documents, based upon the undersigned's own estimate of quantities and costs and including sales, consumer, use, and other taxes, and overhead and profit, the bid quantities and totals stated in the following Bid Schedule.

00 41 03-2
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

Bid Schedule		
Item No.	Description	Total Cost
1.	Mobilization - Demobilization	\$
2.	Trench sheeting, shoring, and bracing as required by Section 6707 of the California Labor Code	\$
3.	Water Pollution Control Plan	\$
4.	Tie-Back Soil Anchor Design	
5.	Demolition	\$
6.	Civil Site Work and Grading	\$
7.	Phase 1 Tank 2 Construction	\$
8.	Phase 2 Tank 1 Construction	\$
9.	Retaining Wall Construction (walls not associated with Tank structures)	
10.	Existing Slab Repair	
11.	Temporary Bypass Piping	\$
12.	Site Finishing (including gravel surfacing, sidewalk and driveway concrete, and asphalt road repair within the limits of the WTP)	\$
13.	Electrical and Instrumentation	\$
14.	SCADA Integration	\$
15.	All Remaining Work	\$
Total Bid Lines 1-15 (Basis for Award)		\$

All other associated items of work and incidentals that are required to complete this project and provide a fully functioning facility in accordance with the contract documents are considered to be included in the Bid Schedule items and no additional compensation will be made by the District.

00 41 03-3
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

10. SURETY.

10.1 If Bidder is awarded a construction contract from this Bid, the surety who provides the Performance and Payment Bond(s) shall be:

Whose address is

Street City State Zip

11. LICENSE.

11.1 Class _____, California Contractor License No.: _____.

12. BIDDER.

An Individual

By _____
(Individual's name and signature)

A Partnership

By _____
(Partnership name)

(Name and signature of general partner)

(Title)

A Corporation

By _____
(Corporation name)

(State of incorporation)

By _____
(Name and signature of person authorized to sign)

00 41 03-4
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

(Title)

(Corporate Seal)

A Joint Venture

By _____
(Business name)

(Name and signature of person authorized to sign)

By _____
(Business name)

(Name and signature of person authorized to sign)

(Each joint venturer must sign. The manner of signing each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Name, Phone Number, and Address for receipt of official communications and for additional information on this Bid:

SUBMITTED ON _____, 20__.

+ + END OF SECTION + +

00 41 03-5
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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00 41 03-6
Specification Name

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 00 43 03

BID BOND

BOND NO. _____

KNOW ALL MEN BY THESE PRESENTS, that _____

hereinafter called the PRINCIPAL, and _____

a corporation duly organized under the laws of the State of _____

having its principal place of business at _____

_____ in the State of _____

and authorized to do business in the State of California, as SURETY,

are held and firmly bound unto _____,

as OWNER, hereinafter called the OBLIGEE, in the sum of _____

_____ DOLLARS (\$ _____)

for the payment for which we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS BOND IS SUCH THAT:

WHEREAS, the PRINCIPAL is herewith submitting his or its Bid for _____

_____ said Bid, by reference thereto, being hereby made a part hereof.

NOW, THEREFORE, if said Proposal shall be rejected, or in the alternate, if said Proposal shall be accepted and the PRINCIPAL shall sign and deliver a Contract to OBLIGEE, in the form of Contract attached hereto and shall execute and deliver Performance and Payment Bonds in the forms attached hereto (all completed in accordance with said Proposal) to OBLIGEE, and shall in all other respects perform the agreement created by the acceptance of said Proposal;

Then, this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the SURETY for any and all default of the PRINCIPAL hereunder shall be the amount of this obligation as herein stated.

00 43 03-1
Bid Bond Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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

IN WITNESS THEREOF, the above-bounded parties have executed this instrument under their several seals, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Signed and sealed this _____ day of _____, 20__.

PRINCIPAL

By _____

SURETY

By _____
Attorney-In-Fact

The rate of premium on this bond is _____ per thousand.

Total amount of premium charged \$ _____.

+ + END OF SECTION + +

00 43 03-2
Bid Bond Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 00 43 36
(Required to Accompany Bid)

LIST OF SUBCONTRACTORS

PART 1 - GENERAL

1.1 SUBLETTING AND SUBCONTRACTING FAIR PRACTICES ACT

- A. Contractor shall comply with the requirements of the Subletting and Subcontracting Fair Practices Act, Chapter 4, Part 1, Division 2 of the Government Code, which include the following:
1. Contractor shall, in its bid or proposal, set forth:
 - a. The name, the location of the place of business, the California contractor license number, and public works contractor registration number issued pursuant to Section 1725.5 of the Labor Code of each subcontractor who will perform work or labor or render service to Contractor in or about the construction of the work or improvement, or a subcontractor licensed by the State of California who, under subcontract to Contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications, in an amount in excess of one-half of 1 percent of Contractor's total bid or proposal.
 - b. The portion of the work that will be done by each subcontractor under this act. Contractor shall list only one subcontractor for each portion as is defined by the Contractor in its bid.
 2. If Contractor fails to specify a subcontractor or specifies more than one subcontractor for the same portion of work to be performed under the Contract in excess of one-half of 1 percent of the Contractor's total bid, Contractor agrees that it is fully qualified to perform that portion itself, and that Contractor shall perform that portion itself.
 3. Contractor may not substitute a person as subcontractor in place of the subcontractor listed in the original bid, except as provided in the Act.

00 43 36-1
List of Subcontractors

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

00 43 36-2
List of Subcontractors
Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 00 43 93

BIDDER'S CHECKLIST

This checklist has been prepared and furnished to aid Bidders in including all necessary supporting information with their bid. Bidders' submittals shall include, but are not limited to, the following:

<u>Item</u>	<u>Checked</u>
Bid Form	_____
Addenda Acknowledged on Bid Form	_____
Contractor's License Number and Class Provided	_____
Authority to Sign Bid if Signature is by Agent Other Than Officer of Corporation, Partner, or Owner	_____
List of Subcontractors	_____
Bid Bond	_____
Power-of-Attorney for Surety's Agent to execute Bidder's Bond	_____
Confirmed Bond and Insurance Companies Ratings are in accordance with Supplemental Conditions, Par. SC-5.02.A.	_____

++ END OF SECTION ++

00 43 93-1
Bidder's Checklist

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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00 43 93-2
Bidder's Checklist

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 00 52 03

AGREEMENT FORM

This Agreement is by and between **Paradise Irrigation District** (“Owner”) and _____ (“Contractor”).

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

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

- Mobilization and Demobilization to the site, including all temporary construction facilities
- Trenching, sheeting, shoring, and bracing as required by Section 6707 of the California Labor Code
- Electrical and Instrumentation installation
- SCADA Integration
- All remaining work including identification devices

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **Equalizer Tank Replacement Project.**

ARTICLE 3—ENGINEER

3.01 The Owner has retained **Water Works Engineers** (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by **Water Works Engineers.**

ARTICLE 4—CONTRACT TIMES

4.01 *Contract Times: Working Days*

- A. The Work will be substantially complete within **130** working days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the

00 52 03 -1

Agreement Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

General Conditions within **150** working days after the date when the Contract Times commence to run.

4.02 *Liquidated Damages*

- A. Contractor and Owner recognize that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):
1. *Substantial Completion*: Contractor shall pay Owner **\$1,500** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.
- B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay.

ARTICLE 5—CONTRACT PRICE

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

- A. For all Work other than Unit Price Work, a lump sum of \$_____.

All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.

- B. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item).

Unit Price Work					
Item No.	Description	Unit	Estimated Quantity	Unit Price	Extended Price
				\$	\$
				\$	\$
				\$	\$
				\$	\$
				\$	\$
Total of all Extended Prices for Unit Price Work (subject to final adjustment based on actual quantities)					\$

00 52 03 -2

Agreement Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

- C. Total of Lump Sum Amount and Unit Price Work (subject to final Unit Price adjustment) \$_____.
- D. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

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

6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the 10th day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.
 - 1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.
 - a. 95 percent of the value of the Work completed (with the balance being retainage).
 - 1) If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and
 - b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

6.03 *Final Payment*

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

00 52 03 -3
Agreement Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

6.04 *Consent of Surety*

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

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

- A. The Contract Documents consist of all of the following:
 - Volume 1 – Bid Requirements and Specifications
 - Volume 2 – Drawings (11-inch by 17-inch)
 - Volume 3 – Geotechnical Report
- B. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field Orders.
 - e. Warranty Bond, if any.
- C. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).
- D. There are no Contract Documents other than those listed above in this Article 7.
- E. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

- A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:
 - 1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
 - 2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.
7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

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

00 52 03 -5

Agreement Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. “corrupt practice” means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
2. “fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
3. “collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or “track changes” (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

Owner:

Contractor:

(typed or printed name of organization)

(typed or printed name of organization)

By: _____
(individual's signature)

By: _____
(individual's signature)

Date: _____
(date signed)

Date: _____
(date signed)

Name: _____
(typed or printed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Title: _____
(typed or printed)

(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
(individual's signature)

Attest: _____
(individual's signature)

Title: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

Address for giving notices:

Designated Representative:

Designated Representative:

Name: _____
(typed or printed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

Address:

Phone: _____

Phone: _____

Email: _____

Email: _____

(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

License No.: _____
(where applicable)

State: _____

00 52 03 -7
Agreement Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

++ END OF SECTION ++

00 52 03 -8
Agreement Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 00 61 03
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That

WHEREAS, the Paradise Irrigation District, hereinafter designated as the "Owner" has awarded to _____ as the

(Principal)
"Principal," a contract for the construction of _____ for the Owner; and

WHEREAS, said Principal is required under the terms of said contract to furnish a bond for the faithful performance of said contract;

NOW, THEREFORE, we the PRINCIPAL, and _____

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

THE CONDITION OF THIS OBLIGATION IS SUCH, that if said Principal, his or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in said contract and any alteration therefore made as therein provided, on his or their part, to be kept and performed at the time and in the manner therein specified and in all respects according to their true intent and meaning; shall guarantee and shall repair and replace defective materials and workmanship therein, for all work required under the said contract and shall indemnify and save harmless the Owner, their officers and agents as therein stipulated, then this obligation shall become null and void; otherwise it shall be and remain in full force and virtue.

Neither the Owner's acceptance of any work by, or on behalf of, Principal, nor the Owner or its agents' repair of any defects arising in the work, shall be deemed a waiver of any Owner's rights under this bond, where defects, whether resulting from defective materials or defective workmanship, are discovered after the Owner's issuance of its Notice of Completion. Principal and Surety shall remain jointly and severally liable for such defects for the period of time set forth in the Code of Civil Procedure Sections 337 and 337.15, or any successor statute or amendment thereto.

00 61 03-1
Performance Bond Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

And the Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any way affect its obligations on this bond and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the Specifications.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their seals this _____ day of _____, 20____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representatives, pursuant to authority of its governing body.

Principal

By: _____

Surety

By: _____
(Attach Acknowledgment)

00 61 03-2

Performance Bond Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District

WWE Project No. 22-098

March 2024

Bid Documents

NOTE: The principal amount of this bond shall not be less than 100% of the total contract price.

00 61 03-3

Performance Bond Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 00 61 06

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we (1) _____
_____ a (2) _____
hereinafter called "Principal" and (3) _____
of _____ State of _____ hereinafter called the
"Surety," are held and firmly bound unto Paradise Irrigation District, hereinafter called
"Owner," in the penal sum of _____ dollars (\$ _____) in
lawful money of the United States, for the payment of which sum well and truly to be made,
we bind ourselves, our heirs, executors, administrators and successors, jointly and severally,
firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that WHEREAS, the Principal entered into a
certain Contract with the Owner, dated the _____ day of _____, 20____, a
copy of which is hereto attached and made a part hereof for the construction of the -----
-----, including all appurtenances thereto, all as set forth in the
Contract Documents entitled, "-----
PROJECT ".

NOW, THEREFORE, if the Principal, or a Subcontractor, fails to pay (1) persons or entities
authorized to make claims under Civil Code Section 9100, (2) amounts due under the
Unemployment Insurance Code with respect to work or labor performed under Contract, or (3)
for any amounts required to be deducted, withheld, and paid over to the Employment
Development Department from the wages of employees of the Contractor and Subcontractors
pursuant to §13020 of the Unemployment Insurance Code with respect to the work and labor,
then surety will pay for the same, and also, in case suit is brought upon this bond, a
reasonable attorney's fee, to be fixed by the Court,

PROVIDED, FURTHER, Surety's obligation hereunder shall inure to the benefit of any of the
persons or entities authorized to make claims under Civil Code § 9100 so as to give a right of
action to those persons or entities or their assigns in any suit brought upon this bond, and

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall
abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

00 61 06-1
Payment Bond Form

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

LABOR AND MATERIAL PAYMENT BOND**PAGE 2 OF 2****CONTRACT NO. -----**

IN WITNESS WHEREOF, this instrument is executed in two (2) counter-parts, each one of which shall be deemed an original, this the _____ day of _____, 20____.

ATTEST:

_____	_____ ,
(Principal) Secretary	Principal
(Seal)	By _____ ,

_____	_____ ,
(Witness as to Principal)	

_____	_____ ,
(Address)	(Address)

ATTEST:

_____	_____ ,
(Surety) Secretary	Surety
(Seal)	

_____	By _____ ,
(Witness as to Surety)	Attorney-in-Fact

_____	_____ ,
(Address)	(ADDRESS)

NOTE: Date of Bond must not be prior to date of Contract:

- (1) Correct name of Contractor.
- (2) A Corporation, A Partnership, or an Individual, as case may be.
- (3) Correct name of Surety.
- (4) If Contractor is Partnership, all partners should execute bond.

++ END OF SECTION ++

00 61 06-2
Payment Bond Form

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By



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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

	Page
Article 1—Definitions and Terminology	1
1.01 Defined Terms	1
1.02 Terminology	6
Article 2—Preliminary Matters	7
2.01 Delivery of Performance and Payment Bonds; Evidence of Insurance	7
2.02 Copies of Documents	7
2.03 Before Starting Construction	7
2.04 Preconstruction Conference; Designation of Authorized Representatives	8
2.05 Acceptance of Schedules	8
2.06 Electronic Transmittals	8
Article 3—Contract Documents: Intent, Requirements, Reuse	9
3.01 Intent	9
3.02 Reference Standards	9
3.03 Reporting and Resolving Discrepancies	10
3.04 Requirements of the Contract Documents	10
3.05 Reuse of Documents	11
Article 4—Commencement and Progress of the Work	11
4.01 Commencement of Contract Times; Notice to Proceed	11
4.02 Starting the Work	11
4.03 Reference Points	11
4.04 Progress Schedule	12
4.05 Delays in Contractor’s Progress	12
Article 5—Site; Subsurface and Physical Conditions; Hazardous Environmental Conditions	13
5.01 Availability of Lands	13
5.02 Use of Site and Other Areas	14
5.03 Subsurface and Physical Conditions	15
5.04 Differing Subsurface or Physical Conditions	16

5.05	Underground Facilities.....	17
5.06	Hazardous Environmental Conditions at Site	19
Article 6—Bonds and Insurance		21
6.01	Performance, Payment, and Other Bonds	21
6.02	Insurance—General Provisions.....	22
6.03	Contractor’s Insurance	24
6.04	Builder’s Risk and Other Property Insurance	25
6.05	Property Losses; Subrogation	25
6.06	Receipt and Application of Property Insurance Proceeds	27
Article 7—Contractor’s Responsibilities		27
7.01	Contractor’s Means and Methods of Construction	27
7.02	Supervision and Superintendence	27
7.03	Labor; Working Hours.....	27
7.04	Services, Materials, and Equipment	28
7.05	“Or Equals”	28
7.06	Substitutes	29
7.07	Concerning Subcontractors and Suppliers.....	31
7.08	Patent Fees and Royalties.....	32
7.09	Permits.....	33
7.10	Taxes.....	33
7.11	Laws and Regulations	33
7.12	Record Documents	33
7.13	Safety and Protection	34
7.14	Hazard Communication Programs.....	35
7.15	Emergencies.....	35
7.16	Submittals	35
7.17	Contractor’s General Warranty and Guarantee	38
7.18	Indemnification.....	39
7.19	Delegation of Professional Design Services	39
Article 8—Other Work at the Site		40
8.01	Other Work.....	40
8.02	Coordination	41
8.03	Legal Relationships	41

Article 9—Owner’s Responsibilities.....	42
9.01 Communications to Contractor	42
9.02 Replacement of Engineer.....	42
9.03 Furnish Data.....	42
9.04 Pay When Due	42
9.05 Lands and Easements; Reports, Tests, and Drawings.....	43
9.06 Insurance	43
9.07 Change Orders	43
9.08 Inspections, Tests, and Approvals.....	43
9.09 Limitations on Owner’s Responsibilities	43
9.10 Undisclosed Hazardous Environmental Condition.....	43
9.11 Evidence of Financial Arrangements	43
9.12 Safety Programs.....	43
Article 10—Engineer’s Status During Construction	44
10.01 Owner’s Representative	44
10.02 Visits to Site	44
10.03 Resident Project Representative	44
10.04 Engineer’s Authority	44
10.05 Determinations for Unit Price Work	45
10.06 Decisions on Requirements of Contract Documents and Acceptability of Work	45
10.07 Limitations on Engineer’s Authority and Responsibilities.....	45
10.08 Compliance with Safety Program	45
Article 11—Changes to the Contract.....	46
11.01 Amending and Supplementing the Contract	46
11.02 Change Orders	46
11.03 Work Change Directives.....	46
11.04 Field Orders	47
11.05 Owner-Authorized Changes in the Work.....	47
11.06 Unauthorized Changes in the Work.....	47
11.07 Change of Contract Price	47
11.08 Change of Contract Times.....	49
11.09 Change Proposals.....	49
11.10 Notification to Surety	50

Article 12—Claims	50
12.01 Claims	50
Article 13—Cost of the Work; Allowances; Unit Price Work	51
13.01 Cost of the Work	51
13.02 Allowances	55
13.03 Unit Price Work	55
Article 14—Tests and Inspections; Correction, Removal, or Acceptance of Defective Work	56
14.01 Access to Work	56
14.02 Tests, Inspections, and Approvals	56
14.03 Defective Work	57
14.04 Acceptance of Defective Work	58
14.05 Uncovering Work	58
14.06 Owner May Stop the Work	58
14.07 Owner May Correct Defective Work	59
Article 15—Payments to Contractor; Set-Offs; Completion; Correction Period	59
15.01 Progress Payments	59
15.02 Contractor’s Warranty of Title	62
15.03 Substantial Completion	62
15.04 Partial Use or Occupancy	63
15.05 Final Inspection	64
15.06 Final Payment	64
15.07 Waiver of Claims	65
15.08 Correction Period	66
Article 16—Suspension of Work and Termination	67
16.01 Owner May Suspend Work	67
16.02 Owner May Terminate for Cause	67
16.03 Owner May Terminate for Convenience	68
16.04 Contractor May Stop Work or Terminate	68
Article 17—Final Resolution of Disputes	69
17.01 Methods and Procedures	69
Article 18—Miscellaneous	69
18.01 Giving Notice	69
18.02 Computation of Times	69

18.03	Cumulative Remedies	70
18.04	Limitation of Damages	70
18.05	No Waiver	70
18.06	Survival of Obligations	70
18.07	Controlling Law	70
18.08	Assignment of Contract	70
18.09	Successors and Assigns	70
18.10	Headings	70

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*
 - a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

- requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.
- b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.
 - c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.
 - d. A demand for money or services by a third party is not a Claim.
- 11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
 - 12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.
 - 13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
 - 14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.
 - 15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
 - 16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
 - 17. *Cost of the Work*—See Paragraph 13.01 for definition.
 - 18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
 - 19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
 - 20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.
 - 21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

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

22. *Engineer*—The individual or entity named as such in the Agreement.
23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.
 - a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.
 - b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
 - c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.
25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.
28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.
32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.
34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.
36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.
39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.
42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.
44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
46. *Technical Data*
- a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.
 - b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.
 - c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.
47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.
48. *Unit Price Work*—Work to be paid for on the basis of unit prices.
49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:* The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.
- C. *Day:* The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:* The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - 1. does not conform to the Contract Documents;
 - 2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - 3. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).
- E. *Furnish, Install, Perform, Provide*
 - 1. The word “furnish,” when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 - 2. The word “install,” when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 - 3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.
 - 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

- F. *Contract Price or Contract Times*: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.
- G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

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

- A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.
- C. *Evidence of Owner’s Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.
 - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 - 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 - 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.
 - 4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.
- B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.
- F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.
- G. Nothing in the Contract Documents creates:
 - 1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or
 - 2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

- A. *Standards Specifications, Codes, Laws and Regulations*
 - 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 - 2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

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

- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
 - 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
 - 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

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

4.02 *Starting the Work*

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

4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
 - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
 - 1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 - 2. Abnormal weather conditions;
 - 3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and
 - 4. Acts of war or terrorism.

- D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:
1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
 2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
 3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.
- E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:
1. The circumstances that form the basis for the requested adjustment;
 2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
 3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
 4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
 5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.
- Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.
- F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.
- G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

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

5.01 *Availability of Lands*

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

- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

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

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.
- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.
 - C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

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

5.03 *Subsurface and Physical Conditions*

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

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

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

- C. *Reliance by Contractor on Technical Data:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

- D. *Limitations of Other Data and Documents:* Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
 3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
 4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:
1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
 2. is of such a nature as to require a change in the Drawings or Specifications;
 3. differs materially from that shown or indicated in the Contract Documents; or
 4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

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

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- E. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

- a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,
 - c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;
 - b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice required by Paragraph 5.04.A.
 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.
- F. *Underground Facilities; Hazardous Environmental Conditions:* Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:
1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;
 4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.
- C. *Engineer's Review:* Engineer will:
1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;
 2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;
 3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and
 4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- F. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

- a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and
 - c. Contractor gave the notice required in Paragraph 5.05.B.
2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.
 4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

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

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;
2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
3. Technical Data contained in such reports and drawings.

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

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

- of construction to be employed by Contractor, and safety precautions and programs incident thereto;
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.
- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.
- H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.
- B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.
- C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

Regulations, and must be issued and signed by a surety named in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual’s authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

- D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.
- E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.
- F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner’s termination rights under Article 16.
- G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.
- H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Alternative forms of insurance coverage, including but not limited to self-insurance and “Occupational Accident and Excess Employer’s Indemnity Policies,” are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.
- D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

- E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.
- F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.
- H. Contractor shall require:
 - 1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and
 - 2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.
- I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.
- K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

- L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.
- M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.
- N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

- A. *Required Insurance:* Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.
- B. *General Provisions:* The policies of insurance required by this Paragraph 6.03 as supplemented must:
 - 1. include at least the specific coverages required;
 - 2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;
 - 3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;
 - 4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and
 - 5. include all necessary endorsements to support the stated requirements.
- C. *Additional Insureds:* The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:
 - 1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;
 - 2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;
 - 3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and
5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

- A. *Builder's Risk:* Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.
- B. *Property Insurance for Facilities of Owner Where Work Will Occur:* Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.
- C. *Property Insurance for Substantially Complete Facilities:* Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.
- D. *Partial Occupancy or Use by Owner:* If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.
- E. *Insurance of Other Property; Additional Insurance:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

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

Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
 2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.
1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.
- C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.
- D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

- A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

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

- B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.
- C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

- A. *Contractor's Request; Governing Criteria:* Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that the proposed item:
 - 1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

- 2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) has a proven record of performance and availability of responsive service; and
 - 4) is not objectionable to Owner.
- b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:
- 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
- C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.
- E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 Substitutes

- A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.
1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.
 2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:
 - a. will certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design;
 - 2) be similar in substance to the item specified; and
 - 3) be suited to the same use as the item specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from the item specified; and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

- E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.
- B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.
- E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.
- F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

- H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.
- J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.
- K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.
- L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.
- M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

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

7.10 *Taxes*

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

7.11 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.
- C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

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

7.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.
- B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.
- C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - 1. all persons on the Site or who may be affected by the Work;
 - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
- F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.
- H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

- I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).
- J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

- 1. Before submitting a Shop Drawing or Sample, Contractor shall:
 - a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determine and verify:
 - 1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;
 - 2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - 3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;
 - c. confirm that the Submittal is complete with respect to all related data included in the Submittal.
- 2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.
- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.
1. *Shop Drawings*
 - a. Contractor shall submit the number of copies required in the Specifications.
 - b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.
 2. *Samples*
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.
 3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Engineer's Review of Shop Drawings and Samples*
1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.
 3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
 4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.
6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.
8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. Resubmittal Procedures for Shop Drawings and Samples

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.
2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

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

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:
 - a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.
 - b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.
 - c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

- d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.
- 2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03, 2.04, and 2.05.
- F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 Contractor's General Warranty and Guarantee

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.
- B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:
 - 1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and
 - 2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.
- C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 - 1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 - 2. normal wear and tear under normal usage.
- D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:
 - 1. Observations by Engineer;
 - 2. Recommendation by Engineer or payment by Owner of any progress or final payment;
 - 3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 - 4. Use or occupancy of the Work or any part thereof by Owner;
 - 5. Any review and approval of a Shop Drawing or Sample submittal;
 - 6. The issuance of a notice of acceptability by Engineer;
 - 7. The end of the correction period established in Paragraph 15.08;
 - 8. Any inspection, test, or approval by others; or

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

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

- A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.
- B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.
- C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

- D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.
- E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:
 - 1. Checking for conformance with the requirements of this Paragraph 7.19;
 - 2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
 - 3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.
- F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.
- G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.
- D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

- E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.
- F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 - 2. An itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. The extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

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

- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.
 - 1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.
 - 2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.
- C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

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

9.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

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

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

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

9.07 *Change Orders*

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

9.08 *Inspections, Tests, and Approvals*

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

9.09 *Limitations on Owner's Responsibilities*

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

9.10 *Undisclosed Hazardous Environmental Condition*

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

9.11 *Evidence of Financial Arrangements*

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

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

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

10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.
- B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

- A. Engineer has the authority to reject Work in accordance with Article 14.
- B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.
- C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.
- D. Engineer's authority as to changes in the Work is set forth in Article 11.

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

10.05 *Determinations for Unit Price Work*

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

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

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

10.07 *Limitations on Engineer's Authority and Responsibilities*

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

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

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

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

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

10.08 *Compliance with Safety Program*

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

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

- A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
- B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.
- C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
 - 1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
 - 2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 - 3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and
 - 4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

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

- B. If Owner has issued a Work Change Directive and:
 - 1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.
 - 2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

- A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.
- B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.
- B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.
- C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

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

11.07 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
 2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
 3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).
- C. *Contractor's Fee:* When applicable, the Contractor's fee for overhead and profit will be determined as follows:
1. A mutually acceptable fixed fee; or
 2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;
 - b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;
 - c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
 - d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
 - f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.
- B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

- A. *Purpose and Content:* Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.
- B. *Change Proposal Procedures*
 - 1. *Submittal:* Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.
 - 2. *Supporting Data:* The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.
 - a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.
 - b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

- 3. *Engineer's Initial Review:* Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.
- 4. *Engineer's Full Review and Action on the Change Proposal:* Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.
- D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

- A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:
 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;
 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and
 4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.
- B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

- C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation*
 - 1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.
 - 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.
 - 3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
 - 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included:* Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.
 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.
 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
 4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.
 5. Other costs consisting of the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

- 1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

- 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.
 - 2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
 - 3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.
- d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
- e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
- f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

- g. The cost of utilities, fuel, and sanitary facilities at the Site.
 - h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
 - i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.
- C. *Costs Excluded:* The term Cost of the Work does not include any of the following items:
- 1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
 - 2. The cost of purchasing, renting, or furnishing small tools and hand tools.
 - 3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
 - 4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
 - 5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
 - 6. Expenses incurred in preparing and advancing Claims.
 - 7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.
- D. *Contractor's Fee*
- 1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:
 - a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.
 - b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:
 - 1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.
 - 2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.
 - 2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

- E. *Documentation and Audit:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. *Cash Allowances:* Contractor agrees that:
1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.
- C. *Owner's Contingency Allowance:* Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 - b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 3. by manufacturers of equipment furnished under the Contract Documents;
 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 Defective Work

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 Owner May Correct Defective Work

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments*
 - 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.
 - 2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work;
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

- b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. The Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. The Contract Price has been reduced by Change Orders;
 - i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;
 - j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or
 - l. Other items entitle Owner to a set-off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.
2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.
2. The final Application for Payment must be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

- d. a list of all duly pending Change Proposals and Claims; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.
- B. *Engineer's Review of Final Application and Recommendation of Payment:* If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.
- C. *Notice of Acceptability:* In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.
- D. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.
- E. *Final Payment Becomes Due:* Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

- A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such adjacent areas;
 - 2. correct such defective Work;
 - 3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.
- B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.
- C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.
- D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

- F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
 - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);
 - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 - 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:
 - 1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and
 - 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

- A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this article:
 - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and
 - 2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this article, Owner or Contractor may:
 - 1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;
 - 2. agree with the other party to submit the dispute to another dispute resolution process; or
 - 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

- A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:
 - 1. in person, by a commercial courier service or otherwise, to the recipient's place of business;
 - 2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
 - 3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

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

18.08 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SECTION 00 73 03

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, "Paragraph SC-4.05."

ARTICLE 1— DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

SC-1.01.10.A. Delete 10.A in its entirety.

SC-1.01.10.B Amend the section 10.B to read as follows:

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

SC-1.01.10.C. Delete 10.C in its entirety.

SC-1.01.50 Amend the section 50 to read as follows:

Work Change Directive—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner, ordering an addition, deletion, or revision in the Work.

ARTICLE 2— PRELIMINARY MATTERS

2.02 Copies of Documents

SC-2.02 Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to Contractor one electronic portable document format (PDF) of the Contract Documents (including one fully signed counterpart of the Agreement).

ARTICLE 3— CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.04 Requirements of Contract Documents

SC-3.04.A Amend the section to read as follows:

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

SC-3.04.B Amend the section to read as follows:

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

SC-3.04.C Amend the section to read as follows:

If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. Contractor may pursue resolution as provided in Article 12.

ARTICLE 4— COMMENCEMENT AND PROGRESS OF THE WORK

No suggested Supplementary Conditions in this Article.

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

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

- E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Geotechnical Report – Backwash Equalization Tank Improvements	March 25, 2024	Technical data related to subsurface conditions at the Equalization Basin site

Report Title	Date of Report	Technical Data
Preliminary Environmental Constraints Evaluation	November 22, 2023	Environmental conditions related to site construction activities

- F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
Water Treatment Plant Expansion	March 1993	As built documents of existing treatment plant

- G. Contractor may examine copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents at 6332 Clark Road, Paradise, CA during regular business hours or may request copies from Engineer.

5.05 *Underground Utilities*

SC-5.05.G Amend the section to read as follows:

1. Notwithstanding the foregoing, and pursuant to Government Code section 4215, Owner shall assume the responsibility, between the parties to the Contract, for the timely removal, relocation, or protection of existing utilities located on the site of the Project that is a subject of the Contract, if such utilities are not identified by Owner in the Contract. Contractor shall be compensated for the costs of locating, repairing damage not due to the failure of Contractor to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Contract with reasonable accuracy, and for equipment necessarily idled during such work. Contractor shall not be assessed liquidated damages for delay in completion of the work, when such delay was caused by the failure of Owner or the owner of the utility to provide for removal or relocation of such utility facilities.
2. Nothing herein shall be deemed to require Owner to indicate the presence of existing service laterals or appurtenances whenever the presence of such utilities on the site of the work can be inferred from the presence of other visible facilities, such as buildings, meter and junction boxes, on or adjacent

to the site of the construction; provided, however, nothing herein shall relieve Owner from identifying main or trunk lines in the Contract.

3. If Contractor, while performing the Contract, discovers utility facilities not identified by Owner in the Contract Documents, it shall immediately notify Owner and the utility in writing.
4. This section does not relieve Contractor of its obligations under the Regional Notification Center System, Section 4216 et seq., of the California Government Code.

5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Geotechnical Report – Backwash Equalization Tank Improvements	March 25, 2024	Technical data related to subsurface conditions at the Equalization Basin site, including Naturally Occurring Asbestos

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
None provided		

ARTICLE 6— BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

6.03 *Contractor's Insurance*

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

- E. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Jones Act (if applicable)	
Bodily injury by accident—each accident	\$1,000,000
Bodily injury by disease—aggregate	\$1,000,000
Employer's Liability	
Each accident	\$1,000,000
Each employee	\$1,000,000
Policy limit	\$1,000,000

- F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:
1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
 2. damages insured by reasonably available personal injury liability coverage, and
 3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage.
 - a. Such insurance must be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
 4. Underground, explosion, and collapse coverage.
 5. Personal injury coverage.

6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
 7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:
1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
 2. Any exclusion for water intrusion or water damage.
 3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
 4. Any exclusion of coverage relating to earth subsidence or movement.
 5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
 6. Any limitation or exclusion based on the nature of Contractor's work.
 7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.
- I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	Policy limits of not less than:
General Aggregate	\$10,000,000
Products—Completed Operations Aggregate	\$5,000,000
Personal and Advertising Injury	\$5,000,000
Bodily Injury and Property Damage—Each Occurrence	\$5,000,000

- J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	Policy limits of not less than:
Bodily Injury	

Automobile Liability	Policy limits of not less than:
Each Person	\$1,000,000
Each Accident	\$1,000,000
Property Damage	
Each Accident	\$1,000,000

- M. *Contractor's Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	\$5,000,000
General Aggregate	\$10,000,000

- P. *Unmanned Aerial Vehicle Liability Insurance:* If Contractor uses unmanned aerial vehicles (UAV—commonly referred to as drones) at the Site or in support of any aspect of the Work, Contractor shall obtain UAV liability insurance in the amounts stated; name Owner, Engineer, and all individuals and entities identified in the Supplementary Conditions as additional insureds; and provide a certificate to Owner confirming Contractor's compliance with this requirement. Such insurance will provide coverage for property damage, bodily injury or death, and invasion of privacy.

Unmanned Aerial Vehicle Liability Insurance	Policy limits of not less than:
Each Claim	\$1,000,000
General Aggregate	\$1,000,000

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

- F. *Builder's Risk Requirements:* The builder's risk insurance must:
1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

- a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.
 - b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.
2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).
4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier). If this coverage is subject to a sublimit, such sublimit will be a minimum of the contractor's bid price.
5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of the contractor's bid price.
6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.
7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.
8. include performance/hot testing and start-up, if applicable.
9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.
10. include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04,

6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:

a. None

11. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:

a. None.

12. If debris removal in connection with repair or replacement of insured property is subject to a coverage sublimit, such sublimit will be a minimum of 25 percent of the builder's risk insurance amount.

13. In addition to the coverage sublimits stated above, the following coverages are also subject to sublimits, as follows:

a. None

14. Minimum builder's risk amount shall be the value of the bid plus 10%.

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

H. *Builder's Risk and Other Property Insurance Deductibles:* The purchaser of any required builder's risk, installation floater, or other property insurance will be responsible for costs not covered because of the application of a policy deductible.

1. The builder's risk policy (or if applicable the installation floater) will be subject to a deductible amount of no more than **\$50,000** for direct physical loss in any one occurrence.

ARTICLE 7— CONTRACTOR'S RESPONSIBILITIES

7.03 *Labor; Working Hours*

SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state "...all Work at the Site must be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday."

7.17 *Contractor's General Warranty and Guarantee*

SC-7.17.B Replace the section with:

Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights.

7.20 *Compliance with Requirements for Public Works*

SC-7.20 Insert the following section:

- A. This is a public work. Contractor and any subcontractors are subject to the requirements of Chapter 1, Part 7 of the Labor Code, commencing with section 1720, pertaining to public works, and they are responsible for ascertaining and applying those requirements. Any person who willfully violates Article 2 of Chapter 1 is guilty of a misdemeanor. (Labor Code§ 1777). All contractors and subcontractors working on the Contract work must keep certified payroll records in accordance with Labor Code section 1776.
- B. At the time of the award, and at all times while performing the work, Contractor and any subcontractors shall be, and shall remain, registered and qualified to perform public work, pursuant to Labor Code sections 1725.5and 1771.1. This Agreement is subject to cancellation by District, and Contractor is subject to an assessment of penalties under section 1771.1, upon determination that Contractor or any subcontractor is not in compliance with the provisions of those sections.
- C. This Contract is subject to compliance monitoring and enforcement by the Department of Industrial Relations, as required by Labor Code section 1771.4. Contractor shall post job site notices, as prescribed by regulation. Contractor shall furnish the records specified in Labor Code section 1776 directly to the Labor Commissioner.
- D. Not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed, and not less than the general prevailing rate of per diem wages for holiday and overtime work fixed as provided in Chapter 1, Part 7 of the Labor Code, shall be paid for each craft, classification, or type of worker needed to execute the Contract work.
- E. Copies of the prevailing rates of per diem wages are on file at the District's office and shall be made available on request. Alternatively, said rates are accessible on the INTERNET under the heading "General Prevailing Wage Determination made by the Director of Industrial Relations pursuant to California Labor Code Part 7, Chapter 1, Article 2, Sections 1770, 1773 and 1773.1". The Internet address is <http://www.dir.ca.gov/>.
- F. A copy of the prevailing rate of per diem wages shall be posted at the worksite. Contractor, and any subcontractor under it, shall pay not less than the prevailing rates of wages to all workers employed in the execution of the Contract work. Contractor, and any subcontractor under it, shall be subject to penalties under Labor Code section 1775 for paying less than the prevailing wage rates.
- G. Contractor and any subcontractors shall keep accurate payroll records showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by it in connection with the Project work, and shall certify and make those records available for inspection and otherwise comply with the provisions of Labor Code sections 1776 and 1812. Contractor's failure to comply is a misdemeanor, as provided in Labor Code section 1777.

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Supplementary Conditions

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- H. Contractor shall be subject to the provisions of Labor Code section 1777.5 pertaining to the employment of apprentices. Contractor shall pay every apprentice employed in the execution of the Contract work the prevailing rate of per diem wages for apprentices in the trade to which he or she is registered and shall otherwise comply with the provisions of that section.
- I. Contractor warrants that neither it nor any of its subcontractors is ineligible to work on public works projects pursuant to Section 1777.1 or 1777.7 of the Labor Code. Contractor is prohibited from performing the Contract work with an ineligible subcontractor.
- J. The time of service of any worker employed in the execution of the Contract work is limited and restricted to eight (8) hours during any one (1) calendar day, and forty (40) hours during any one calendar week, except that work performed by Contractor 's or subcontractor's employees in excess of eight (8) hours per day, and forty (40) hours during any one week, shall be permitted upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and one-half (1 ½) times the basic rate of pay, or at any higher rate of overtime pay that may be required pursuant to a Department of Industrial Relations prevailing wage determination. Contractor, or any subcontractor working under it, shall be subject to penalties under Labor Code section 1813 for violations of these limitations.
- K. Contractor and its subcontractors shall not discriminate in the employment of persons upon public works on any basis listed in subdivision (a) of Section 12940 of the Government Code, as those bases are defined in Sections 12926 and 12926.1 of the Government Code, except as otherwise provided in Section 12940 of the Government Code. Every contractor for public works who violates this section is subject to all the penalties imposed for a violation of this chapter.
- L. Contractor shall secure the payment of worker's compensation to its employees performing the work, in accordance with the provisions of Sections 1860 and 3700 of the Labor Code and, in case any such work is sublet, the Contractor shall require its subcontractors similarly to comply with those provisions.

7.21 Trenching Plan

SC-7.21 Add the following section:

- A. Pursuant to Labor Code Section 6705, Contractor shall submit, in advance of excavation of any trench or trenches five feet or more in depth, a detailed plan showing the design of shoring, bracing, or sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trench or trenches, acceptable to Owner. If such plan varies from the shoring system standards, the plan shall be prepared by a registered civil or structural engineer.
- B. Pursuant to Labor Code section 6707, for trenches or other excavations which are five feet or deeper, Contractor's bid shall contain adequate sheeting, shoring, and bracing or equivalent method for the protection of life or limb, which shall conform to applicable safety orders.

ARTICLE 8— OTHER WORK AT THE SITE

No suggested Supplementary Conditions in this Article.

ARTICLE 9— OWNER'S RESPONSIBILITIES

9.02 *Replacement of Engineer*

SC-9.02.A Replace the section with:

Owner may at its discretion appoint an engineer to replace Engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.11 *Evidence of Financial Arrangements*

SC-9.11 Delete this section in its entirety.

ARTICLE 10— ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

SC-10.01.A Amend section to read as follows:

Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract, and by separate written agreement between Engineer and Owner.

10.03 *Resident Project Representative*

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

- C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:
 - 1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.
 - 2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.
 - 3. *Liaison*
 - a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

- b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.
 - c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.
4. *Review of Work; Defective Work*
- a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.
 - b. Observe whether any Work in place appears to be defective.
 - c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.
5. *Inspections and Tests*
- a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.
 - b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.
6. *Payment Requests:* Review Applications for Payment with Contractor.
7. *Completion*
- a. Participate in Engineer's visits regarding Substantial Completion.
 - b. Assist in the preparation of a punch list of items to be completed or corrected.
 - c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.
 - d. Observe whether items on the final punch list have been completed or corrected.
- D. The RPR will not:
- 1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
 - 2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
 - 3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
 - 4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

- 5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Authorize Owner to occupy the Project in whole or in part.

10.06 Decisions on Requirements of Contract Documents and Acceptability of Work

SC-10.06.A Replace the section with:

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

10.07 Limitations on Engineer's Authority and Responsibilities

SC-10.07.A Replace the section with:

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

SC-10.07.B Replace the section with:

Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents, except as provided by separate written agreement between Engineer and Owner.

ARTICLE 11— CHANGES TO THE CONTRACT

11.02 Change Orders

SC-11.02A Amend the section to read:

A Change Order, to be effective, must be written and signed by Contractor and Owner.

11.03 Work Change Directives

SC-11.03.B.2 Amend the section to read:

If Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall, after negotiations by the parties, notify Contractor of such an adjustment. Contractor may appeal Owner's determination under Article 12.

11.09 *Change Proposals*

SC-11.09.B.4 Amend the section to read:

Engineer's Full Review and Action on the Change Proposal: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then Contractor may at any time thereafter submit a letter to Owner indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

SC-11.09.B.5 Amend the section to read:

Binding Decision: Engineer's decision is final and binding upon Contractor, unless Contractor appeals the decision by filing a Claim under Article 12.

ARTICLE 12— CLAIMS

SC-12.0 Replace the section in its entirety with:

12.0 *Resolution of Construction Claims*

- A. Contractor claims shall be governed by Public Contract Code section 9204. Key provisions of that section are summarized below:
 - 1. "Claim" means a separate demand by Contractor sent by registered mail or certified mail with return receipt requested, for one or more of the following:
 - a. A time extension, including, without limitation, for relief from damages or penalties for delay assessed by District under this Contract.
 - b. Payment by District of money or damages arising from work done by, or on behalf of, Contractor pursuant to this Contract and payment for which is not otherwise expressly provided or to which the Contractor is not otherwise entitled.
 - c. Payment of an amount that is disputed by District.
 - 2. Upon receipt of a claim pursuant to this section, District shall conduct a reasonable review of the claim and, within a period not to exceed 45 days, shall provide Contractor

a written statement identifying what portion of the claim is disputed and what portion is undisputed. Upon receipt of a claim, District and a Contractor may, by mutual agreement, extend the time period provided in this subdivision.

3. Contractor shall furnish reasonable documentation to support the claim.
4. Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after Owner issues its written statement.
5. If Contractor disputes Owner's written response, or if Owner fails to respond to a claim, Contractor may demand in writing an informal conference to meet and confer for settlement of the issues in dispute. Upon receipt of a demand in writing sent by registered mail or certified mail, return receipt requested, Owner shall schedule a meet and confer conference within 30 days for settlement of the dispute.
6. Within 10 business days following the conclusion of the meet and confer conference, if the claim or any portion of the claim remains in dispute, Owner shall provide Contractor a written statement identifying the portion of the claim that remains in dispute and the portion that is undisputed. Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after Owner issues its written statement.
7. Any disputed portion of the claim, as identified by Contractor in writing, shall be submitted to nonbinding mediation, with Owner and Contractor sharing the associated costs equally. If the mediation is unsuccessful, the parts of the claim remaining in dispute shall be subject to sections 12 B and 12 C, below.
8. Failure by Owner to respond to a claim from Contractor within the time periods described herein or to otherwise meet the time requirements of this section shall result in the claim being deemed rejected in its entirety.
9. Amounts not paid in a timely manner as required by this section shall bear interest at 7 percent per annum.
10. Contractor may present to Owner a claim on behalf of a subcontractor or lower tier subcontractor. A subcontractor may request in writing, either on his or her own behalf or on behalf of a lower tier subcontractor, that Contractor present a claim for work which was performed by the subcontractor or by a lower tier subcontractor on behalf of the subcontractor. The subcontractor requesting that the claim be presented to Owner shall furnish reasonable documentation to support the claim. Within 45 days of receipt of this written request, Contractor shall notify the subcontractor in writing as to whether Contractor presented the claim to the Owner and, if Contractor did not present the claim, provide the subcontractor with a statement of the reasons for not having done so.
 - a. Nothing in this section creates or acknowledges a contractual or other legal relationship between Owner and any subcontractor.

- b. Nothing in this section creates or acknowledges in a subcontractor a direct claim or cause or right of action against Owner.
 - c. Nothing in this section imposes on Owner an obligation to review claims presented directly by a subcontractor or, with regard to claims made by Contractor on behalf of a subcontractor, to issue written statements to the subcontractor, or to meet and confer with the subcontractor, or to mediate claims with the subcontractor, or to make payments to the subcontractor.
- 11. Except as provided herein, this section does not alter extra work, change order, claim, or dispute resolution procedures and requirements set forth in this Contract.
- B. Following the mediation, if the claim or any portion remains in dispute, Contractor may file a claim as provided in Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government Code. For purposes of those provisions, the running of the period of time within which a claim must be filed shall be tolled from the time Contractor submits his or her written claim until the conclusion of mediation.
- C. The following procedures are established for all civil actions filed to resolve claims subject to Article 12:
 - 1. Within 60 days, but no earlier than 30 days, following the filing or responsive pleadings, the court shall submit the matter to nonbinding mediation unless waived by mutual stipulation of both parties. The mediation process shall provide for the selection within 15 days by both parties of a disinterested third person as mediator, shall be commenced within 30 days of the submittal, and shall be concluded within 15 days from the commencement of the mediation unless a time requirement is extended upon a good cause showing to the court or by stipulation of both parties. If the parties fail to select a mediator within the 15-day period, any party may petition the court to appoint the mediator.
 - 2. If the matter remains in dispute after mediation, the case shall be submitted to judicial arbitration pursuant to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, notwithstanding Section 1141.11 of that code. The Civil Discovery Act (Title 4 (commencing with Section 2016.010) of Part 4 of the Code of Civil Procedure) shall apply to any proceeding brought under this subdivision consistent with the rules pertaining to judicial arbitration.
 - a. Notwithstanding any other provision of law, upon stipulation of the parties, arbitrators shall be experienced in construction law, and, upon stipulation of the parties, mediators and arbitrators shall be paid necessary and reasonable hourly rates of pay not to exceed their customary rate, and such fees and expenses shall be paid equally by the parties, except in the case of arbitration where the arbitrator, for good cause, determines a different division. In no event shall these fees or expenses be paid by state or county funds.

- b. In addition to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, any party who after receiving an arbitration award requests a trial de novo but does not obtain a more favorable judgment shall, in addition to payment of costs and fees under that chapter, pay the attorney's fees of the other party arising out of the trial de novo.
- c. The court may, upon request by any party, order any witnesses to participate in the mediation or arbitration process.

ARTICLE 13— COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.03 Unit Price Work

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. Adjustments in Unit Price

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. the extended price of a particular item of Unit Price Work amounts to **10** percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than **25** percent from the estimated quantity of such item indicated in the Agreement; and
 - b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14— TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

No suggested Supplementary Conditions in this Article.

ARTICLE 15— PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 Progress Payments

SC-15.01 Replace section 15.01.B.4. with the following:

- a. Owner shall retain five percent (5%) of all progress payments as part security for fulfillment of the Contract. In any contract between Contractor and a subcontractor the percentage of the retention proceeds withheld may not exceed the percentage specified in this contract between Owner and Contractor. This section shall not be construed to limit the ability of Owner to withhold one hundred fifty percent (150%) of the value of any disputed amount of Work from the final payment, as provided for in subdivision (c) of section 7107 of the Public Contract Code. Nothing in this section shall be construed to require Owner to pay for work that is not approved or accepted in accordance with the Contract.
- b. Contractor may substitute securities for any moneys withheld by Owner to ensure performance under the Contract or Contractor may request and Owner shall make payment of retentions earned directly to the escrow agent at the expense of the Contractor, as provided in Public Contract Code section 22300.
- c. Within sixty (60) days after the date of completion of the Work, the retention withheld by the Owner shall be released. In the event of a dispute between Owner and Contractor, Owner may withhold from the final payment an amount not to exceed 150 percent of the disputed amount. For purposes of this requirement, "completion" means any of the following:
 - 1) The occupation, beneficial use, and enjoyment of a work of improvement, excluding any operation only for testing, startup, or commissioning, by Owner, or its agent, accompanied by cessation of labor on the work of improvement.
 - 2) The acceptance by Owner, or its agent, of the work of improvement.
 - 3) After the commencement of a work of improvement, a cessation of labor on the work of improvement for a continuous period of 100 days or more, due to factors beyond the control of Contractor.
 - 4) After the commencement of a work of improvement, a cessation of labor on the work of improvement for a continuous period of thirty (30) days or more, if Owner files for record a notice of cessation or a notice of completion.
2. Except as provided below, within seven (7) days from the time that all or any portion of the retention proceeds are received by Contractor, Contractor shall pay each of its subcontractors from whom retention has been specifically designated for a particular subcontractor, payment of the retention to the designated subcontractor, if the payment is consistent with the terms of the subcontract.

3. Contractor may withhold from a subcontractor its portion of the retention proceeds if a bona fide dispute exists between the subcontractor and Contractor. The amount withheld from the retention payment shall not exceed 150 percent of the estimated value of the disputed amount.
4. In the event that retention payments are not made within the time periods required by this section, Owner or Contractor withholding the unpaid amounts shall be subject to a charge of two percent (2%) per month on the improperly withheld amount, in lieu of any interest otherwise due. Additionally, in any action for the collection of funds wrongfully withheld, the prevailing party shall be entitled to attorney's fees and costs.
5. Release of retentions under this section shall not be construed as acceptance of defective or improper work or materials.

SC-15.01.C Replace section 15.01.C.1 with the following:

Engineer will, within seven days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

SC-15.01.D Replace section 15.01.D.1 with the following:

B. Payment Becomes Due

1. Payment will be made within 30 days after receipt of an undisputed and properly submitted payment application from Contractor with Engineer's recommendation for payment. The 30-day period will be reduced by the number of days by which Engineer exceeds the seven-(7) day return requirement. Progress payments made after the required time period will include interest equivalent to the legal rate set forth in subdivision (a) of section 685.010 of the Code of Civil Procedure.

15.03 *Substantial Completion*

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

15.06 *Final Payment*

SC-15.06 Replace section 15.06.D with:

D. Payment Becomes Due

1. Payment will be made within 30 days after receipt of an undisputed and properly submitted payment application from Contractor with Engineer's recommendation for payment. The 30-day period will be reduced by the number of days by which Engineer exceeds the seven-(7) day return requirement. Progress payments made after the required time period will include interest equivalent to the legal rate set forth in subdivision (a) of section 685.010 of the Code of Civil Procedure.

SC-15.06 Replace section 15.06E with:

Final Payment Becomes Due: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall also withhold for stop payment notices presented under Chapter 4, Title 3, Part 6, Division 4 of the Civil Code, commencing with section 9350. Owner shall pay the resulting balance due to Contractor within 60 days of Owner's receipt of the final Application for Payment from Engineer.

ARTICLE 16— SUSPENSION OF WORK AND TERMINATION

16.02 Owner May Terminate for Cause

SC-16.02.E Replace 16.02.E with:

If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

16.04 Contractor May Stop Work or Terminate

SC-16.04.A Replace section 16.04.A with:

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, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

SC-16.04B Replace section 16.04.B with:

If Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to

be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17— FINAL RESOLUTIONS OF DISPUTES

17.01 Methods and Procedures

SC-17.01 Delete this section in its entirety.

ARTICLE 18— MISCELLANEOUS

No suggested Supplementary Conditions in this Article.

EXHIBIT C—GEOTECHNICAL BASELINE REPORT SUPPLEMENT TO THE SUPPLEMENTARY CONDITIONS

1.01 *Definitions*

SC-1.01 Add to the list of definitions in Paragraph 1.01.A by inserting the following as numbered items in their proper alphabetical positions:

1. *Geotechnical Baseline Report (GBR)*—The interpretive report prepared by or for Owner regarding subsurface conditions at the Site, and containing specific baseline geotechnical conditions that may be anticipated or relied upon for bidding and contract administration purposes, subject to the controlling provisions of the Contract, including the GBR's own terms. The GBR is a Contract Document.
2. *Geotechnical Data Report (GDR)*—The factual report that collects and presents data regarding actual subsurface conditions at or adjacent to the Site, including Technical Data and other geotechnical data, prepared by or for Owner in support of the Geotechnical Baseline Report. The GDR's content may include logs of borings, trenches, and other site investigations, recorded measurements of subsurface water levels, the results of field and laboratory testing, and descriptions of the investigative and testing programs. The GDR does not include an interpretation of the data. If opinions, or interpretive or speculative non-factual comments or statements appear in a document that is labeled a GDR, such opinions, comments, or statements are not operative parts of the GDR and do not have contractual standing. Subject to that exception, the GDR is a Contract Document.

5.03 *Subsurface and Physical Conditions*

SC-5.03 Delete Paragraph 5.03 in its entirety and replace with the following:

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions hereby identify:
1. those reports of explorations and tests of subsurface conditions at or adjacent to the Site (other than any Geotechnical Data Report or Geotechnical Baseline Report) that contain Technical Data. Such reports are as follows:
 - a. *Report Title:* Geotechnical Report, Backwash Equalization Tank Improvements. Paradise Irrigation District, Town of Paradise & Butte County, California
 - b. *Date of Report:* March 25, 2024
 - c. 2. Contractor may examine copies of reports identified immediately above that were not included with the Bidding Documents at 6332 Clark Road, Paradise, CA during regular business hours, or may request copies from Engineer, at the cost of reproduction.
- B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph SC-5.03.A. Information and data regarding the presence or location of

Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

- C. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.
- D. *Limitations of Other Data and Documents:* Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 - 3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
 - 4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.
- E. *Geotechnical Data Report*
 - 1. This Contract contains a Geotechnical Data Report ("GDR"), identified as follows: Geotechnical Report, Backwash Equalization Tank Improvements for Paradise Irrigation District dated March 25, 2024 prepared by Bajada Geosciences, Inc.
 - 2. The GDR is incorporated as Contract Documents. The GDR is to be used in conjunction with other Contract Documents, including the Drawings and Specifications.
 - 3. The GDR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations (referred to here in the Supplementary Conditions as "Baseline Conditions"). These may include ground, geological, groundwater, and other subsurface geotechnical conditions, and baselines of anticipated Underground Facilities or subsurface structures.
 - 4. The Baseline Conditions will be used to assist in the administration of the Contract's differing site conditions clause at locations where subsurface conditions have been baselined. If a condition is baselined in the GDR, then only the pertinent Baseline Conditions will be used to determine whether there is a differing site condition; and no other indication of that condition in the

Contract Documents or Technical Data, or of a condition that describes, quantifies, or measures a similar characteristic of the subsurface, will be used for the differing site condition determination.

5. The Baseline Conditions will not be used to make differing site conditions determinations at locations that have not been baselined in the GDR, or at any location with respect to subsurface conditions that the Baseline Conditions do not address. If Underground Facilities or Hazardous Environmental Conditions are expressly addressed in the Baseline Conditions, then comparison to such Baseline Conditions will be the primary means of determining (a) whether an Underground Facility was shown or indicated with reasonable accuracy, as provided in Paragraph 5.05 of the General Conditions, or (b) whether a Hazardous Environmental Condition was shown or indicated in the Contract Documents as indicated in Paragraph 5.06.H of the General Conditions. As indicated in Paragraph SC-5.04 below, the GDR will be the primary resource for differing site conditions determinations.
6. The descriptions of subsurface conditions provided in the GDR are based on geotechnical investigations, laboratory tests, interpretation, interpolation, extrapolation, and analyses. Neither Owner, Engineer, nor any geotechnical or other consultant warrants or guarantees that actual subsurface conditions will be as described in the GDR, nor is the GDR intended to warrant or guarantee the use of specific means or methods of construction.
7. The behavior of the ground during construction depends substantially upon the Contractor's selected means, methods, techniques, sequences, and procedures of construction. If ground behavior conditions are baselined in the GDR, they are based on stated assumptions regarding construction means and methods.
8. The GDR will not reduce or relieve Contractor of its responsibility for the planning, selection, and implementation of safety precautions and programs incident to Contractor's means, methods, techniques, sequences, and procedures of construction, or to the Work.

5.04 *Differing Subsurface or Physical Conditions*

SC-5.04 Delete Paragraph 5.04 in its entirety and replace with the following:

5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice:* If Contractor believes that any subsurface condition that is uncovered or revealed at the Site:
 1. differs materially from conditions shown or indicated in the GDR; or
 2. differs materially from conditions shown or indicated in Contract Documents other than the GDR, to the extent the GDR is inapplicable; or
 4. to the extent the GDR is inapplicable, is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or

5. to the extent the GDR is inapplicable, is of such a nature as to require a change in the Drawings or Specifications; or
6. to the extent the GDR is inapplicable, is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

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

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph SC-5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption or continuation of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption or continuation of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- E. *Possible Price and Times Adjustments*
 1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must fall within any one or more of the categories described in Paragraph SC-5.04.A;

- b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03 of the General Conditions; and
 - c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
- 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or
 - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph SC-5.04.A.
- 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment must be set forth in a Change Order.
- 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.
- F. *Underground Facilities; Hazardous Environmental Conditions:* Paragraph 5.05 of the General Conditions governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 of the General Conditions governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs SC-5.03 and SC-5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

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Supplementary Conditions

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 11 03

SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION AND DESCRIPTION OF WORK

- A. The Work covers the construction of two roof-less cast-in-place rectangular concrete tanks, piping, electrical, controls and performing related required work, located as shown on these Drawings and Specifications.
1. The primary Work is divided into two separate phases:
- a. Phase 1:
 - 1) Demolition of existing stepped retaining wall and site utilities
 - 2) Site excavation
 - 3) Construction of Tank 2 and associated piping
 - 4) Site backfill, concrete slabs and paving
 - 5) Construction of access platform and stairs
 - 6) Electrical and controls associated with Tank 1 operation
 - 7) Testing of Tank 2
 - b. Phase 2:
 - 1) Installation of temporary bypass piping and bringing Tank 2 online
 - 2) Demolition of existing Tank and slab
 - 3) Construction of Tank 1 and piping
 - 4) Construction of access platform and stairs
 - 5) Electrical and controls associated with Tank 2 operation
 - 6) Testing of Tank 2
- B. The Work is located 13888 Pine Needle Drive, Magalia, CA.
- C. The Work will be constructed under one contract. The Contract Documents include the following:
- 1. Volume 1 – Bid Documents and Specifications
 - 2. Volume 2 – Drawings
 - 3. Volume 3 – Geotechnical Report

1.2 COORDINATION

- A. The CONTRACTOR shall be solely responsible for coordination of all of the Work of this Contract.
- B. The CONTRACTOR shall supervise, direct and cooperate fully with all Subcontractors, manufacturers, fabricators, suppliers, distributors, installers, testing agencies and all others whose services, materials or equipment are required to ensure completion of the Work within the Contract Time.
- C. Work of Others:
- 1. The CONTRACTOR shall cooperate with and coordinate CONTRACTOR's Work with the work of any other contractor, utility service companies, or OWNER's employees performing work at the site.

01 11 03-1
Summary of Work

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2. The CONTRACTOR shall also coordinate their Work with the work of others to assure compliance with schedules.
 3. The CONTRACTOR shall attend and participate in all project coordination or progress meetings and report on the progress of all Work and compliance with schedules.
 4. If any part of the work depends upon the work of others for proper execution or results, the CONTRACTOR shall inspect and promptly report to the ENGINEER any apparent discrepancies or defects in such work of others that render it unsuitable for such proper execution and results.
 5. Failure of the CONTRACTOR to so inspect and report shall constitute an acceptance of the work of others as fit and proper except as to defects which may develop in the work of others after execution of the work by the CONTRACTOR.
- D. Interference with work on utilities:
1. The CONTRACTOR shall cooperate fully with all utility forces of the OWNER or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the work.
 2. The CONTRACTOR shall schedule the work so as to minimize interference with said relocation, altering, or other rearranging of facilities.
- E. Responsibility for Damage:
1. The CONTRACTOR shall not be responsible for damage done by CONTRACTORS not under their jurisdiction.
 2. The CONTRACTOR will not be liable for any such loss or damage, unless it is through the negligence of the CONTRACTOR.

1.3 SITE CONDITIONS

- A. Site Investigation and Representation
1. The CONTRACTOR acknowledges that it has satisfied itself as to the nature and location of the work, the general and local conditions, particularly those bearing upon availability of transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, tide stages, or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this Contract.
 2. The CONTRACTOR further acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials to be encountered from inspecting the site and from evaluating information derived from exploratory work that may have been done by the OWNER or included in these Contract Documents. Any failure by the CONTRACTOR to become acquainted with all the available information will not relieve the CONTRACTOR from responsibility for properly estimating the difficulty or cost of successfully performing the work.
 3. Field Verification:
 - a. Before undertaking each part of the work, the CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements.
 - b. As the work proceeds, the CONTRACTOR shall field verify the depth and location of all buried utilities, and existing systems, and location of hazardous waste and contaminants.

- c. The CONTRACTOR shall promptly report in writing to the ENGINEER any conflict, error, or discrepancy which the CONTRACTOR may discover and shall obtain a written interpretation or clarification from the ENGINEER before proceeding with any work affected thereby.
- B. Existing Utilities and Improvements
- 1. Location of Underground Utilities:
 - a. Known existing underground conduits, pipelines and other utilities have been shown on the contract drawings in their approximate locations (within 3 feet of actual location). However, the accuracy or completeness of utilities indicated on the drawings is not guaranteed.
 - b. It shall be the responsibility of the CONTRACTOR to determine the exact location of all utilities and their service connections.
 - c. All potholing or other procedures for verifying utility location shall be performed by the CONTRACTOR as necessary to prepare for excavation at least 4 working days in advance of scheduled excavation.
 - d. The CONTRACTOR shall immediately notify the ENGINEER as to any utility located by him which has been incorrectly shown or omitted from the drawings.
 - e. If the CONTRACTOR cannot locate an underground utility whose presence is indicated on the Drawings, the ENGINEER shall be notified in writing.
 - f. The CONTRACTOR shall ascertain the exact locations of underground utilities whose presence is indicated on the Drawings, the locations of their service laterals work and of service laterals or appurtenances of any other underground utilities which can be inferred from the presence of visible facilities such as buildings, meters and junction boxes prior to doing work that may damage such utilities or interfere with their service.
 - g. Utilities Not Shown on Drawings:
 - 1) Attention is directed to the possible existence of underground utilities not indicated on the Drawings and to the possibility that underground utilities may be in a location different from that indicated on the Drawings.
 - 2) If the ENGINEER determines that the underground utility for which such notice has been given has not been depicted on the Drawings with reasonable accuracy (within 3 feet of actual location), the additional cost incurred in locating the utility will be paid for as extra work as provided in the General Conditions.
 - 3) If the CONTRACTOR discovers an underground utility not indicated on the Drawings, the CONTRACTOR shall immediately give the ENGINEER and the Utility Company written notification of the existence of such utility.
 - 4) Such utilities shall be located and protected from damages as directed by the ENGINEER and the cost of such work will be paid for as extra work as provided in the General Conditions.
 - 2. Utility Coordination:
 - a. The CONTRACTOR shall notify Underground Service Alert (USA), telephone (800) 642-2444 at least 4 days prior to excavation.
 - b. The CONTRACTOR shall also contact all utility owners not registered with USA but known to have utilities in the project area to field locate underground utilities at least 4 days prior to excavation.
 - c. The CONTRACTOR shall notify all owners of utilities when the Work is in progress and shall make arrangements as are necessary to make any emergency repairs.

- d. Existing utilities that are shown or that are made known and located to the CONTRACTOR prior to excavation, and that are to be retained; and all utilities that are constructed during excavation operations shall be properly supported and protected from damage during the progress of the work.
 - 3. Utility Protection and Damage:
 - a. Existing utilities that are shown or that are made known and located to the CONTRACTOR prior to excavation, and that are to be retained, and all utilities that are constructed during excavation operations shall be properly supported and protected from damage during the progress of the work.
 - b. Should any damage to a utility occur during the progress of the work, the CONTRACTOR shall notify the OWNER or the utility at once and render all assistance possible to repair the damage and restore the service.
 - c. No extra compensation will be made for the repair of any services or utility damaged by the CONTRACTOR nor for any damage incurred through neglect or failure to provide adequate protection to existing utilities.
 - d. The provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.
 - e. Damaged water pipelines will be repaired by the OWNER at the CONTRACTOR's expense. If the CONTRACTOR fails to pay the cost of repairs to water pipelines within thirty days of receipt of the invoice, the OWNER reserves the right to withhold the amount owed from the CONTRACTOR's Progress Payment.
 - f. Damage Report:
 - 1) In the event that the CONTRACTOR damages any underground utilities not shown on the Drawings or not depicted on the Drawings with reasonable accuracy (within 3 feet of actual location) or any lateral service the location of which could not be inferred by the CONTRACTOR, a written report thereof shall be made immediately to the ENGINEER.
 - 2) The CONTRACTOR's report shall also advise the ENGINEER of any schedule delays. Compensation for such delays will be determined in accordance with the General Conditions. The CONTRACTOR shall be entitled to no other compensation for any such damage.
 - 4. All utilities encountered along the line of the work shall remain continuously in service during all work under the Contract, unless otherwise shown on the drawings, or unless other arrangements satisfactory to the ENGINEER are made with the owner of said utilities.
- C. CONTRACTOR's Responsibility for Utility Facilities and Service
- 1. Where the CONTRACTOR's operations could cause damage or inconvenience to railway, telephone, television, power, oil, gas, water, sewer, or irrigation systems, the CONTRACTOR shall make all arrangements necessary for the protection of these utilities and services.
 - 2. 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.
 - 3. 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.

4. In no event shall interruption of any utility service be allowed outside working hours unless granted by the owner of the utility.
5. No sand, mud, rocks or other construction debris shall be disposed of in the sanitary sewers or storm sewers.
6. Where bypassing of sewage is required to perform sewer repairs or service relocations and where temporary pumps are required to bypass any sewage across traffic lanes, the discharge lines crossing the traffic lanes shall be buried a minimum of 4 inches below the pavement surface and backfilled with temporary asphalt concrete surfacing. The CONTRACTOR shall take all necessary steps to assure continuous flow of sewage. Bypassing of untreated wastewater to surface waters or courses will not be permitted.
7. The CONTRACTOR shall replace, at its own expense, any and all existing utilities or structures removed or damaged during construction, to their existing condition unless otherwise provided for in these Contract Documents.
8. The CONTRACTOR shall repair or replace, at its own expense, all pavement damaged during the construction, to its existing condition unless otherwise provided for in these Contract Documents.

D. Names of Known Utilities Serving the Area

1. The following is a list of the known public utilities serving the area:
 - a. Water – Paradise Irrigation District
 - b. Sewer – N/A
 - c. Telephone – AT&T
 - d. Electric – PG&E
 - e. Gas – PG&E

E. Interfering Structures

1. 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. While the information has been compiled from the best available sources, its completeness and accuracy cannot be guaranteed, and it is presented as a guide to avoid possible difficulties.
2. The CONTRACTOR shall protect all existing structures, trees, shrubs, and other items on the project site that are to be preserved, by substantial barricades or other devices commensurate with the hazard, from injury or destruction by vehicles, equipment, workmen, or other agents.
3. Where existing fences, gates, buildings, or any other structure must be removed to properly carry out the work, or are damaged during the work, they shall be restored at the CONTRACTOR's expense to their original condition or better.
4. Without additional compensation, the CONTRACTOR may remove and replace in a condition as good as or better than original, any small structures such as fences, and signposts that interfere with the CONTRACTOR's operations.

F. Field Relocation

1. During the progress of construction, it is expected that minor relocations of the work will be necessary.
2. Such relocations shall be made only by direction of the ENGINEER.
3. If existing structures are encountered that will prevent construction as shown, notify the ENGINEER before continuing with the work in order that the ENGINEER may make such field revisions as necessary to avoid conflict with the existing structures.

01 11 03-5
Summary of Work

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

4. If the CONTRACTOR shall fail to notify the ENGINEER when an existing structure is encountered, and shall proceed with the work despite this interference, CONTRACTOR shall do so at their own risk.
5. Any CONTRACTOR request(s) for additional compensation or contract time resulting from necessary field relocations will be considered as set forth in the General Conditions.
6. If the CONTRACTOR fails to notify the ENGINEER when a structure which interferes with construction is encountered, and proceeds with the work despite this obstruction, the CONTRACTOR shall do so at their own risk and at no additional cost to the OWNER.

1.4 REFERENCE POINTS AND SURVEYS

- A. Location and elevation of bench marks are shown on Drawings.
- B. Dimensions for lines and elevations for grades of structures, appurtenances, and utilities are indicated on Drawings, together with other pertinent information required for laying out Work. If conditions vary from those indicated, notify OWNER immediately, who will make minor adjustments required.
- C. OWNER may perform checks to verify accuracy of CONTRACTOR's layout Work and that completed Work complies with Contract Documents.
- D. Any existing survey points or other control markers destroyed without proper authorization will be replaced by owner of the survey points or control markers at CONTRACTOR's expense.
- E. CONTRACTOR's Responsibilities:
 1. Provide all survey and layout required.
 2. Locate and protect reference points prior to starting site preparation.
 3. Notify OWNER at least 3 working days in advance of time when grade and line to be provided by others will be needed.
 4. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
 5. In event of discrepancy in data provided by OWNER, request clarification before proceeding with Work.
 6. Provide cut sheets for all staking.
 7. Preserve and leave undisturbed control staking until ENGINEER has completed checks it deems necessary.
 8. Re-establish reference points resulting from destruction by CONTRACTOR's operations.
 9. Cooperate with ENGINEER so that checking and measuring may be accomplished with least interference to CONTRACTOR's operations.

1.5 SEQUENCE AND PROGRESS OF WORK

- A. The CONTRACTOR shall submit a Construction Schedule covering the entire Work in accordance with Section 01 32 13, Progress Schedule.
- B. CONTRACTOR shall incorporate the requirements of Section 01 14 03, Special Project Constraints, into the Construction Schedule.

01 11 03-6
Summary of Work

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

C. Alternate Sequence:

1. The CONTRACTOR's schedule may use a different sequence from that shown or specified, if techniques and methods known to the CONTRACTOR will result in cost and time savings to the OWNER, still achieve the required objective and maintain the same or greater level of treatment.
2. The ENGINEER's determination on the acceptability of any alternative sequence from that shown or specified shall be final.

1.6 CONTRACTOR'S USE OF PREMISES

- A. The CONTRACTOR shall coordinate use of the premises, for the CONTRACTOR's storage and the operations of the CONTRACTOR's workmen, with OWNER and utility service companies.
- B. Restriction of Work Area:
1. The full use of the premises for storage, the operations of workmen and for all other construction activities will not be available to the CONTRACTOR.
 2. The CONTRACTOR must operate entirely within the space allowed to the CONTRACTOR.
 3. The Drawings defines the area allocated to the CONTRACTOR.
- C. The CONTRACTOR shall be solely responsible for obtaining and paying all costs in connection with any additional work area, storage sites, access to the site or temporary right-of-way, which may be required for proper completion of the Work.
- D. Limitations on Use of Work Area:
1. It shall be understood that responsibility for protection and safe-keeping of equipment and materials on or near the site will be entirely that of the CONTRACTOR and that no claim shall be made against the OWNER or their authorized representatives by reason of any act.
 2. It shall be further understood that should any occasion arise necessitating access to the sites occupied by these stored materials or equipment, the ENGINEER shall direct the CONTRACTOR owning or responsible for the stored materials and equipment to immediately move the same.
 3. No materials or equipment may be placed upon the property of the OWNER, other than in the designated areas as shown on the Drawings, unless the ENGINEER has agreed to the location contemplated by the CONTRACTOR to be used for storage.
 4. All stored materials shall be labeled according to the appropriate contractor or Subcontractor with the manufacturer's label as well.
 5. Appropriate material safety data sheets (e.g., MSDS) shall be provided.
- E. The CONTRACTOR shall be required to share use of the premises with other Contractors whose services the OWNER has obtained or will obtain for construction of other facilities on the site.

1.7 USE OF OWNER'S FACILITIES

- A. The CONTRACTOR may use existing facilities or equipment in the Work for construction purposes, only if the OWNER's written permission is obtained.

- B. Restore existing facilities and equipment used for temporary purposes to original condition in a manner satisfactory to OWNER.

1.8 USE OF CADD DRAWING FILES

- A. Upon written request, the project CADD drawing files may be provided by the Engineer to the Contractor for the Contractor's convenience, and the Engineer shall assume no responsibility for any information which is extrapolated from the files that is not shown, or shown differently, than the Contract Documents. The Engineer assumes no liability for the Contractor's utilization of the CADD files, and Contractor is responsible for verification of any subcontractor's use or interpretation of CADD files against the Contract Documents. The drawing files may include miscellaneous or superseded engineering linework, layers, dimensions, references, and data that is not depicted in the Contract Drawings, is not to scale, or is not geo-referenced. It is the responsibility of the Contractor to interpret the data relative to the final printed condition of the Contract Drawings. Additionally, Contractor is solely responsible for ensuring the completeness and accuracy of the data as Contract Documents are revised, modified, and/or updated through Construction progress.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

01 11 03-8
Summary of Work

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 14 03

SPECIAL PROJECT CONSTRAINTS

PART 1 - GENERAL

1.1 LIMIT OF CONSTRUCTION ACTIVITIES ON WORK SITE

- A. Traffic Control:
 - 1. During non-work hours, the CONTRACTOR shall keep all lanes of traffic open and clear. All trenches shall be backfilled or covered with suitable steel plates and open to traffic.
 - 2. No equipment, construction material or excavated material that will interfere with traffic shall be stored on streets or roadways at any time.

1.2 SEQUENCE OF WORK

- A. General:
 - 1. The CONTRACTOR shall schedule and sequence their work in order to complete the Work by the specified completion date.
 - 2. The OWNER's water treatment plant must remain operational at all times.
 - 3. Re-vegetation of graded areas shall take place as quickly as possible as weather permits.

1.3 PROJECT CONSTRAINTS

- A. Maintenance of OWNER's Operations:
 - 1. Constraints listed herein involve limits on activities during construction. These limits relate to the critical nature of the existing water system.
 - 2. Continuous operation of OWNER's facilities is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.
 - 3. Work Plan:
 - a. The CONTRACTOR shall submit a detailed Work Plan and time schedule for all construction activities that will make it necessary to remove a tank, pipeline, electrical circuit, equipment, structure, road or other facilities from service, including the critical outages identified herein.
 - b. The Work Plan shall, at a minimum, identifying:
 - 1) the date and time when each activity will occur;
 - 2) what equipment will be present including standby equipment;
 - 3) what assistance will be required by OWNER's operating personnel;
 - 4) an emergency backup plan identifying what action will be taken if Work cannot be completed within the allotted time; and
 - 5) what individual will be in charge of the activity.
 - c. Submit Work Plan 10 days prior to the scheduled activity.
 - 4. Perform Work continuously during critical connections and changeovers, and as required to prevent interruption of OWNER's operations.
 - 5. Shutdowns:

01 14 03-1

Special Project Constraints

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- a. Coordinate proposed Work with OWNER and facility operations personnel before affecting unit shutdowns. The CONTRACTOR shall provide written confirmation of the shutdown date and time two (2) working days prior to the actual shutdown.
 - b. Under no circumstances shall the CONTRACTOR cease Work at the end of a normal working day or at the end of a working week if such actions may inadvertently cause a cessation of any facility operating process, in which case, remain onsite until necessary repairs are complete.
6. Do not close lines, open valves or gates, shut down equipment, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after approval of OWNER.
 7. Do not proceed with Work affecting a facility's operation without obtaining OWNER's advance approval of the need for and duration of such Work.
- B. Relocation of Existing Facilities:
1. During construction, it is expected that minor relocations of Work will be necessary.
 2. Provide complete relocation of existing structures and Underground Facilities, including piping, utilities, equipment, structures, electrical conduit wiring, electrical duct bank, and other necessary items.
 3. Use only new materials for relocated facility. Match materials of existing facility, unless otherwise shown or specified.
 4. Perform relocations to minimize downtime of existing facilities.
 5. Install new portions of existing facilities in their relocated position prior to removal of existing facilities, unless otherwise accepted by OWNER.
- C. Overtime:
1. Conduct Work outside regular working hours on prior written consent of OWNER to meet Project schedule and avoid undesirable conditions.
 2. All overtime Work by the CONTRACTOR necessary to conform to the requirements of this Section and related Sections shall be performed by the CONTRACTOR, at no cost to the OWNER and shall be performed in accordance with the General Conditions. The CONTRACTOR shall make no claims for extra compensation as a result thereof.

1.4 SCHEDULED SHUTDOWNS AND CONSTRUCTION SEQUENCING CONSTRAINTS

- A. Scheduled Shutdowns:
1. The scheduled shutdowns during the period of the CONTRACTOR'S Work will be as shown in Table 01 14 03-A
 2. All Work requiring the OWNER's facilities to be out-of-service shall be performed during the scheduled shutdowns shown.
 3. The OWNER's staff will continue to perform administrative, operation and maintenance functions during shutdowns.
- B. Critical work sequencing constraints are described in this paragraph. Work not specifically covered in this Section may, in general, be done anytime during the contract period.
- C. Key work sequencing constraints are as follows:

01 14 03-2
Special Project Constraints

TABLE 01 14 03-A SCHEDULED SHUTDOWNS				
AREA/ITEMS	SHUT-DOWN	FACILITY/PHASE	DESCRIPTION OF WORK	SUBSTANTIAL/ FINAL COMPLETION & CONSTRAINTS
Tank 2	8 hours	Phase 1	6" D, 24" BWR, and 6" BWR tie-ins	None
Tank 1	None	Phase 2	Demolition of existing tank	Tank 2 and temporary piping system shall be completed and tested before demolition of Tank 1 begins
Tank 1	4 hours	Phase 2	6" D, 24" BWR, 10" BWR and 6" BWR tie-ins	None

PART 2 - PRODUCTS (NOT USED)**PART 3 - EXECUTION (NOT USED)**

++ END OF SECTION ++

01 14 03-3
Special Project Constraints

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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01 14 03-4
Special Project Constraints

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 29 03
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 GENERAL

- A. Payment will be made at the price bid for each item listed on the bidding form or as extra work as provided in the General Conditions.
- B. No initial progress payment (other than a single mobilization payment as described in Article 1.3 below) will be made prior to acceptance by the ENGINEER of the CPM Construction Schedule, the associated Schedule of Costs, and the list of anticipated submittals.
- C. No subsequent progress payment will be made prior to receipt by the ENGINEER of the monthly update of the Construction Progress Schedule, as specified in Sections 01 31 19, Project Meetings and 01 32 13, Progress Schedule.
- D. No subsequent progress payment will be made prior to receipt by the ENGINEER of Certified Payroll for the previous month.

1.2 SCHEDULE OF COSTS FOR PAYMENTS

- A. Submit to the ENGINEER, within 5 days of acceptance of the Construction Schedule, five (5) copies of a Schedule of Costs. The Schedule of Costs shall be a form showing a detailed breakdown of quantities and prices of work and materials required to perform and complete the contract.
- B. The Schedule of Costs shall provide a cost breakdown for each element detailed in the approved Construction Schedule. The total of the price breakdown must agree with the lump-sum price bid. The elements listed and price breakdown shall not be front end loaded or unbalanced, shall be subject to adjustment between the ENGINEER and the CONTRACTOR, and will be used as a basis for progress payments.
- C. The Schedule of Costs will be used as a basis for determining the amount of the monthly progress payments.
- D. Acceptance of the Schedule of Costs by the ENGINEER shall not relieve the CONTRACTOR of the responsibility of performing all the work needed to complete the project at the lump-sum price bid.

1.3 PAYMENT FOR MOBILIZATION

- A. Mobilization Cost Breakdown:
 - 1. As soon as practicable after receipt of the Notice to Proceed, the CONTRACTOR shall submit a breakdown to the ENGINEER for approval, which shall show the estimated value of each major component of mobilization.

01 29 03-1
Measurement and Payment

2. When approved by the ENGINEER, the breakdown will be the basis for initial progress payments in which mobilization is included.
 3. Said breakdown shall not be "front end loaded" or unbalanced.
- B. One CONTRACTOR payment may be made prior to acceptance of the Construction Schedule, Schedule of Costs, and list of anticipated submittals.
1. Payment shall be limited to mobilization items only.
 2. The Construction Schedule is described in Section 01 32 13, Simplified Project Schedule
 3. Mobilization items are described in Section 01 71 13, Mobilization.
 4. The Schedule of Costs is described in Paragraph 1.2 of this Section.
 5. The list of anticipated submittals is described in Section 01 33 03, Submittal Procedures.

1.4 PROGRESS PAYMENTS

- A. Progress Payment Request Submittal:
1. Unless otherwise mutually agreed, by the 25th of each month, the CONTRACTOR shall prepare and submit monthly progress payment requests for work completed through the 25th day of the month.
 2. Said payment request shall be based on the breakdown of activities as specified in the Schedule of Costs described in Paragraph 1.2 above.
 3. The monthly schedule update shall be submitted as part of the monthly progress payment report.
- B. The ENGINEER will review progress payment requests and make a determination of the percent completion of all activities (rounded to the nearest whole percent) based on an approximate measurement of all materials supplied and work performed.
- C. In the event that the CONTRACTOR fails to provide the OWNER with an acceptable Monthly Contract Record Drawing Submittal in accordance with Section 01 33 03, Submittal Procedures the OWNER shall deduct compensation for such monthly submittal as provided in Section 01 32 13, Simplified Project Schedule. Said deduction shall become the sole property of the OWNER.
- D. Retention:
1. From the amount thus determined, five percent thereof will be deducted as retention by OWNER for performance security.
 2. Acceptance of separate components shall not operate to release performance retention.
 3. The amount of all payments previously made to the CONTRACTOR and any amounts due the OWNER from the CONTRACTOR for supplies, materials, services, damages, or otherwise deductible under the terms of the contract will be deducted from the remainder.
 4. The remaining amount will be paid as a progress payment by the OWNER to the CONTRACTOR on the third Friday of the succeeding month or as soon thereafter as is practical.
- E. In addition to the retention under Paragraph D above, the whole or part of any payment of the estimated amount due the CONTRACTOR may be withheld as an additional retention if such course be deemed necessary to protect the OWNER from loss due to the

01 29 03-2

Measurement and Payment

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

CONTRACTOR's failure to perform any of the following: (1) meet CONTRACTOR's payment obligations; (2) execute the work; (3) correct defective work; (4) settle damages as provided; or (5) produce substantial evidence that no stop notices will or have been filed, and/or if it has been determined that unpaid balances may be insufficient to complete the work.

- F. All material and work covered by progress payments thereupon become the sole property of the OWNER, but this provision shall not be construed as relieving the CONTRACTOR from sole responsibility for all materials and work upon which payments have been made or the restoration of any damaged work or as a waiver of the OWNER's right to require fulfillment of all of the contract terms. Said CONTRACTOR's obligation extends through the close of the warranty period.
- G. Payment for Materials:
1. No payment shall be made for materials stored offsite.
 2. Payment may be made for those materials delivered to the site but not incorporated in the work to the extent that the materials are included in the Construction Schedule as cost-loaded material delivery activities.
 3. Only material items manufactured specifically for this project and that cost individually in excess of \$20,000 will be considered for partial payment as stored materials.
 4. Partial payment for materials delivered will not be made before the respective shop drawings, installation instructions and O&M manuals have been submitted, reviewed, and accepted in accordance with Section 01 33 03, Submittal Procedures.
 5. To receive partial payment for materials delivered to the site, but not incorporated in the work, it shall be necessary for the CONTRACTOR to submit to the ENGINEER, at least 7 days prior to the end of said month, a list of such materials.
 6. At their sole discretion, the ENGINEER will approve items for which partial payment is to be made.
 7. The list of materials and invoices shall be clearly identified by referencing the associated activity or item on the price breakdown.
 8. Partial payment for materials delivered to the site or a bonded warehouse will be made in an amount equal to 75% of the respective suppliers' invoices(s) for the actual net cost for the item(s) delivered plus delivery charges.
 9. The CONTRACTOR's actual net cost for the materials must be supported by invoices of suppliers.
 10. Proper storage and protection of materials shall be provided by the CONTRACTOR. Final payment shall be made only for materials actually incorporated in the work and, upon acceptance of the work, all materials remaining for which advance payments had been made shall revert to the CONTRACTOR, unless otherwise agreed, and partial payments made for these items shall be deducted from the final payment for the work.

1.5 FINAL PAYMENT AND RELEASE OF CLAIMS

1. Upon the completion of the work as determined by the ENGINEER, a Notice of Acceptance will be issued and recorded with the County.
2. The OWNER will pay to the CONTRACTOR within 35 days after filing of the Notice of Acceptance, or as soon thereafter as practicable, the remaining amount due the CONTRACTOR including retainage, less all prior payments and advances whatsoever to or for the account of the CONTRACTOR for supplies, materials, services, damages, stop notices, or otherwise deductible under the terms of the contract.

01 29 03-3

Measurement and Payment

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

3. All prior estimates and payments including those relating to extra work shall be subject to correction by this payment, which throughout this contract is called "Final Payment".

1.6 RELEASE OF CLAIMS:

- A. Neither the final payment nor any part of the retained percentage shall become due until the CONTRACTOR shall have delivered to the OWNER a complete release of all claims against the OWNER arising under and by virtue of this contract and related to undisputed amounts, including claims of Subcontractors and suppliers of either materials or labor.
- B. If disputed contract claims in stated amounts are unresolved 35 days after issuance of the Notice of Acceptance, a progress payment of undisputed amounts and retained funds will be made by OWNER upon receipt of a release specifically excluding the disputed contract claims.
- C. Claims by the OWNER against the CONTRACTOR for liquidated damages or actual damages or other causes will be a valid basis for withholding of funds by the OWNER.
- D. Upon resolution of disputed claims the CONTRACTOR shall execute a supplemental release and, upon delivery the OWNER will make final payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

01 29 03-4

Measurement and Payment

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRE-CONSTRUCTION CONFERENCE

- A. Upon receipt of the Notice to Proceed, or at an earlier time if mutually agreeable, the ENGINEER will arrange a preconstruction conference to be attended by the CONTRACTOR's superintendent or other project representative authorized to commit on the behalf of the CONTRACTOR and to direct the performance of the work by others, the OWNER, the ENGINEER or ENGINEER's representative, and representatives of utilities, major subcontractors, and others involved in the execution of the work.
- B. The purpose of this conference will be to establish a working relationship and understanding between the parties and to discuss subjects as may be pertinent for the execution of the work.
- C. CONTRACTOR shall be prepared to discuss the following subjects, as a minimum:
 - 1. Required schedules.
 - 2. Status of Bonds and insurance.
 - 3. Sequencing of critical path work items.
 - 4. Progress payment procedures.
 - 5. Project changes and clarification procedures.
 - 6. Use of site, access, office and storage areas, security and temporary facilities.
 - 7. Major product delivery and priorities.
 - 8. CONTRACTOR's safety plan and representative.

1.2 PROGRESS MEETINGS

- A. The ENGINEER will arrange and conduct progress meetings. The ENGINEER will prepare and circulate a draft agenda of each meeting. The CONTRACTOR may add items as appropriate to the draft agenda.
- B. Progress meetings will be conducted on a regular basis, at such frequency as the OWNER and CONTRACTOR may mutually agree. Progress meetings shall be attended by the ENGINEER, OWNER Operations personnel, CONTRACTOR's superintendent or other project representative, and representatives of all subcontractors involved in the work at the time of the meeting, required by the CONTRACTOR, or requested by the OWNER.
- C. The purpose of the meetings will be to facilitate the work of the CONTRACTOR and any subcontractor or other organization that is not up to schedule, resolve conflicts, identify and resolve any potential delays or necessary changes in the work and in general, coordinate and facilitate the execution of the work.
- D. The agenda of progress meetings shall include review of work progress, the latest Construction Schedule submittal (monthly), potential project delays, the status of key shop drawings, submittal reviews, information requests, safety concerns, record drawings, and extra work items.

01 31 19-1
Project Meetings

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1.3 CONSTRUCTION SCHEDULE REVIEW

- A. The Construction Schedule will be reviewed monthly during an agreed upon progress meeting to verify at a minimum:
1. Actual start and finish dates of completed activities since the last progress meeting.
 2. Durations and progress of all activities not completed.
 3. Critical submittals/materials delivery problems.
 4. Potential project delays.
 5. Any activity behind schedule and CONTRACTOR's plan to bring it back on schedule.
 6. Reason, logic, time, and cost data for Change Order work that is to be incorporated into the Construction Schedule or payment request form.
 7. Payment due to the CONTRACTOR based on percentage complete of items in the submittal payment request form.
- B. At the progress meeting, the CONTRACTOR shall provide an update of the Construction Schedule as described in Section 01 32 13, Progress Schedule.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 32 13

PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The work specified in this Section includes the CONTRACTOR's preparation, submittal, maintenance and use of a computerized Critical Path Method (CPM) Construction Schedule to plan and monitor construction progress for the project.
- B. The computerized CPM schedule shall be completed using Microsoft Project for Windows or another software package acceptable to the ENGINEER.
- C. The requirements specified under Section 01 33 03, Submittal Procedures, also apply to the Construction Schedule initial submittal(s) and subsequent updates and revisions.

1.2 PREPARATION AND SUBMITTAL PROCEDURE

- A. Schedule Preparation and Submittal:
 - 1. The CONTRACTOR's on-site construction supervisor (superintendent, project manager, etc.) shall be directly involved in preparation of the Construction Schedule.
 - 2. The Construction Schedule shall be completed and submitted to the ENGINEER within 30 days after Notice to Proceed.
 - a. By preparing and submitting the Construction Schedule the CONTRACTOR represents that the CONTRACTOR can and intends to execute the work and portions thereof within the specified times and constraints and that the CONTRACTOR's bid covers the costs associated with the execution of work in accordance with the Construction Schedule.
 - 3. At the time of submittal of the Construction Schedule, CONTRACTOR's on-site construction supervisor shall review the schedule with ENGINEER's construction project representative.
 - 4. If the initial Construction Schedule submittal is not acceptable to the ENGINEER, it shall be revised in coordination with observations and comments from the ENGINEER and resubmitted within 7 days of the return of the schedule to the CONTRACTOR.

1.3 CONSTRUCTION SCHEDULE CONTENT

- A. The Construction Schedule shall be calendar-based, time-scaled, and show the durations of and relationships between the various work activities.
- B. Work activities shall be selected which reflect actual work to be performed for this specific project. No generic work activities shall be allowed.
 - 1. Work activities shall include non-construction activities such as submittal preparation and review, manufacturing, equipment delivery, mobilization, preparation of Contract Record Drawings, etc. for a complete picture of the CONTRACTOR's plan for project execution.
 - 2. Information on each activity shall include:
 - a. Concise description of the activity.

01 32 13-1
Project Schedule

- b. Duration in working days.
 - c. The dates for the beginning and completion of each activity.
 - d. The relationship of each activity to other activities.
 - 3. No work activity shall be longer than 10 working days.
 - a. Work tasks which will take longer than 10 working days shall be broken down into several work activities which are no longer than 10 working days.
 - b. Each work activity must be defined clearly and measurable. For example, a series of work activities such as "Building 1, east wall piping; Building 1, west wall piping; Building 1, north and south wall piping", each with a duration less than 10 days would be acceptable. A series of work activities all labeled "Building 1 Piping", even if each had a duration less than 10 days, would not be acceptable because the tasks are not defined clearly or measurable.
 - 4. Provide a monthly activity for preparation of Contract Record Drawings, in accordance with Section 01 33 03, Submittal Procedures with a minimum monthly cost of \$2,500.
- C. The schedule shall be referenced to calendar dates, and the beginning of the contract time shall be the date of receipt of the Notice to Proceed.
- D. Failure to include an activity required for the execution of the work shall not excuse the CONTRACTOR from completing the work and portions thereof within the specified times and at the price specified in the Agreement, and from meeting the constraints specified for sequence of work and control dates.

1.4 UPDATING THE CONSTRUCTION SCHEDULE

- A. The CONTRACTOR shall review and discuss the project progress relative to the most up to date Construction Schedule (updated monthly) at the weekly progress meetings, as specified in Section 01 31 19, Project Meetings.
- B. The schedule update shall reflect progress to date. The schedule update shall incorporate all revisions to logic and duration.

1.5 ADJUSTMENT OF THE CONTRACT TIME AND CHANGE ORDERS

- A. Adjustments of the contract time due to delays, additional work, or any other cause will only be issued through a contract change order in accordance with the General Conditions.
 - 1. The CONTRACTOR shall include, as part of each change order proposal for which the CONTRACTOR is requesting an adjustment in the contract duration, a proposed revised Construction Schedule.
 - 2. The proposed revised Construction Schedule shall be compared to the most recent Construction Schedule to assess overall schedule impact.
 - 3. If a Change Order is issued by the OWNER, the CONTRACTOR shall incorporate the Change Order into the Construction Schedule.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

01 32 13-3
Project Schedule

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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01 32 13-4
Project Schedule

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 33 03

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 GENERAL

- A. General:
1. This Section outlines in general the items that the CONTRACTOR must prepare or assemble for submittal during the progress of the work.
 2. There is no attempt herein to state in detail all of the procedures and requirements for each submittal.
 3. The CONTRACTOR's attention is directed to the individual Specification Sections in these Contract Documents, which may contain additional and special submittal requirements.
 4. The OWNER reserves the right to direct and modify the procedures and requirements for submittals as necessary to accomplish the specific purpose of each submittal.
 5. The CONTRACTOR shall anticipate resubmitting submittals for major pieces of equipment and for control systems.
 6. Should the CONTRACTOR be in doubt as to the procedure, purpose, or extent of any submittal, inquiries shall be directed to the ENGINEER.
- B. Schedule of Submittals:
1. Within 30 days of the Notice to Proceed, the CONTRACTOR shall submit a complete list of anticipated submittals, including specification/drawing references.
 2. This list shall be updated with "late start" submittal dates within 15 days of submittal of the CONTRACTOR's Construction Schedule.
 3. The submittal dates shall be updated upon approval of the Construction Schedule and periodically thereafter.
 4. Any additional submittals shall also be included in updates.

1.2 ADMINISTRATIVE SUBMITTALS

- A. The CONTRACTOR is reminded of their obligation as required by law to make required submittals promptly to the applicable federal, state, or local agency. Failure to comply with this requirement may result in the withholding of progress payments and make the CONTRACTOR liable for other prescribed action and sanctions.
- B. The CONTRACTOR shall submit to the ENGINEER a copy of all letters relative to the Contract, transmitting notifications, reports, certifications, certified payrolls, and the like, that the CONTRACTOR submits directly to a federal, state, or other governing agency.
- C. During the performance of the Contract, the CONTRACTOR shall maintain on a daily basis, and submit to the ENGINEER as requested, full and correct information as to the number of persons employed in connection with each subdivision of the work, the classification, rate of pay, citizenship status, and address of each person, and the cost, source, and amount of each class of materials delivered, equipment received, and major construction equipment used in each subdivision of the work.

01 33 03-1
Submittal Procedures

1.3 TECHNICAL SUBMITTALS

A. General:

1. Requirements in this Section are in addition to any specific requirements for submittals specified in other divisions and Sections of these Contract Documents.
2. Submittal Contents and Numbering:
 - a. Each submittal shall contain material pertaining to no more than one equipment or material item and shall have the specification Section and applicable paragraph number clearly identified on the front of the submittal transmittal form.
 - b. Each submittal shall be numbered based on the specification number relating to that piece of equipment. For multiple pieces of equipment under one specification section, numbering shall be sequential in order that they are received (e.g. 46 43 63-00 followed by 46 43 63-01).
 - c. Resubmittals shall include the number of the original submittal plus the suffix "01" for the first resubmittal, "02" for the second resubmittal, etc. (e.g. submittal 46 43 63-01-01, 46 43 63-01-02, etc.).
 - d. Submittals not conforming to these requirements will be rejected.
3. Submitted data shall be fully sufficient in detail for determination of compliance with the provisions and intent of the Contract Documents.
4. Coordination Responsibilities:
 - a. Shop drawing submittal and coordination are the responsibility of the CONTRACTOR; this responsibility shall not be delegated in whole or in part to Subcontractors or suppliers.
 - b. Designation of work "by others," if shown on shop drawings, shall mean that the work will be the responsibility of the CONTRACTOR rather than the Subcontractor or supplier who has prepared the shop drawings.
5. No equipment or material for which listings, drawings, or descriptive material is required shall be fabricated, purchased, or installed until the ENGINEER has reviewed and accepted such lists, final shop drawings, or other descriptive material. Installation of such equipment or material without accepted submittals will be considered defective work.
6. Submittal Review Time:
 - a. Submittals will be acted upon by the ENGINEER as promptly as possible, and returned to the CONTRACTOR not later than the time allowed for review in Paragraph B.2 below.
 - b. The CONTRACTOR shall provide in their Construction Schedule the time for OWNER review of each submittal (and resubmittal for major equipment and control systems) in accordance with the allowable time specified herein and in Section 01 32 13, Progress Schedule.
 - c. This required time for OWNER review shall not be a cause for delay in contract completion nor shall it be a reason for an extension of contract time.
 - d. If the CONTRACTOR is required by the OWNER to resubmit data, then neither the time required for the CONTRACTOR to prepare and resubmit such data, nor the required time for OWNER review, shall be a cause for delay in contract completion or for an extension of contract time.
 - e. Responsibility for time required for preparing and submitting required data shall be assigned solely to the CONTRACTOR.
7. Excessive Submittal Review:

01 33 03-2
Submittal Procedures

Washwater Equalizer Tank Replacement Project

- a. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the ENGINEER by the second submission of a submittal item.
- b. Additional costs of the ENGINEER's review beyond the second submission shall be the responsibility of the CONTRACTOR and may be deducted from the monthly progress payments.
- c. This applies to all submittals including shop drawings.
8. Changes After Review:
 - a. After a submittal has been reviewed and accepted, no changes or substitutions in that submittal will be allowed without the ENGINEER's approval.
 - b. If allowed, the CONTRACTOR will be responsible for the additional costs for engineering, administrative, clerical or other work required for additional review.
9. Intent of Review:
 - a. Shop drawings will be reviewed for general conformance with the drawings and specifications.
 - b. The intent of the review is to determine if the CONTRACTOR is submitting materials and equipment which are in general conformance with the Contract Documents.
 - c. Detailed review of dimensions, sizes, space requirements, coordination with other equipment, and other construction details is not performed.
 - d. Additional work and costs, resulting from errors in the shop drawings shall be the CONTRACTOR's responsibility and liability.
 - e. Accuracy, coordination, and completeness of shop drawings shall be the sole responsibility of the CONTRACTOR, including responsibility to backcheck comments, corrections, and modifications from the ENGINEER's review before fabrication.
10. The CONTRACTOR shall indicate on the submittal transmittal form if and how the submittal deviates from the contract requirements.
11. Rebar Shop Drawings:
 - a. The CONTRACTOR shall supply the ENGINEER with a copy of all reinforcing steel detail drawings.
 - b. Changes to the Contract Documents made by the CONTRACTOR in reinforcing steel shop drawings shall be called out in the letter of submittal.
 - c. Such changes will not be acceptable unless the ENGINEER has expressed consent to such changes in writing.
12. Shop drawings, layout diagrams, catalog cuts and data, test reports, and information in sufficient detail to show complete compliance with all specified requirements shall be furnished to the ENGINEER, covering but not limited to the following items:
 - Aggregate Base Course
 - Asphalt mixes
 - Block masonry
 - Building specialties
 - Concrete mixes
 - Control panels
 - Demolition plan
 - Doors and frames
 - Electrical conduit, wire and specials
 - Electrical fixtures and appliances
 - Electrical load centers
 - Electrical conduit, wire and specials

Engineered fill
Engines and appurtenances
Equipment provided by the CONTRACTOR
Fences, barricades and gates
Grating
Grout
Hardware
Instrumentation
Lights and lighting fixtures
Louvers
Meters
Miscellaneous fabricated metals
Motor control centers
Motors, starters and controls
Paints, coatings and finishes
Pipe, fittings and specials
Pipe supports and anchors
Pressure gauges
Programmable logic controllers
Pumps
Reinforcing steel and layout drawings
Roofing and waterproofing
Signs
Structural steel
Temporary bypasses
Valve and gate operators and controllers
Valves and gates
Variable frequency drives
Windows

B. Submittal Procedure:

1. The CONTRACTOR shall submit to the ENGINEER for review one (1) electronic copy of each submittal (shop drawings, electrical diagrams, and catalog cuts for fabricated items and manufactured items furnished under this Contract, etc.)
2. Shop drawings shall be submitted in sufficient time to allow the ENGINEER not less than twenty (20) working days for examining the shop drawings except for designs for turnkey items for which thirty (30) working days will be allowed, and substitutions for which (40) working days will be allowed.
3. Shop drawings shall be accurate, distinct, and complete, and shall contain all required information, including satisfactory identification of items, units, and assemblies in relation to the Contract Drawings and Specifications.
4. CONTRACTOR Certification:
 - a. Shop drawings shall be submitted only by the CONTRACTOR, who shall indicate by a signed stamp on the shop drawings, or other approved means, that the CONTRACTOR has checked and approved the shop drawings, and that the work shown is in accordance with Contract requirements and has been checked for dimensions and relationship with work of all other trades involved.
 - b. Submitting incomplete or unchecked shop drawings for the ENGINEER to correct or finish will not be acceptable, and shop drawings that, in the opinion of the

- ENGINEER, indicate that they have not been checked by the CONTRACTOR will be rejected and returned to the CONTRACTOR for resubmission in the proper form.
5. Return of Reviewed Submittals:
 - a. When the shop drawings have been reviewed by the ENGINEER, the appropriate number of submittals will be returned to the CONTRACTOR appropriately stamped.
 - b. If major changes or corrections are necessary, the shop drawing will be rejected and returned to the CONTRACTOR with the need for such changes or corrections indicated.
 - c. The CONTRACTOR shall correct and resubmit rejected shop drawings in the same manner and quantity as specified for the original submittal.
 - d. If changes are made by the CONTRACTOR (in addition to those requested by the ENGINEER) on the resubmitted shop drawings, such changes shall be clearly explained in a transmittal letter accompanying the resubmitted shop drawings.
 6. The review of such shop drawings and catalog cuts by the ENGINEER shall not relieve the CONTRACTOR from responsibility for correctness of dimensions, fabrication details, coordination with other work, and space requirements, or for deviations from the Contract Drawings or Specifications, unless the CONTRACTOR has called attention to such deviations in writing by a letter accompanying the shop drawings and the ENGINEER approves the change or deviation in writing at the time of submission; nor shall review by the ENGINEER relieve the CONTRACTOR from the responsibility for errors in the shop drawings.
 7. The CONTRACTOR agrees that shop drawing submittals processed by the ENGINEER do not become Contract Documents and are not Change Orders; that the purpose of the shop drawing review is to establish a reporting procedure and to permit the ENGINEER to monitor the CONTRACTOR's progress and understanding of the design.
- C. Shop Drawing Requirements: Shop drawings referred to herein shall include shop drawings, catalog cuts and information schematic diagrams, and other submittals for both shop and field-fabricated items. The CONTRACTOR shall submit, as applicable, the following for all prefabricated or manufactured structural items, material, and equipment:
1. General:
 - a. For structures, submit all shop, setting, equipment, miscellaneous iron and reinforcement drawings and schedules necessary for construction. The foregoing shall include detailed "pour drawings" which shall show the sequence of concrete placement, and the type, quantity and location of all embedment items (sleeves, anchor bolts, door frames, etc.)
 - b. For pipelines, submit a detailed layout of the pipeline with details of bends, closure pieces and fabricated specials and furnish any other details necessary.
 - c. For trench excavation, submit detailed plan showing the design of shoring, bracing, sloping or other provisions necessary for safety.
 - d. For boring and jacking, submit a detailed description of the process to be used.
 - e. For equipment which requires electrical service, submit detailed information to show power supply requirements, MCC and control panel, elevations, wiring diagrams, control and protection schematics, shop test data, operation and maintenance procedures, outline drawings, and manufacturer's recommendation of the interface/interlock among the equipment.
 - f. For mechanical equipment submit all data pertinent to the installation and maintenance of the equipment including shop drawings, anchorage requirements,

- manufacturer's recommended installation procedure, detailed installation drawings, test data and curves, operation and maintenance manuals, and other details necessary.
- g. For architectural fabrication submit all data pertinent to the installation of the fabrications, including shop drawings, manufacturer's recommended installation procedure, detailed installation drawings, and other details necessary.
 - h. For shop drawings or equipment drawings, including dimensions, size and location of connections to other work, and weight of equipment.
 - i. Installation or placing drawings for equipment, drives, and bases.
 - j. Supporting calculations for equipment and associated supports, or hangers required or specified to be designed by equipment manufacturers, including seismic restraint information and details.
 - k. Complete coating manufacturer's specifications, including materials description and paint system.
 - l. Performance data and head vs. flow curves for compressor and pumps.
 - m. Suggested spare parts list with current price information.
 - n. List of special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)
 - o. List of special tools furnished with the equipment.
 - p. List of materials and supplies required for the equipment prior to and during startup.
 - q. Installation instructions.
 - r. List of materials and supplies furnished with the equipment.
 - s. Samples of finish colors for selection.
 - t. Special handling instructions.
 - u. Requirements for storage and protection prior to installation.
 - v. Requirements for routine maintenance required prior to plant startup.
 - w. Startup and operating instructions.
 - x. Seismic design calculations and restraint details for equipment and piping supports. Calculations shall be stamped by a Civil or Structural Engineer registered in the State of CA.
2. Electrical:
- a. Wiring and control diagrams of systems and equipment. Local control panel details.
 - b. List of special motor features being provided (e.g., space heaters, altitude corrections, thermal protectors, mounting arrangement, etc.).
 - c. Complete motor rating for all motors, including motor no-load, starting, and full-load current at rated voltage; full-load speed and full-load current at 110 percent voltage; motor service factor; motor efficiency and power factor at 1/2, 3/4, and full-load at rated voltage; recommended maximum kVAR of power factor correction capacitors when capacitors are switched with motor.
 - d. See Division 26, ELECTRICAL, for additional specific submittal requirements.
3. Instrumentation and Control:
- a. See Technical Sections for additional specific submittal requirements.
 - b. The submittals shall include satisfactory identification of items, units, and assemblies in relation to the Specification Section number, and the system or equipment identification or tag number shown on the Drawings, the Process and

Instrumentation Diagram (P&ID), or as provided in applicable Specification Section.

- D. Submittals required for foreign-manufactured items:
 - 1. In addition to the submittal requirements stated above, suppliers of foreign-manufactured items shall submit the names and addresses of companies within the United States that maintain technical service representatives and a complete inventory of spare parts and accessories for each foreign-made item proposed for incorporation into the work. Failure to provide the foregoing capabilities shall be just cause for rejection of the foreign-manufactured items.
- E. Final shop drawings to be submitted to OWNER:
 - 1. Complete sets of reproducible (full size mylar or vellum base) final shop drawings shall be submitted to the OWNER before, or at the time of, delivery of equipment onto the site.
- F. Seismic loading design provisions:
 - 1. All equipment supports that are not specifically detailed on the Drawings or specified herein shall be the responsibility of the equipment manufacturers and shall be designed by a Civil or Structural Engineer registered in the State of CA.
 - 2. The design shall be in accordance with the seismic provisions of the latest edition of the International Building Code and of the seismic design requirements listed in Section 01 61 03, General Product Requirements, in addition to all other loading conditions.
- G. Submittal of interface information (connection and correlation with other work):
 - 1. Where called for in the Specifications, and as determined necessary by the ENGINEER to provide proper correlation with other equipment, complete interface information shall be submitted.
 - 2. This interface information shall be accurate, and contain all information necessary to allow the completion of detailed design and construction of the interfacing or connecting work.
 - 3. The CONTRACTOR shall include in their negotiation for subcontract work, such agreements as may be necessary to ensure the accuracy of Subcontractor's interface submittal information.
 - 4. In the event additional costs are incurred due to subsequent changes to information given in said interface information, such additional costs shall be borne by the CONTRACTOR.
- H. Record Drawings
 - 1. The CONTRACTOR shall deliver to the OWNER one complete set of final Record Drawings for OWNER records before the contract will be accepted by the OWNER. The Record Drawings will consist of a set of reproducible drawings of all CONTRACTOR supplied equipment (including control systems) and a marked-up set of Contract Record Drawings.
 - 2. Record Drawings of CONTRACTOR-Supplied Equipment
 - a. Drawings shall be provided in electronic pdf form.
 - b. The overall dimensions of each drawing submitted to the ENGINEER shall be equal to one of the OWNER's standard sheet sizes. The title block area in the lower right hand corner of each drawing shall be clear of all linework, dimensions, details, and notes, except for the CONTRACTOR's title block. The dimensions of

the title block area are minimum and are measured from the edges of the drawing sheet.

DRAWING FORMAT	
Sheet Sizes Height x Width	Title Block Area Height x Width
11" x 8-1/2"	2-1/2" x 3-3/4"
11" x 17"	3" x 4"
22" x 34"	3-1/2" x 8"

3. Contract Record Drawings

- a. The CONTRACTOR shall keep an up-to-date set of marked-up Contract Drawings on an OWNER-supplied set of Drawings.
- b. The OWNER-supplied set of Drawings will consist of one set of full-size sepia reproductions of the Contract Drawings, supplied to the CONTRACTOR at the start of the work.
- c. During the progress of the work, the CONTRACTOR shall record on the Contract Record Drawings any changes from or additions to the work described in the Plans and Specifications.
- d. All information recorded on the Contract Record Drawings shall be clearly legible.
- e. Information to be recorded on the Contract Record Drawings shall include, but not be limited to, the following:
 - 1) Actual routing of electrical conduits, whose routing is only indicated in general on the Drawings.
 - 2) Actual location of manhole structures.
 - 3) Actual alignment of all installed pipe.
 - 4) Specific details of pipe connections, and manhole structures.
 - 5) Specific details on the installation and connection of mechanical and electrical equipment.
 - 6) Field dimensions where they differ from those shown on the Drawings.
 - 7) Additions to and/or deletions from the work, including all contract change orders.
 - 8) Other details showing as-built conditions, which are shown differently or only in general on the Drawings.
 - 9) Addenda.
 - 10) Location of buried features located during construction except utility service connections.
- f. It is the CONTRACTOR's responsibility to ensure that any changes, deletions, specific construction details, etc., performed by a Subcontractor are recorded on the Contract Record Drawings.
- g. Location Survey:
 - 1) The CONTRACTOR shall professionally survey the lateral and vertical position of anything buried underground as part of this Contract to within one inch accuracy of the benchmark and baseline provided by the OWNER.

- 2) The survey information shall be included on the record drawings and the CONTRACTOR shall not be allowed to cover the buried materials until after the OWNER's inspector has verified the information as accurate and complete, and is shown on the record drawings.
 - h. Once every month, starting from the completion of mobilization as defined in Section 01 71 13, Mobilization, the CONTRACTOR shall provide the OWNER with a copy of the then up-to-date set of marked-up Contract Record Drawings in accordance with the provisions under Section 01 29 03, Measurement and Payment, and Section 01 32 13, Project Schedule.
 - i. At the end of the work, prior to Project Closeout, the CONTRACTOR shall provide the OWNER with the Contract Record Drawings, showing all "as-built" conditions.
 - j. See also Section 01 77 03, Operational Completion and Project Closeout.
- I. Operation and Maintenance (O&M) Manuals:
1. The CONTRACTOR shall furnish five (5) hard-copies (if requested by the Owner at project completion) and two (2) electronic copies on USB drives of a complete instruction manual for installation, operation, maintenance, and lubrication requirements for each component of mechanical and electrical equipment or system.
 2. All equipment manufacturers shall be made aware of these requirements and all associated costs shall be included in the costs for furnishing the equipment or system.
 3. O&M Submittal Review Checklist:
 - a. The CONTRACTOR shall include a completed O&M Manual Submittal Review Checklist (copy included at the end of this Section) with each O&M manual submittal.
 - b. The checklist shall indicate that the O&M manual as submitted complies in all respects to the contract requirements.
 - c. Any O&M manual submitted without a completed checklist will be rejected.
 4. The manuals shall be furnished to the ENGINEER upon the delivery of the respective equipment.
 5. No payment will be made for equipment or materials or equipment installation before the respective O&M manuals have been approved by the ENGINEER.
 6. Each O&M manual shall be complete in all respects for all equipment, controls, accessories, and associated appurtenances.
 7. Each O&M manual shall include, but not be limited to, the following:
 - a. Diagrams and illustrations, including pump curves indicating operating points.
 - b. Detailed description of the function of each principal component of the system.
 - c. Performance and nameplate data.
 - d. Installation instructions.
 - e. Starting procedure
 - f. Proper adjustment procedure.
 - g. Test procedures.
 - h. Operating procedure.
 - i. Shutdown instructions.
 - j. Emergency operating instructions and troubleshooting guide.
 - k. Safety instructions.
 - l. Maintenance and overhaul instructions which shall include detailed assembly drawings with part numbers, parts list, instructions for ordering spare parts, and

01 33 03-9
Submittal Procedures

Washwater Equalizer Tank Replacement Project

- complete preventive maintenance instructions required to ensure satisfactory performance and longevity of the equipment.
- m. Lubrication instructions which shall list points to be greased or oiled, shall recommend type, grade, and temperature range of lubricants, and shall recommend frequency of lubrication.
 - n. List of electrical relay settings and control and alarm contact settings.
 - o. Electrical interconnection wiring diagram for equipment furnished, including all control and lighting systems.
 - p. Recommendations for spare parts and special tools.
8. Hard-Copy O&M Manuals:
- a. Each copy of the manual shall be assembled in one or more hard-back type three-ring binders, each with title page, typed table of contents, and heavy section dividers with numbered plastic index tabs.
 - b. Cover label and title page shall be clearly labeled to designate the project title, project number, Specification Section where the item is specified, system or equipment for which it is intended with reference to the facility, equipment number, and equipment manufacturer name.
 - c. Typed table of contents for the entire set, identified by volume number, shall appear in each binder.
 - d. Each manual shall be divided into sections paralleling the equipment specifications.
 - e. All data shall be hole-punched for binding and composition and printing shall be arranged so that punching does not obliterate any data.
 - f. Pages larger than 8-1/2" x 11" shall be folded, showing title block or optionally included in binder pockets.
 - g. Where more than one binder is required, they shall be labeled "Vol. 1", "Vol. 2", and so on.
 - h. Submit manual organization and format to the ENGINEER for approval prior to manual preparation.
9. Electronic O&M Manuals:
- a. In addition to the designated number of hard-copies for each required Manufacturer's O&M manual, provide an electronic copy, each on its own separate compact disc/s (CD-ROM).
 - b. The CD-ROM shall contain one full version of the O&M manual in Adobe's Portable Document File (PDF) format.
 - c. In addition, the CD-ROM shall contain the separate text and drawing files used to create the PDF O&M manual.
 - d. An index shall be provided on the CD-ROM as a separate text file with the name "index" and shall include the file name and detailed description of each individual file included on the CD-ROM.
 - e. The CD-ROM and the CD-ROM case shall be labeled with the Project title, Project number, Specification section, equipment number, equipment name, and equipment manufacturer name.
10. Manuals shall be transmitted to the ENGINEER upon delivery of the equipment and all equipment shall be serviced in accordance with the manufacturer's recommendations prior to operation. A service record shall be maintained on each item of equipment and shall be delivered to the ENGINEER prior to final acceptance of the project.

J. Manufacturers' certificates and proper installation:

01 33 03-10
Submittal Procedures

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. The CONTRACTOR shall submit manufacturers' certificates of proper installation for items of equipment as specified under Section 01 75 06, Testing, Training and Startup.
- K. Samples and test specimens:
1. Where required in the Specifications, and as determined necessary by the ENGINEER, test specimens or samples of materials, appliances, and fittings to be used or offered for use in connection with the work shall be submitted to the ENGINEER at the CONTRACTOR's expense, with information as to their sources, with all cartage charges prepaid, and in such quantities and sizes as may be required for proper examination and tests to establish the quality or equality thereof, as applicable.
 2. All samples and test specimens shall be submitted in ample time to enable the ENGINEER to make any tests or examinations necessary, without delay to the work. The CONTRACTOR will be held responsible for any loss of time due to their neglect or failure to deliver the required samples to the ENGINEER, as specified.
 3. The CONTRACTOR shall submit additional samples as required by the ENGINEER to ensure equality with the original approved sample and/or for determination of Specification compliance.
 4. Laboratory tests and examinations that the OWNER elects to make in its own laboratory will be made at no cost to the CONTRACTOR, except that, if a sample of any material or equipment proposed for use by the CONTRACTOR fails to meet the Specifications, the cost of testing subsequent samples shall be borne by the CONTRACTOR.
 5. All tests required by the Specifications to be performed by an independent laboratory shall be made by a laboratory approved by the ENGINEER. Certified test results of all specified tests shall be submitted in duplicate to the ENGINEER. The samples furnished and the cost for the laboratory services shall be at the expense of the CONTRACTOR and included in the prices bid for the associated work.
 6. Approved sample items (fixtures, hardware, etc.) may be incorporated into the work upon approval, and when no longer needed by the ENGINEER for reference.
- L. Material and equipment colors:
1. The ENGINEER will provide a schedule of selected colors within 30 days after approval of materials and equipment, and after receiving samples of the manufacturers' standard colors for those items requiring OWNER's selection.
- M. Certificates of Compliance:
1. A Certificate of Compliance shall be furnished for materials specified to a recognized standard or code prior to the use of any such materials in the work.
 2. The ENGINEER may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a Certificate of Compliance.
 3. The certificate shall be signed by the manufacturer of the material or the manufacturer of assembled materials and shall state that the materials involved comply in all respects with the requirements of the Specifications.
 4. A Certificate of Compliance shall be furnished with each lot of material delivered to the work and the lot so certified shall be clearly identified in the certificate.
- N. Quality Assurance
1. Source limitations: To the greatest extent possible for each unit of work, the CONTRACTOR shall provide products, materials, or equipment of a singular generic kind from a single source.

2. Compatibility of options:
 - a. Where more than one choice is available as options for CONTRACTOR's selection of a product, material, or equipment, the CONTRACTOR shall select an option which is compatible with other products, materials, or equipment already selected.
 - b. Compatibility is a basic general requirement of product/material selections.
- O. Review by ENGINEER
1. After review by the ENGINEER of each of the CONTRACTOR's submissions, the material will be returned to the CONTRACTOR with actions defined as follows:
 - a. NO EXCEPTIONS TAKEN: Accepted subject to its compatibility with further submittals and additional partial submittals for portions of the work not covered in this submittal. Does not constitute approval or deletion of specified or required items not shown in the partial submittal.
 - b. MAKE CORRECTIONS NOTED: Same as 1.a., except that minor corrections as noted shall be made by the CONTRACTOR.
 - c. REVISE AND RESUBMIT: Rejected because of major inconsistencies or errors which shall be resolved or corrected by the CONTRACTOR prior to subsequent review by the ENGINEER.
 - d. REJECTED - RESUBMIT: Submitted material does not conform to Plans and Specifications in major respect, e.g., wrong item, wrong size, model, capacity, or material.
 2. Review actions (a) and (b) above constitute acceptance by the ENGINEER of the submittal.
- P. Requests for Information
1. Requests for Information about the Contract Documents shall be directed by the CONTRACTOR to the ENGINEER using a Request for Information (RFI) form as agreed to by the OWNER and the ENGINEER. Such requests shall not be transmitted directly to the ENGINEER from a Subcontractor or Supplier.
 2. A separate form shall be used for each specific item for which information is required. Requests for Information for more than one item using a single RFI form will be permitted only when the items are so functionally related that expediency indicates review of the group of items as a whole.
 3. The ENGINEER will reply to the CONTRACTOR's Request for Information as soon thereafter as practicable.
- Q. Construction Photographs
1. Provide photographs showing the preconstruction site, construction progress, and the post-construction site.
 2. Format: Photographs shall be digital format
 - a. Digital Format:
 - 1) Digital photos shall be taken with a minimum 3.5 mega pixel density and provided in JPG format.
 - 2) Digital photo files shall be provide on a CD accompanied by a text file that lists the file name, date photo was taken, and brief description of the photograph and location where the photograph was taken.
 3. Take a minimum of 50 photos of the preconstruction site and the property adjacent to the perimeter of the construction site. Particular emphasis shall be directed to structures both inside and outside the site, or as directed by OWNER.

4. Take a minimum of 72 photos monthly showing the progress of construction. The location of these photographs shall be determined by OWNER.
5. Take a minimum of 50 photos of the post-construction site and the property adjacent to the perimeter of the site. Particular emphasis shall be directed to structures both inside and outside the plant boundary, or as indicated by OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

01 33 03-13
Submittal Procedures

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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01 33 03-14
Submittal Procedures

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

O&M MANUAL REVIEW CHECKLIST

SUBMITTAL NO. _____	DATED _____
SPEC. SECTION. _____	REVIEW DATE _____
SUBJECT _____	REVIEWER _____
EQUIP. ITEM _____	SUPPLIER _____
_____	MANUFACTURER _____

ACCEPTABLE _____	PROJECT TITLE: _____
UNACCEPTABLE _____	PROJECT NO. 22-098

DISPOSITION	ACCEPTABLE?			COMMENTS
	YES	NO	NA	
HARD-COPY O&M MANUALS				
▪ Minimum five (5) copies.....				
▪ Three-ring binder with hard-back cover.....				
▪ Cover Label and Title Page:				
Project title and Project number				
Specification section				
System/Equipment names				
Facility				
Equipment number				
▪ Typed table of contents.....				
▪ Heavy section dividers w/numbered plastic index tabs .				
▪ Sections parallel equipment specifications				
▪ Pages punched for 3 ring binder (punching does not obliterate data).....				
▪ Info larger than 8-1/2"x11" folded showing title block, or included in binder pockets				
▪ Multiple volumes labeled "Vol. 1", "Vol. 2", etc.....				
▪ Table of contents for entire set in each binder.....				
ELECTRONIC O&M MANUALS				
▪ Minimum one (1) copy on CD-ROM.....				
▪ Full version of O&M manual in PDF format.....				
▪ Separate text and drawing files used to create PDF O&M manual.....				
▪ Index on CD-ROM as separate file titled "index"				
▪ CD-ROM and case labeled				
TECHNICAL CONTENT				
▪ Diagrams and illustrations, including pump curves				
▪ Detailed description of function of principal components.....				

01 33 03-CL-1
O&M Manual Review Checklist

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

DISPOSITION	ACCEPTABLE?			COMMENTS
	YES	NO	NA	
▪ Performance and nameplate data	_____	_____	_____	_____
▪ Installation instructions.....	_____	_____	_____	_____
▪ Starting procedure	_____	_____	_____	_____
▪ Proper adjustment procedure.....	_____	_____	_____	_____
▪ Test procedures	_____	_____	_____	_____
▪ Operating procedure.....	_____	_____	_____	_____
▪ Shutdown instructions	_____	_____	_____	_____
▪ Emergency operating instructions & troubleshooting	_____	_____	_____	_____
▪ Safety instructions	_____	_____	_____	_____
▪ Maintenance and overhaul instructions.....	_____	_____	_____	_____
▪ Lubrication instructions	_____	_____	_____	_____
▪ List of electrical relay settings and control and alarm contact settings	_____	_____	_____	_____
▪ Electrical interconnection wiring diagrams, including control and lighting systems	_____	_____	_____	_____
▪ Recommended spare parts and special tools	_____	_____	_____	_____
▪ Project specific warranty statement	_____	_____	_____	_____

01 33 03-CL-2
O&M Manual Review Checklist

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 33 13

CERTIFICATES AND REFERENCE FORMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The CONTRACTOR shall provide a completed Certificate of Unit Responsibility, Certificate of Proper Installation, Certificate of Proper Operations, and Equipment Information Form, and Certificate of Compliance for all products furnished and installed under this contract as required in the general stipulations set forth in the Contract Documents except as otherwise specified in other Sections.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CERTIFICATES AND REFERENCE FORMS

- A. The following forms shall be completed by the CONTRACTOR for the Certificate of Unit Responsibility, Certificate of Proper Installation, Certificate of Proper Operations, Equipment Information Form, and Certificate of Compliance.
- B. A single Certificate of Proper Installation, Certificate of Proper Operations, and Certificate of Compliance may be used for multiple pieces of equipment if the equipment is identical, installed at the same location, and certified at the same time.

[CLIENT - PROJECT]

CERTIFICATE OF UNIT RESPONSIBILITY

for

Specification Section _____

(Section Title)

In accordance with Section 01 61 03 of the Contract Documents, the undersigned manufacturer accepts unit responsibility for all components of equipment furnished under specification Section _____. We hereby certify that these components are compatible and comprise a functional unit suitable for the specified performance and design requirements.

Notary Public

Name of Corporation

Commission expiration date

Address

Seal:

By: _____
Duly Authorized Official

Legal Title of Official

Date: _____

[CLIENT - PROJECT]
CERTIFICATE OF PROPER INSTALLATION

Equipment ID(s):

Equipment Name:

Equipment Specification Section:

Manufacturer:

Model:

Date/Time of Inspection:

I am an authorized representative of the manufacturer and certify that this equipment:

Yes	No	N/A	
☐	☐	☐	Has been properly installed
☐	☐	☐	Has been properly adjusted
☐	☐	☐	Has been properly lubricated
☐	☐	☐	Is in accurate alignment
☐	☐	☐	Is free from undue stress imposed by connecting piping or anchor bolts
☐	☐	☐	Has been operated satisfactorily under full-load condition
☐	☐	☐	Is ready for full-time operation
☐	☐	☐	Operates within the manufacturer's allowable limits for vibration
☐	☐	☐	All controls, protective devices, instrumentation, control panels furnished as part of the manufacturer's equipment package are properly installed and calibrated
☐	☐	☐	The control logic for equipment startup, shutdown, sequencing, interlocks and emergency shutdown has been tested and is properly operating

CERTIFIED BY:
(MANUFACTURER'S REPRESENTATIVE)

ACKNOWLEDGED BY:
(CONTRACTOR)

Signature

Signature

Printed Name

Printed Name

Company

Company

Date

Date

[CLIENT - PROJECT]
CERTIFICATE OF PROPER OPERATIONS

Equipment ID(s):

Equipment Name:

Equipment Specification Section:

Manufacturer:

Model:

Date/Time of Inspection:

I am an authorized representative of the manufacturer and certify that this equipment:

Yes	No	N/A	
☐	☐	☐	Has Certificate of Proper Installation
☐	☐	☐	Has been operating satisfactorily under various load conditions
☐	☐	☐	Has been operated satisfactorily under full-load condition
☐	☐	☐	Is ready for full-time operation
☐	☐	☐	Operates within the manufacturer's allowable limits for vibration
☐	☐	☐	All controls, protective devices, instrumentation, control panels furnished as part of the manufacturer's equipment package are operating as per Contract Documents
☐	☐	☐	The control logic for equipment startup, shutdown, sequencing, interlocks and emergency shutdown has been tested and is properly operating

CERTIFIED BY:
(MANUFACTURER'S REPRESENTATIVE)

ACKNOWLEDGED BY:
(CONTRACTOR)

Signature

Signature

Printed Name

Printed Name

Company

Company

Date

Date

[CLIENT - PROJECT]
EQUIPMENT INFORMATION FORM

Facility Location: _____ Date: _____

Service Desc: _____ Process Location: _____

Spec Section #: _____ Drawing Ref: _____

Vendor: _____ Assoc. Equipment: _____

Manuf: _____ Type: _____

Model #: _____ Size: _____

Serial #: _____ GPM: _____

Temperature Range: _____ PSI Range: _____

CFM: _____ Operating Range: _____

Electrical Equipment or Motor Data:

Manufacturer Name: _____ Horsepower: _____ Volts: _____ Amp's: _____

Phase: _____ AC or DC: _____ RPM's: _____ Frame #: _____

Enclosure Nema Rating: _____ Service/Power Factor: _____ Insulation Class: _____

Miscellaneous Info: _____

Mechanical Data:

Belt Manufacturer: _____ Belt Model #: _____ Number of Belts: _____

Bearing Manufacturer: _____ Bearing Model #: _____

Weight Oil Used: _____ Volume Oil Required: _____

Miscellaneous Info: _____

[CLIENT - PROJECT]
CERTIFICATE OF COMPLIANCE

Equipment / Material Name:

Equipment ID(s):

Specification Section:

Manufacturer:

Model:

Referenced Standard(s) or Code(s):

I am an authorized representative of the manufacturer and certify that this equipment / material complies with the above referenced standard(s) or code(s). Relevant letters and certifications from the appropriate standard setting organization(s) have been attached to this document.

CERTIFIED BY:
(MANUFACTURER'S REPRESENTATIVE)

ACKNOWLEDGED BY:
(CONTRACTOR)

Signature

Signature

Printed Name

Printed Name

Company

Company

Date

Date

++ END OF SECTION ++

01 33 13-7

Certificates and Reference Forms

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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01 33 13-7

Certificates and Reference Forms

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 42 03**REFERENCE STANDARDS AND ABBREVIATIONS****PART 1 - GENERAL****1.1 REFERENCE STANDARDS**

- A. The standards referred to, except as modified, shall have full force and effect as though printed in this Specification, and shall be the latest edition or revision thereof in effect on the bid opening date, unless a particular edition or issue is indicated. Copies of these standards are not available from the OWNER.
- B. The ENGINEER will furnish, upon request, information as to how copies may be obtained.
- C. Abbreviations and terms, or pronouns in place of them, shall be interpreted as follows:

AAMA:	Architectural Aluminum Manufacturer's Association
AAN:	American Association of Nurserymen
AAR:	Association of American Railroads
AASHTO:	American Association of State Highway and Transportation Officials, Standard Specifications
AATCC:	American Association of Textile Chemists and Colorists
ACI:	American Concrete Institute, Standards
AFBMA:	Anti-Friction Bearing Manufacturer's Association, Inc.
AGA:	American Gas Association
AGC:	Associated General Contractors
AGMA:	American Gear Manufacturer's Association
AHAM:	Association of Home Appliance Manufacturer's
AI:	The Asphalt Institute
AIA:	American Institute of Architects
AISC:	American Institute of Steel Construction, Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, and the AISC Code of Standard Practice
AISI:	American Iron and Steel Institute
AITC:	American Institute of Timber Construction
AMCA:	Air Moving and Conditioning Association, Standards
ANS:	American Nuclear Society
ANSI:	American National Standards Institute
APA:	American Plywood Association
API:	American Petroleum Institute
APWA:	American Public Works Association, Standard Specifications for Public Works Construction
ASA:	Acoustical Society of America
ASAE:	American Society of Agriculture Engineers
ASCE:	American Society of Civil Engineers
ASHRAE:	American Society of Heating, Refrigeration and Air Conditioning Engineers

01 42 03-1

Reference Standards and Abbreviations

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

ASLE:	American Society of Lubricating Engineers
ASME:	American Society of Mechanical Engineers
ASQC:	American Society of Quality Control
ASSE:	American Society of Sanitary Engineers
ASTM:	American Society for Testing and Materials, Standards
AWG:	American Wire Gauge
AWPA:	American Wood-Preservers' Association, Standards
AWPI:	American Wood Preservers Institute
AWS:	American Welding Society
AWWA:	American Water Works Association, Standards
BBC:	Basic Building Code, Building Officials and Code Administrators International
BHMA:	Builders Hardware Manufacturer's Association
CAL/OSHA:	California/Occupational Safety and Health Administration, Standards
CBM:	Certified Ballast Manufacturer's
CCR:	California Code of Regulations
CEMA:	Conveyors Equipment Manufacturer's Association
CGA:	Compressed Gas Association
CISPI:	Cast Iron Soil Pipe Institute, Standards
CLPCA:	California Lathing and Plastering Contractors Association
CLFMI:	Chain Link Fence Manufacturer's Institute
CMAA:	Crane Manufacturers' Association of America
CMA:	Concrete Masonry Association
CRSI:	Concrete Reinforcing Steel Institute, Standards
CSS:	CalTrans Standard Specifications, State of California, Department of Transportation
DCDMA:	Diamond Core Drill Manufacturer's Association
DOSH:	Division of Occupational Safety and Health, State of California, Department of Industrial Relations
EIA:	Electronic Industries Association
ETL:	Electrical Test Laboratories
FED/OSHA:	Federal Occupational Safety and Health Administration, Standards
FM:	Factory Mutual
IBC:	International Building Code
ICBO:	International Conference of Building Officials
ICEA:	Insulated Cable Engineers Association
IEEE:	Institute of Electrical and Electronic Engineers
IES:	Illuminating Engineering Society
IME:	Institute of Makers of Explosives
IP:	Institute of Petroleum (London)
IPC:	Institute of Printed Circuits
IPCEA:	Insulated Power Cable Engineers Association
ISA:	Instrument Society of America
ISO:	International Organization of Standardization
ITE:	Institute of Traffic Engineers
MBMA:	Metal Building Manufacturer's Association
MPTA:	Mechanical Power Transmission of Association
MTI:	Marine Testing Institute

01 42 03-2

Reference Standards and Abbreviations

Washwater Equalizer Tank Replacement Project

MSS:	Manufacturers Standardization Society
NAAM:	National Association of Architectural Metal Manufacturers
NACE:	National Association of Corrosion Engineers, Standards
NBS:	National Bureau of Standards
NCCLS:	National Committee for Clinical Laboratory Standards
NEC:	National Electric Code
NEMA:	National Electrical Manufacturers' Association, Standards
NFPA:	National Fire Protection Association
NFPA:	National Forest Products Association
NGLI:	National Lubricating Grease Institute
NMA:	National Microfilm Association
NWMA:	National Woodwork Manufacturers Association
OSHA:	Occupational Safety and Health Administration
PCA:	Portland Cement Association
PCI:	Prestressed Concrete Institute
PID:	Paradise Irrigation District
RIS:	Redwood Inspection Service, Standard Specifications
RVIA:	Recreational Vehicle Industry Association
RWMA:	Resistance Welder Manufacturer's Association
SAE:	Society of Automotive Engineers
SAMA:	Scientific Apparatus Makers Association
SDI:	Steel Door Institute
SIS:	Swedish Standards Association
SMA:	Screen Manufacturer's Association
SMACNA:	Sheet Metal and Air Conditioning Contractors National Association
SPR:	Simplified Practice Recommendation
SSBC:	Southern Standard Building Code, Southern Building Code Congress
SSPC:	Steel Structures Painting Council, Specifications
SSPWC:	Standard Specifications for Public Works Construction
TAPPI:	Technical Association of the Pulp and Paper Industry
TFI:	The Fertilizer Institute
UBC:	Uniform Building Code of the International Conference of Building Officials
UPC:	Uniform Plumbing Code
UL:	Underwriters Laboratories
WCLA:	West Coast Lumbermen's Association, Standard Grading and Dressing Rules
WCLIB:	West Coast Lumber Inspection Bureau
WCRSI:	Western Concrete Reinforcing Steel Institute
WIC:	Woodwork Institute of California
WRI:	Wire Reinforcement Institute, Inc.
WWPA:	Western Wood Products Association

1.2 OTHER ABBREVIATIONS

- A. Other common abbreviations that may be found in the Specifications are, but may not be limited to:

acrylonitrile butadiene	ABS	styrene alternating current	a-c, AC
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01 42 03-3

Reference Standards and Abbreviations

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

American wire gauge	AWG	gram	g
ante meridiem	am	ground fault current interrupter	GFCI
ampere	A, amp		
average	avg		
		hand/off/automatic heating, ventilating, and air conditioning	HOA HVAC
biochemical oxygen demand	BOD		
brake horsepower	bhp	Hertz	Hz
British thermal unit	Btu	hour	hr
		horsepower	hp
Centigrade	C		
chlorinated polyvinyl chloride	CPVC	inch	in
company	Co	inch-pound	in-lb
cubic inch	cu in, in ³	input/output	I/O
cubic foot	cu ft, CF, ft ³	inside diameter	ID
cubic yard	cu yd, CY, yd ³	instrumentation and control	I&C
cubic feet per minute	cfm, ft ³ /min		
cubic feet per second	cfs, ft ³ /s	kilovolt	kV
		kilovolt-ampere	kVA
decibel	dB	kilowatt	kW
decibels, A-weighted	dBA	kilowatt-hour	kWhr
degree Centigrade (Celsius)	°C, C		
degree Fahrenheit	°F, F	length	L
diameter	diam, ø	length to least radius of gyration	L/r
direct current	d-c, DC	light emitting diode	LED
dollars	\$	linear	lin
ductile iron	DI	linear foot	LF, lin ft
		liter	l
each	ea, @		
efficiency	eff		
elevation	El., Elev	manhole	MH
ethylene propylene rubber	EPDM	maximum	max
exhaust fan	EF	mean sea level	MSL
		megawatt	MW
Fahrenheit	F	mercury	Hg
feet	ft	miles per hour	mph
feet per hour	fph, ft/h	milli-amp	mA
feet per minute	fpm, ft/min	milliampere DC	mAdc
feet per second	fps, ft/s	milligram	mg
fiberglass reinforced plastic	FRP	milligrams per liter	mg/l
figure	Fig.	milliliter	ml
flange	flg	millimeter	mm
foot-pound	ft-lb	million gallon	MG, mil
		million gallons per day	mgd
gallon	gal	minimum	min
gallons per hour	gph, gal/hr	motor control center	MCC
gallons per minute	gpm, gal/min		
gallons per second	gps, gal/s	net positive suction head available	NPSHA

01 42 03-4

Reference Standards and Abbreviations

Wastewater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

net positive suction head required	NPSHR	revolutions per minute	rpm
number	No., #	second	sec, s
National Pipe Thread	NPT	specific gravity	sp gr
Operation and Maintenance	O&M	square foot	sq ft, SF, ft ²
ounce	oz	square inch	sq in, in ²
outside diameter	OD	square yard	sq yd, SY, yd ²
		stainless steel	SS
		standard	std
parts per million	ppm	standard cubic feet	
post meridiem	pm	per minute	scfm
plus or minus	+/-, ±	symmetrical	sym.
polytetrafluorethylene	PTFE		
polyvinyl chloride	PVC	total dynamic head	tdh
pound	lb	totally-enclosed, fan-cooled	TEFC
pound-force	lbf	totally-enclosed, non-ventilated	TENV
pounds per square foot	psf, lb/ft ²	twisted shielded	TWSH
pounds per square inch	psi, lb/in ²		
pounds per square inch absolute	psia		
pounds per square inch gage	psig	ultraviolet	UV
Process and Instrumentation Diagrams	P&ID	United States	US, USA
		variable frequency drive	VFD, AFD
random access memory	RAM	volt	V
reinforced concrete pipe	RCP	volts alternating current	VAC
reinforced concrete cylinder		volts direct current	VDC
pipe	RCCP		
relative humidity	RH	water to cement	W/C, wc
		water column	W.C.

PART 2 - PRODUCTS (NOT USED)**PART 3 - EXECUTION (NOT USED)**

++ END OF SECTION ++

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01 42 03-6

Reference Standards and Abbreviations

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 45 03

QUALITY CONTROL

PART 1 - GENERAL

1.1 OBSERVATION AND SUPERVISION

- A. The ENGINEER or ENGINEER's appointed representative will review the Work and the CONTRACTOR shall provide facilities and access to the Work at all times as required to facilitate this review.
- B. Responsibility:
 - 1. The CONTRACTOR shall be solely responsible to supervise and direct the entire Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to complete the Work in accordance with the Contract Documents.
 - 2. The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, quality control, and procedures of construction and safety precautions and programs incidental thereto.
 - 3. The foregoing includes work performed by the CONTRACTOR's Subcontractors.
 - 4. The CONTRACTOR shall be responsible to see that the finished Work complies accurately with the Contract Documents.
- C. Superintendent:
 - 1. The CONTRACTOR shall designate in writing and keep on the work site at all times during its progress a technically qualified, English-speaking superintendent, who shall not be replaced without written acceptance of the ENGINEER.
 - 2. The superintendent shall be the CONTRACTOR's representative at the job site and shall have authority to act on behalf of the CONTRACTOR.
 - 3. All communications given to the superintendent shall be as binding as if given to the CONTRACTOR.
 - 4. The CONTRACTOR's superintendent shall be present at the site of the Work at all times while work is in progress. Failure to observe this requirement shall be considered as suspension of the Work by the CONTRACTOR until such time as such superintendent is again present at the site.

1.2 RESPONSIBILITY

- A. The CONTRACTOR is responsible for conducting all testing and inspection specifically required by the Specifications and otherwise necessary to ensure compliance with the Contract Documents.
 - 1. Approval of Testing Laboratories:
 - a. All laboratory work under this contract shall be performed by a laboratory approved by the ENGINEER, whether the laboratory is employed by the CONTRACTOR, or is owned and operated by the CONTRACTOR.
 - b. The basis of approval includes the following:
 - 1) Testing laboratories performing work in connection with concrete, steel, and bituminous materials shall comply with ASTM E 329 and ASTM D 3666, respectively.

01 45 03-1
Quality Control

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- 2) Testing laboratories performing work not in connection with concrete, steel, bituminous materials, soils and non-destructive testing shall comply with ASTM E 548.
- B. The ENGINEER may conduct periodic independent testing and inspection to verify compliance with the Contract Documents.
- C. Retesting:
 1. The OWNER reserves the right to back-charge the CONTRACTOR for retesting of deficient or defective work or products upon written notification.
 2. Compensation for retesting on behalf of the OWNER will be made through deductions from the Progress Payments.
- D. The CONTRACTOR is responsible for correcting all defective work discovered prior to final acceptance of the Contract, despite the failure of the Inspector(s) to discover it.

1.3 TESTS AND INSPECTIONS

- A. The CONTRACTOR shall be responsible for scheduling all inspections and tests required.
 1. The ENGINEER shall be given a minimum 48 business hours' notice prior to any inspections or tests.
- B. The OWNER will employ a special inspector during construction on the types of work indicated on the Structural Notes Drawing. The Contractor shall coordinate with the special inspector to schedule all special inspections.
- C. The CONTRACTOR shall pay for all tests including, but not limited to, the following:
 1. Mix designs, including tests of trial batches, on concrete mixes.
 2. Tests of materials, inspections, and certifications required by the Specifications, but not noted as special inspection.
 3. Testing, adjusting, and balancing of equipment and systems required by the Specifications.
 4. One tension and elongation test for each 5 tons of steel or fractional part thereof for each size will be required, unless the steel can be identified by heat or melt numbers and is accompanied by mill analysis and test reports. Commercial stock may be used, subject to approval of the ENGINEER.
 5. Any testing performed by the CONTRACTOR for their own quality control (e.g., compaction tests).
 6. Retests or re-inspections by the OWNER, if required, and tests or inspections required due to CONTRACTOR error or lack of required identifications of material.
 7. Any and all water used by the CONTRACTOR in any testing.
- D. Two copies of the agency or laboratory report of each test or inspection shall be provided to the ENGINEER. All tests of materials shall be made in accordance with the commonly recognized standards of national technical organizations, and such other special methods and tests as are prescribed in the Contract Documents.
- E. Purchase Orders:
 1. One copy of each of the CONTRACTOR's purchase orders for materials forming a portion of the work shall be furnished to the ENGINEER, if requested.

01 45 03-2
Quality Control

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2. Each such purchase order shall contain a statement that the materials included in the order are subject to inspection by the OWNER.
3. Materials purchased locally will be inspected at the point of manufacture or supply, and materials supplied from points more than 50 miles from the job site will be inspected upon arrival at the job, except when other inspection requirements are provided for specific materials in other Sections of this Specification.

F. Samples:

1. The CONTRACTOR shall furnish samples of materials as are required by the ENGINEER, without charge.
2. No material shall be used until the ENGINEER has had the opportunity to test or examine such materials.
3. Samples will be secured and tested whenever necessary to determine the quality of the material.
4. Samples and test specimens prepared at the job site, such as concrete test cylinders, shall be taken or prepared by the ENGINEER in the presence and with the assistance of the CONTRACTOR.

1.4 AUTHORITY AND DUTIES OF INSPECTOR

- A. Inspectors employed by the OWNER shall be authorized to inspect all work done and materials and equipment furnished to complement the CONTRACTOR furnished independent inspector.
1. Such inspection may extend to all or any part of the work, and to the preparation, fabrication, or manufacture of the materials and equipment to be used.
 2. The Inspector will not alter or waive the provisions of the Contract Documents.
 3. The Inspector will keep the ENGINEER informed as to the progress of the work and the manner in which it is being done.
 4. The Inspector will call the CONTRACTOR's attention to nonconformance with the Contract Documents that the Inspector may have observed.
 5. The Inspector will not be responsible for the adequacy or correctness of the CONTRACTOR's means, methods, techniques, sequences, or procedures for construction.
 6. The Inspector will not approve or accept any portion of the work, issue instructions contrary to the Contract Documents, or act as foreman for the CONTRACTOR.
 7. The Inspector may reject defective materials, equipment, or work when it is not in compliance with the Contract Documents.
 8. The Inspector will not be responsible for:
 - a. The CONTRACTOR's quality control program.
 - b. The CONTRACTOR's safety program.
 - c. Coordinating the work or activities of the CONTRACTOR or their Subcontractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

01 45 03-3
Quality Control

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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01 45 03-4
Quality Control

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 51 03

TEMPORARY CONSTRUCTION FACILITIES AND UTILITIES

PART 1 - GENERAL

1.1 CONTRACTOR'S STAGING AREA AND WORK ACCESS PLAN

- A. The CONTRACTOR shall limit the location of the storage of equipment and materials to the staging area(s) designated on the Drawings and as directed by the ENGINEER.
- B. The CONTRACTOR shall make their own arrangements for additional space that may be required and shall bear all associated costs.
- C. The CONTRACTOR shall submit a work access plan showing the planned access route for deliveries of supplies and mobilization of work force for ENGINEER's approval prior to mobilization.
- D. On-Site Project Office:
 - 1. The CONTRACTOR shall maintain near the work in progress a suitable office or other protected area in which shall be kept project copies of the Contract Documents, project progress records, project schedule, shop drawings and other relevant documents which shall be accessible to the OWNER and ENGINEER during normal working hours.
 - 2. The CONTRACTOR shall make their own arrangements for additional space that may be required and bear all associated costs.
- E. Temporary Facilities Plan:
 - 1. The CONTRACTOR shall submit to the ENGINEER for approval, as part of the mobilization effort, the proposed plan and layout for all temporary offices, sanitary facilities, temporary construction roads, storage buildings, storage yards, temporary water service and distribution, temporary telephone and temporary power service and distribution.
 - 2. The plan shall show all temporary fencing and gates and all proposed access to the work areas.
 - 3. Prior to the removal of existing fence, the CONTRACTOR shall provide temporary security fencing at least equal to the existing chain link and barbed wire fencing to protect the existing facilities and structures.
- F. Access Roads:
 - 1. The CONTRACTOR shall "winterize" all access roads to provide a surface reasonably satisfactory for traffic during wet winter months.
 - 2. The roads shall be gravel surfaced, even, free from humps and depressions.
 - 3. All costs of complying with this requirement shall be included in the lump sum bid.

1.2 STORAGE - GENERAL

- A. The CONTRACTOR shall provide any temporary storage required for the protection of equipment and materials as recommended by manufacturers of such materials.

01 51 03-1

Temporary Construction Facilities and Utilities

Washwater Equalizer Tank Replacement Project

1.3 STORAGE BUILDINGS

- A. The CONTRACTOR shall erect or provide temporary storage buildings of the various sizes as required for the protection of mechanical and electrical equipment and materials as recommended by manufacturers of such equipment and materials.
- B. The buildings shall be provided with such environmental control systems that meet recommendations of manufacturers of all equipment and materials stored in the buildings.
- C. The buildings shall be of sufficient size and so arranged or partitioned to provide security for their contents and provide ready access for inspection and inventory.
- D. At or near the completion of the work, and as directed by the ENGINEER, the temporary storage buildings shall be dismantled, removed from the site, and remain the property of the CONTRACTOR.
- E. Combustible materials (paints, solvents, fuels, etc.) shall be safely stored and separated in accordance with the manufacturer's requirements and in compliance with hazardous material storage requirements. CONTRACTOR shall be responsible for providing proper storage buildings for combustible materials.

1.4 STORAGE YARDS

- A. The CONTRACTOR shall provide temporary storage yards as required for the storage of materials that are not subject to damage by weather conditions.
- B. Materials such as pipe, reinforcing and structural steel, shall be stored on pallets or racks, off the ground, and stored in a manner to allow ready access for inspection and inventory.
- C. Temporary gravel surfacing of the storage yards shall meet with the approval of the ENGINEER.

1.5 PARKING AREAS

- A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, OWNER's operations, or construction operations.

1.6 VEHICULAR TRAFFIC

- A. Comply with Laws and Regulations regarding closing or restricting use of public streets or highways. No public or private road shall be closed, except by written permission of proper authority. Assure the least possible obstruction to traffic and normal commercial pursuits.
- B. Conduct the Work to interfere as little as possible with public travel, whether vehicular or pedestrian.

- C. Whenever it is necessary to cross, close, or obstruct roads, driveways, and walks, whether public or private, provide and maintain suitable and safe bridges, detours, or other temporary expedients for accommodation of public and private travel.

1.7 DELIVERY-STORAGE-HANDLING

A. General:

1. The CONTRACTOR shall deliver, handle, and store materials and equipment in accordance with supplier's written recommendations and by methods and means which will prevent damage, deterioration, and loss including theft.
2. Delivery schedules shall be controlled to minimize long-term storage at the site and overcrowding of construction spaces.
3. In particular, the CONTRACTOR shall provide delivery/ installation coordination to ensure minimum holding or storage for material or equipment recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other sources of loss.

B. Transportation and Handling:

1. Materials and equipment shall be transported by methods to avoid damage and shall be delivered in dry, undamaged condition in supplier's unopened containers or packaging.
2. The CONTRACTOR shall provide equipment and personnel to handle the materials, and equipment by methods that will prevent soiling and damage.
3. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging packaging, and surrounding surfaces.

C. Storage and Protection:

1. Materials and equipment shall be stored in accordance with supplier's written instructions, with seals and labels intact and legible. Exposed metal surfaces of valves, fittings and similar materials shall be coated with grease in accordance with manufacturer's recommendations to prevent corrosion. Sensitive materials and equipment shall be stored in weather-tight enclosures and temperature and humidity ranges shall be maintained within tolerances required by supplier's written instructions.
2. For exterior storage of fabricated materials, they shall be placed on sloped support above ground. Materials or equipment subject to deterioration shall be covered with impervious sheet covering; ventilation shall be provided to avoid condensation.
3. Loose granular materials shall be stored on solid surfaces in a well-drained area and shall be prevented from mixing with foreign matter.
4. Inspection:
 - a. Storage shall be arranged to provide access for inspection.
 - b. The CONTRACTOR shall periodically inspect to assure materials and equipment are undamaged and are maintained under required conditions.
5. Storage shall be arranged in a manner to provide access for maintenance of stored items.

1.8 PROJECT SECURITY

- A. The CONTRACTOR shall make adequate provision for the protection of the work area against fire, theft and vandalism, and for the protection of the public and OWNER personnel against exposure to injury, and for the security of any off-site storage areas.

01 51 03-3

Temporary Construction Facilities and Utilities

Washwater Equalizer Tank Replacement Project

- B. All costs for this protection shall be included within the CONTRACTOR's bid.

1.9 TEMPORARY UTILITIES

- A. The CONTRACTOR shall provide and pay for all necessary temporary telephones, fuel, power, potable water, sanitary, and proper toilet accommodations. CONTRACTOR shall not use OWNER-owned utilities.
- B. The temporary facilities to be provided by the CONTRACTOR as described above shall conform to all requirements in regard to operation, safety, and fire hazards of State and local authorities and of Underwriters.
- C. CONTRACTOR shall return the site and facilities to their original "as-found" condition, unless otherwise specified in the Contract Documents, at the completion of the project.

1.10 SOUND CONTROL

- A. The CONTRACTOR shall comply with all local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the contract.
- B. Each internal combustion engine, used for any purpose on the job or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer, so as to produce a maximum noise level of 85 dBA at 5 feet.
- C. No internal combustion engine shall be operated on the project without said muffler.
- D. Special Precautions for Inhabited Areas:
 - 1. In inhabited areas, particularly residential, operations shall be performed in a manner to minimize unnecessary noise generation.
 - 2. In residential areas, special measures shall be taken to suppress noise generated by repair and service activities during the night hours.

1.11 DUST/AIR POLLUTION CONTROL

- A. The CONTRACTOR shall take whatever steps, procedures, or means as are required to prevent dust conditions being caused by operations in connection with the execution of the Work; and on any road which the CONTRACTOR or any of their Subcontractors are using, excavation or fill areas, demolition operations, or other activities.
- B. Control shall be by sprinkling, use of dust palliatives, modification of operations, or any other means acceptable to agencies having jurisdiction.
- C. Damage to personal property, etc., resulting from the CONTRACTOR's construction operations shall be borne by the CONTRACTOR at no cost to the OWNER.
- D. The CONTRACTOR shall keep the streets and work area clean at all times by means of mechanical sweepers or hand sweeping. Water will be used for dust control only, and not for cleaning streets.
- E. Burning of waste, rubbish, or other debris will not be permitted on or adjacent to site.

01 51 03-4

Temporary Construction Facilities and Utilities

Washwater Equalizer Tank Replacement Project

1.12 WASTE DISPOSAL

- A. The CONTRACTOR shall dispose of surplus materials, waste products, and debris and shall make necessary arrangements for such disposal. The CONTRACTOR shall obtain written permission from property owner prior to disposing surplus materials, waste products, or debris on private property.
- B. All waste disposal shall be done in accordance with applicable laws and regulations.
- C. Landfill Disposal:
 - 1. If the CONTRACTOR proposes to dispose of construction debris, trench spoils, excavation spoils, etc., at a landfill, the CONTRACTOR shall be responsible to provide and pay for all permits and analyses required by the landfill.
 - 2. If the analyses determine that the material is hazardous, then an equitable adjustment of the Contract for the cost of hazardous waste disposal will be made in accordance with the General Conditions, and the following:
 - a. Time extension or contract costs will not be granted for delays that could have been avoided by the CONTRACTOR redirecting their forces and equipment to perform other work on the contract.
- D. Ditches, washes, or drainageways shall not be filled.
- E. Disposal operations shall not create unsightly or unsanitary nuisances.
- F. The CONTRACTOR shall maintain the disposal site in a condition of good appearance and safety during the construction period.
- G. Prior to final acceptance of the work, the CONTRACTOR shall have completed the leveling and cleanup of the disposal site.

1.13 CLEAN UP

- A. Throughout the period of construction, the CONTRACTOR shall keep the work site free and clean of all rubbish and debris, and shall promptly remove from the site, or from property adjacent to the site of the work, all unused and rejected materials, surplus earth, concrete, plaster, and debris.
- B. Upon completion of the work, and prior to final acceptance, the CONTRACTOR shall remove from the vicinity of the work all plant, surplus material, and equipment belonging to the CONTRACTOR or used under their direction during construction.

1.14 TEMPORARY ENCLOSURES

- A. When sandblasting, spray painting, spraying of insulation, or other activities inconveniencing or dangerous to property or the health of employees, the public or construction workers, are in progress, the area of activity shall be enclosed adequately to contain the dust, over spray, or other hazard.
- B. In the event there are no permanent enclosures of the area, or such enclosures are incomplete or inadequate, the CONTRACTOR shall provide suitable temporary enclosures as required by the ENGINEER to meet field conditions in accordance with the

01 51 03-5

Temporary Construction Facilities and Utilities

Washwater Equalizer Tank Replacement Project

recommendations of the owner-furnished equipment supplier (if applicable) and the CONTRACTOR's equipment supplier requirements.

- C. Said temporary or permanent enclosures shall be adequately ventilated to ensure the safety of the workers.

1.15 DRAINAGE

- A. The CONTRACTOR shall take all necessary actions as required to meet discharge requirements of the California Environmental Protection Agency (CalEPA) and other pertinent local ordinances and regulations pertaining to dewatering and/or site drainage discharged into storm drains and creeks. This may include, but may not be limited to, the use of retention basins and silt basins to settle most of the solids prior to discharge.
- B. In excavation, fill, and grading operations, care shall be taken to disturb the pre-existing drainage pattern as little as possible.
- C. Particular care shall be taken not to direct drainage water onto private property or into streets or drainageways inadequate for the increased flow.
- D. Drainage means shall be provided to protect the work.

1.16 TEMPORARY LIGHTING

- A. The CONTRACTOR shall provide temporary lighting in all work areas sufficient to maintain a lighting level during working hours not less than the lighting level required by OSHA standards.

1.17 CONSTRUCTION FACILITIES

- A. Construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities shall be of ample size and capacity to adequately support and move the loads to which they will be subjected. Railings, enclosures, safety devices, and controls required by law or for adequate protection of life and property shall be provided.
- B. Temporary supports shall be designed with an adequate safety factor to assure adequate load bearing capability. Whenever required by safety regulations, the CONTRACTOR shall submit design calculations for staging and shoring prior to application of loads.

1.18 REMOVAL OF TEMPORARY FACILITIES AND UTILITIES

- A. At such time or times as any temporary construction facilities and utilities are no longer required for the work, the CONTRACTOR shall notify the ENGINEER of their intent and schedule for removal of the temporary facilities and utilities, and obtain the ENGINEER's approval before removing the same.
- B. As approved, the CONTRACTOR shall remove the temporary facilities and utilities from the site as CONTRACTOR's property and leave the site in such condition as specified, as directed by the ENGINEER, and/or as shown on the Drawings.

- C. In unfinished areas, such as planted medians, the condition of the site shall be left in a condition that will restore original drainage, evenly graded, seeded or planted as necessary, and left with an appearance equal to, or better than original.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

01 51 03-7

Temporary Construction Facilities and Utilities

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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01 51 03-8

Temporary Construction Facilities and Utilities

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 61 03

GENERAL PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

- A. All products furnished and installed under this contract shall conform to the general stipulations set forth in this Section except as otherwise specified in other Sections.

1.2 COORDINATION

- A. The CONTRACTOR shall coordinate all details of the products and equipment with other related parts of the work, including verification that all structures, piping, wiring, and equipment components are compatible. The CONTRACTOR shall be responsible for all structural and other alterations in the work required to accommodate products or equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

1.3 DESIGN REQUIREMENTS

- A. Where CONTRACTOR design is specified, design and installation of systems, equipment, and components, including supports and anchorage, shall be in accordance with the Design Criteria shown on the Structural Notes Drawing.
- B. Proof of Compliance:
 - 1. Structural integrity and anchorage shall be certified by an approved calculation that demonstrates the adequacy of the anchorage system for seismic forces. This calculation may be based on principles of structural analysis and engineering mechanics, or based on similarity to approved shake-table tests.
 - 2. The CONTRACTOR shall submit for review and approval test data or calculations certified by a Civil or Structural Engineer registered in the State of California to show compliance with the above requirements.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at 2200 feet above sea level.
- B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of -10 degrees F to 120 degrees F.

1.5 WORKMANSHIP AND MATERIALS

- A. The CONTRACTOR shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.

01 61 03-1

General Product Requirements

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- B. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and gages so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.
- C. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4 inch thick.
- D. Except where otherwise specified, all metal which will be exposed to weather, submerged or otherwise exposed to moisture shall be either non-ferrous or stainless steel, as the application may require.

1.6 LUBRICATION

- A. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.
- B. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quantity to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation prior to acceptance of equipment by OWNER. Unless otherwise specified or permitted, the use of synthetic lubricants will not be acceptable.
- C. Lubrication facilities shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.

1.7 ELECTRIC MOTORS

- A. Unless otherwise specified, motors furnished with equipment shall meet the following requirements:
 - 1. Designed and applied in accordance with NEMA, ANSI, IEEE, AFBMA, and NEC for the duty service imposed by the driven equipment, such as frequent starting, intermittent overload, high inertia, mounting configuration, or service environment.
 - 2. Rated for continuous duty at 50 degrees C ambient, unless the application is well recognized for intermittent duty service as a standard industry practice.
 - 3. Insulated with Class F insulation and designed for a service factor of 1.15, or greater.
 - 4. Three phase motors used in conjunction with variable speed drives shall have Class F insulation with a Class B temperature rise at rated nameplate horsepower, and 1.15 service factor.
 - 5. When operating at service factor load, maximum observable temperature rise of insulation and motor parts, as determined by resistance or thermometer methods, shall not exceed the NEMA allowable limits for the type of motor, the type of enclosure, and the particular application with regard to continuous or intermittent duty.

6. To ensure long motor life, nameplate horsepower, regardless of service factor, shall be at least 115 percent of the maximum load imposed by the driven equipment.
7. Designed for full voltage starting.
8. Designed to operate from an electrical system that may have a maximum of 5 percent voltage distortion per IEEE Standard 519.
9. Derated, if required, for the altitude at which the equipment is installed.
10. Clamp-type grounding terminal shall be inside motor conduit box.
11. External conduit boxes shall be oversized at least one size larger than NEMA standard.
12. Totally enclosed motors shall have a continuous moisture drain which also excludes insects.
13. Bearings shall be either oil or grease lubricated.
14. Manufacturer's standard motor may be supplied on integrally constructed, packaged assemblies such as appliances, tools, unit heaters, and similar equipment specified by model number, in which case a redesign of the unit would be required to furnish motors of other than the manufacturer's standard design. However, in all cases, totally enclosed motors are preferred and shall be furnished if offered by the manufacturer as a standard option.
15. Totally enclosed motors shall be furnished on:
 - a. Equipment for installation below grade.
 - b. Equipment operating in wet or dust-laden locations.
16. Drip-proof motors, or totally enclosed motors at the supplier's option, shall be furnished on equipment in indoor, above-grade, clean, and dry locations.
17. Explosion-proof or submersible motors shall be furnished as required by applicable codes, as specified in other Sections, or at the supplier's option.
18. Motors shall be rated and constructed as follows:
 - a. Below 1/2 hp:
 - 1) 115 volts, 60 Hz, single phase.
 - 2) Built-in manual-reset thermal protector, or integrally mounted stainless steel enclosed manual motor starter.
 - b. 1/2 hp and above:
 - 1) 460 volts, 60 Hz, 3 phase.
 - 2) Where specified or required by the drawings, motors used on 240 volt systems shall be 230 volts, 60 Hz, 3 phase.

1.8 DRIVE UNITS

- A. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Drive units shall be designed for 24 hours continuous service.
- B. Unless otherwise specified, the use of gearmotors will not be acceptable.
- C. Gear reducers:
 1. Each gear reducer shall be a totally enclosed unit with oil or grease lubricated antifriction, rolling element bearings throughout.
 2. Helical, spiral bevel, combination bevel-helical, and worm gear reducers shall have a service factor of at least 1.50 based on the nameplate horsepower of the drive motor. Shaft-mounted and flange-mounted gear reducers shall be rated AGMA Class II. Helical gear reducers shall have a gear strength rating to catalog rating of 1.5. Each gear reducer shall bear an AGMA nameplate.

01 61 03-3

General Product Requirements

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

3. The thermal horsepower rating of each unit shall equal or exceed the nameplate horsepower of the drive motor. During continuous operation, the maximum sump oil temperature shall not rise more than 100°F above the ambient air temperature in the vicinity of the unit and shall not exceed 200°F.
 4. Bearings:
 - a. Each grease lubricated bearing shall be installed in a bearing housing designed to facilitate periodic regreasing of the bearing by means of a manually operated grease gun.
 - b. Each bearing housing shall be designed to evenly distribute new grease, to properly dispose of old grease, and to prevent overgreasing of the bearing.
 - c. The use of permanently sealed, grease lubricated bearings will not be acceptable.
 - d. An internal or external oil pump and appurtenances shall be provided if required to properly lubricate oil lubricated bearings.
 - e. A dipstick or sight glass arranged to permit visual inspection of lubricant level shall be provided on each unit.
 5. Gear reducers that require the removal of parts or periodic disassembly of the unit for cleaning and manual regreasing of bearings will not be acceptable.
 6. Certification shall be furnished by the gear reducer manufacturer indicating that the intended application of each unit has been reviewed in detail by the manufacturer and that the unit provided is fully compatible with the conditions of installation and service.
- D. V-belt drives:
1. Each V-belt drive shall include a sliding base or other suitable tension adjustment. V-belt drives shall have a service factor of at least 1.6 at maximum speed based on the nameplate horsepower of the drive motor.

1.9 SAFETY GUARDS

- A. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard.
- B. Safety guards shall be fabricated from 16 USS gauge or heavier galvanized or aluminum-clad sheet steel or 1/2 inch mesh galvanized expanded metal.
- C. Each guard shall be designed for easy installation and removal.
- D. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized.
- E. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

1.10 ANCHOR BOLTS

- A. Equipment suppliers shall furnish suitable anchor bolts for each item of equipment.
- B. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed.

- C. Anchor bolts shall comply with Section 05 05 06, Anchors, Inserts and Epoxy Dowels and, unless otherwise specified, shall have a minimum diameter of 1/2-inch.
- D. Unless otherwise indicated or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.

1.11 EQUIPMENT BASES

- A. Unless otherwise indicated or specified, all equipment shall be installed on concrete bases at least 6 inches high.
- B. Cast iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment.
- C. Each unit and its drive assembly shall be supported on a single baseplate of neat design.
- D. Baseplates shall have pads for anchoring all components and adequate grout holes.
- E. Baseplates for pumps shall have a means for collecting leakage and a threaded drain connection.
- F. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout as specified in Section 03 60 03, Grout.

1.12 SPECIAL TOOLS AND ACCESSORIES

- A. Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

1.13 SHOP PAINTING

- A. Surface Protection:
 - 1. All steel and iron surfaces shall be protected by suitable paint or coatings applied in the shop.
 - 2. Surfaces that will be inaccessible after assembly shall be protected for the life of the equipment.
 - 3. Exposed surfaces shall be finished smooth, thoroughly cleaned, and filled as necessary to provide a smooth uniform base for painting.
 - 4. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with a high-grade oil-resistant enamel suitable for coating in the field with an alkyd enamel.
 - 5. Coatings shall be suitable for the environment where the equipment is installed.
- B. Shop Primer:
 - 1. Surfaces to be painted after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of the specified primer.
 - 2. Unless otherwise specified, the shop primer for steel and iron surfaces shall be:

01 61 03-5

General Product Requirements

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- a. Cook "391-N-167 Barrier Coat",
 - b. Koppers "No. 10 Inhibitive Primer",
 - c. Tnemec "37H Chem-Prime HS",
 - d. Valspar "13-R-28 Chromox Primer",
 - e. Or equal.
- C. Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound, Houghton "Rust Veto 344", Rust-Oleum "R-9", or equal.

1.14 PREPARATION FOR SHIPMENT

- A. All equipment shall be suitably packaged to facilitate handling and protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.
- B. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of ENGINEER.
- C. Grease and lubricating oil shall be applied to all bearings and similar items.
- D. Each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

1.15 STORAGE

- A. Upon delivery, all equipment and material shall immediately be stored and protected until installed in the work.
- B. Pumps, motors, electrical equipment, and all equipment with antifriction or sleeve bearings shall be stored in weathertight structures maintained at a temperature above 60°F. Equipment, controls, and insulation shall be protected against moisture and water damage. All space heaters furnished in equipment shall be connected and operated continuously.
- C. Equipment and materials shall not show any pitting, rust, decay, or other deleterious effects of storage when installed in the work.

1.16 INSTALLATION AND OPERATION

- A. Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary for proper results. When so specified, or when employees of the CONTRACTOR or their subcontractors are not qualified, such personnel shall be field representatives of the manufacturer of the equipment or materials being installed.
- B. Qualified field representatives shall be provided by the equipment manufacturers as required by Section 01 75 06, Testing, Training and Startup.

01 61 03-6
General Product Requirements

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- C. All equipment installed under this Contract, including that furnished by OWNER shall be placed into successful operation according to the written instructions of the manufacturer or the instructions of the manufacturer's field representative. All required adjustments, tests, operation checks, and other startup activity shall be provided.
- D. Acceptance of work in connection with the installation of equipment furnished by others will be subject to approval of the field representative. The CONTRACTOR shall be responsible for planning, supervising, and executing the installation of work, and the approval or acceptance of ENGINEER or the field representative will not relieve the CONTRACTOR of responsibility for defective work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

01 61 03-7

General Product Requirements

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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01 61 03-8

General Product Requirements

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 66 00

TRANSPORTATION AND HANDLING OF GOODS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Description of Work
 - 1. The SUPPLIER shall make all arrangements for transportation and delivery of equipment and materials to the Point of Destination.
 - 2. Shipments of materials shall be delivered to the Point of Destination only during regular working hours. Shipments shall be addressed and delivered to CONTRACTOR, except where otherwise directed.

1.2 SUBMITTALS

- A. Shipping List
 - 1. Prior to the delivery of the Goods, the SUPPLIER shall develop and submit to CONTRACTOR a Bill of Materials for the contents of all shipments. This list shall detail contents, size, weights and tag numbers of each item shipped. Upon receipt of the Goods, the Bill of Materials shall be used to determine that the Goods have been received by CONTRACTOR in accordance with the General Conditions of the Agreement.

1.3 PRODUCT DELIVERY STORAGE AND HANDLING

- A. The SUPPLIER shall arrange deliveries of products in accordance with the Contract Time requirements stipulated in the Agreement.
- B. The SUPPLIER shall coordinate deliveries that occur between specified Contract Times to accommodate the following:
 - 1. Work of other contractors or OWNER
 - 2. Limitations of storage space
 - 3. Availability of equipment and personnel for handling products
- C. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment to simplify accumulation of parts and facilitate assembly.
- D. Each part within a shipment shall be clearly labeled with the reference numbers and tag numbers included in the Bill of Materials.
- E. Upon delivery, the SUPPLIER and CONTRACTOR, shall inspect shipment(s) to ensure:
 - 1. Product complies with requirements of approved submittals
 - 2. Containers and packages are intact
 - 3. Labels are legible
 - 4. Products are properly protected and undamaged

01 78 36-1

Transportation and Handling of Goods

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- F. CONTRACTOR will provide equipment and personnel necessary to handle products by methods designed to prevent soiling or damage.
- G. CONTRACTOR will provide storage facilities in accordance with the SUPPLIER storage requirements to be submitted prior to delivery and along with the delivered equipment under Section 01 66 10, Product Storage, Handling, and Delivery.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 66 10

PRODUCT STORAGE HANDLING AND DELIVERY

PART 1 - PART 1 - GENERAL

1.1 DESCRIPTION

- A. Description of Work
 - 1. SUPPLIER shall protect goods in accordance with manufacturer recommendations and the requirements of the Contract Documents.
 - 2. SUPPLIER shall make all arrangements and provisions necessary for the protection of goods during delivery to the Point of Destination.
 - 3. Manufacturer containers may be opened for inspection and verification of the goods in accordance with Article 8 of the General Conditions. Upon completion of inspection, the goods shall be repackaged and remain unopened until the time of installation, unless recommended by the manufacturer or otherwise specified.
 - 4. SUPPLIER shall provide OWNER and CONTRACTOR with a list of goods that are to be delivered prior to shipment.
- B. Coordination: SUPPLIER shall coordinate with OWNER and CONTRACTOR for goods that require special protection, storage or handling

1.2 SUBMITTALS

- A. Provide submittals required by this section, at least 30 days prior to delivery of the goods.
- B. SUPPLIER shall provide CONTRACTOR with a list of pumps, motors, drives, electrical equipment, instrumentation equipment (controls, devices, panels, etc.), and other equipment having anti-friction or sleeve bearings for storage in weather tight storage facilities, such as warehouses.
- C. SUPPLIER shall provide CONTRACTOR with a list of all panels, microprocessor-based equipment, and all other goods and devices subject to damage or useful life decrease due to:
 - 1. Temperatures below 40 degrees F or above 120 degrees F
 - 2. Relative humidity above ninety (90) percent
 - 3. Or exposure to rain
- D. Fully Protected Storage
 - 1. SUPPLIER shall provide CONTRACTOR with a list of goods which could be damaged by low or high temperature and require temperature-controlled storage space.
 - 2. SUPPLIER shall provide CONTRACTOR a list of goods that require protection from contamination by dust, dirt, and moisture.

01 66 10-1

Product Storage Handling and Delivery

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

3. The System SUPPLIER shall provide CONTRACTOR with a list of goods that require storage at specific humidity levels as recommended by manufacturer.

E. SUPPLIER Storage and Handling Instructions

1. SUPPLIER shall provide specific storage and handling instruction for each loose-shipped item of equipment, instrumentation, materials and crates provided by the System SUPPLIER.

1.3 PRODUCT STORAGE AND HANDLING

- A. Goods shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. Each container shall be clearly marked with SUPPLIER's name, project name, and location. Goods shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.
- B. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted equipment surfaces that are damaged prior to acceptance shall be repainted.
 1. All parts shall be protectively wrapped and/or packaged, using materials commensurate with the weight and configuration of the part, the method of handling, and the method of transportation.
 2. Contact or pressure points shall be sufficiently protected when using steel or elastic banding.
 3. Cabinets and equipment too heavy to be handled or transported by one man shall be adapted for handling with pallet trucks and/or forklifts.
 4. Painted surfaces which will come in contact with lifting forks or other handling equipment (such as the bottom of cabinets or skid base frame members) shall be sufficiently padded with heavy corrugated cardboard, foam or other protective materials.
 5. Small equipment and skids shall be mounted on wooden pallets designed for fork lifting. This equipment shall be bolted (using existing holes in the frame) or strapped to the pallet to prevent tipping. Equipment and skids too large to be mounted on pallets shall have wooden block bolted or strapped to the base foundation pads to prevent paint degradation during handling, assembly and installation.
- C. Electrical equipment, controls, and instrumentation shall be protected against moisture or water damage. Space heaters provided in the equipment will be connected by CONTRACTOR as noted by SUPPLIER and operated at all times until equipment is placed in operation.
- D. Notice of Enclosed Instructions: All delivered packages containing goods shall have notices clearly visible on the exterior of the package indicating that maintenance instructions are enclosed.
- E. Panel and Instrumentation Storage: All packages containing panels, electronic devices, and other microprocessor-based equipment shall contain a desiccant, volatile corrosion inhibitor (VCI) blocks, a moisture indicator, and maximum-minimum indicating

01 66 10-2

Product Storage Handling and Delivery

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

thermometer. SUPPLIER shall provide a spare set of such protection equipment including a desiccant, a moisture indicator, and VCI blocks for each package containing panels, electronic devices, and other microprocessor-based equipment for replacement by CONTRACTOR during the storage period.

PART 2 - PART 2 - PRODUCTS (NOT USED)

PART 3 - PART 3 - EXECUTION (NOT USED)

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01 66 10-4

Product Storage Handling and Delivery

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District

WWE Project No. 22-098

March 2024

Bid Documents

SECTION 01 71 13

MOBILIZATION

PART 1 - GENERAL

1.1 GENERAL

- A. Mobilization shall include the obtaining of all bonds, insurance, and licenses; moving onto the site of all plant and equipment; furnishing and erecting plants, temporary buildings, and other construction facilities; all as required for the proper performance and completion of the work.
- B. Mobilization shall include but not be limited to the following principal items:
 - 1. Moving on to the site of all CONTRACTOR's plant and equipment.
 - 2. Installing temporary construction power, wiring, and lighting facilities.
 - 3. Establishing fire protection system.
 - 4. Developing construction water supply.
 - 5. Furnishing the work access plan as specified in Section 01 51 03, Temporary Construction Facilities and Utilities.
 - 6. Providing all on-site CONTRACTOR communication facilities, including telephones, and radio pagers and any radio communications facilities required for the CONTRACTOR to coordinate their forces.
 - 7. Providing on-site sanitary facilities and potable water facilities as specified in Section 01 51 03, Temporary Construction Facilities and Utilities.
 - 8. Arranging for and erection of the CONTRACTOR's work and storage yard, including site security.
 - 9. Posting all EPA and OSHA required notices and establishment of safety programs.
 - 10. Post all required labor and EEOE notices.
 - 11. Have the CONTRACTOR's superintendent at the job site full time.
 - 12. Submittal and OWNER acceptance of the Construction Schedule.
 - 13. Establishing site security, lighting, fencing, and signing.
 - 14. Obtaining all bonds, insurance and licenses.
 - 15. Providing an organization chart of the project and for the CONTRACTOR's firm. The project chart shall include the name, title and responsibilities of each position which is involved in the work.
 - 16. Other mobilization items approved by the ENGINEER required to support the complete work (e.g., Health and Safety Plans for Hazardous Waste).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

01 71 13-1
Mobilization

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01 71 13-2
Mobilization

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 74 03

CLEANING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This Section covers the work necessary for cleaning during construction and final cleaning on completion of the Work.

1.2 GENERAL

- A. At all times maintain areas covered by the Contract and public properties free from accumulations of waste, debris, and rubbish caused by construction operations.
- B. Pollution Control:
 - 1. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
 - 2. Do not burn or bury rubbish and waste materials on project site.
 - 3. Volatile wastes shall be properly stored in covered metal containers and removed daily.
 - 4. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 5. Do not dispose of wastes into streams or waterways.
- C. Construction materials such as concrete forms and scaffolding shall be neatly stacked by the CONTRACTOR when not in use. The CONTRACTOR shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.
- D. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- E. Use cleaning materials only on surfaces recommended by cleaning material manufacturers.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLEANING DURING CONSTRUCTION

- A. During execution of Work, clean site and public properties and dispose of waste materials, debris, and rubbish to assure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.
- B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

01 74 03-1
Cleaning

- C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. Empty containers within one day after they are full.
- D. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from exposed and semi-exposed surfaces.
- E. Repair, patch, and touch up marred surfaces to specified finish to match adjacent surfaces.
- F. Vacuum clean all interior spaces, including inside cabinets. Broom clean paved surfaces, rake clean other surfaces of grounds.
- G. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
- H. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
- I. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy.

3.2 FINAL CLEANING

- A. Refer to the requirements of the General Conditions, Section 6.11 in addition to the requirements of this Section.
- B. See Section 01 77 03, Operational Completion and Project Closeout, for additional requirements.
- C. At the completion of Work on all Contracts and immediately prior to final inspection, cleaning of the entire Project will be accomplished according to the following provisions:
 - 1. The CONTRACTOR shall thoroughly clean, sweep, wash, and polish all work and equipment, including finishes. The cleaning shall leave the structures and site in a complete and finished condition to the satisfaction of the ENGINEER.
 - 2. Should the CONTRACTOR not remove rubbish or debris or not clean the building and site as specified above, the OWNER reserves the right to have the cleaning done at the expense of the CONTRACTOR.
 - 3. Employ professional cleaners for final cleaning.
 - 4. In preparation for substantial completion of occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.
 - 5. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.
 - 6. Repair, patch, and touch up marred surfaces to specified finish, to match adjacent surfaces.
 - 7. Broom clean paved surfaces; rake clean other surfaces of grounds.
 - 8. Replace air-handling filters if units were operated during construction.
 - 9. Clean ducts, blowers, and coils, if air-handling units were operated without filters during construction.

01 74 03-2
Cleaning

10. Clean luminaires in accordance with manufacturer's recommendations. Clean all light fixtures.
11. Remove from the OWNER's property all temporary structures and all materials, equipment, and appurtenances not required as a part of, or appurtenant to, the completed work. See Section 01 51 03 - Temporary Construction Facilities and Utilities.

++ END OF SECTION ++

01 74 03-3
Cleaning

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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01 74 03-4
Cleaning

SECTION 01 75 06

TESTING, TRAINING AND STARTUP

PART 1 - GENERAL

1.1 GENERAL

- A. Scope:
1. This Section covers general equipment and system testing and startup requirements, services of the manufacturer's representatives and special coordinating services required of the CONTRACTOR that shall apply during construction and training of the OWNER's personnel for facilities operation.
 2. Specific testing and tracking procedures and requirements found in the Technical Specifications shall also apply.
- B. The CONTRACTOR shall inform all Subcontractors and manufacturers of the requirements herein and include the required services in their costs for the work specified in these Contract Documents. Where a minimum amount of time is stated in the Technical Specifications for manufacturers' services, any additional time required to perform the specified services shall be provided at no additional cost to the OWNER.
- C. Scheduling:
1. Equipment testing and plant startup are requisite to satisfactory completion of the Contract and, therefore, shall be completed within the contract time.
 2. All equipment testing and plant startup activities shall be realistically allowed for and shown on the CONTRACTOR's Construction Schedule, in accordance with Section 01 32 13, Progress Schedule.
 3. All equipment testing and plant startup activities shall be scheduled in conformance with the restrictions specified in Section 01 14 03, Special Project Constraints.
- D. Equipment testing shall be satisfactorily completed prior to commencing plant startup associated with the particular equipment item or equipment package. The equipment shall not be considered ready for testing until the following conditions are satisfied:
1. Manufacturer's certification of equipment installation has been accepted by the ENGINEER.
 2. Electrical and/or instrumentation Subcontractor certification of motor control logic has been accepted by the ENGINEER.
 3. Related Technical Submittals, O&M Manual and Final Shop Drawings have been accepted by the ENGINEER.
 4. Operator training services have been furnished by the CONTRACTOR (operational testing only).
 5. Testing procedures have been submitted in writing and accepted by the ENGINEER in accordance with Section 01 33 03, Submittal Procedures. All testing procedures and results shall be submitted in writing.
- E. The requirements of plant startup specified herein shall also apply to the startup of individual treatment plant processes and facilities.
- F. Startup Plan:

01 75 06-1

Testing, Training and Startup

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Not less than 3 months prior to initial equipment or system startup, the CONTRACTOR shall submit to the ENGINEER for review, a detailed Facilities Startup Plan for the associated items of equipment and/or systems.
2. The Startup Plan shall include:
 - a. A detailed sub-network of the CONTRACTOR's Construction Progress Schedule including the following activities:
 - 1) Manufacturer's Services;
 - 2) Installation Certifications;
 - 3) Operator Training;
 - 4) O&M Manual;
 - 5) Functional Testing;
 - 6) Performance Testing;
 - 7) Operational Testing;
 - 8) All other activities necessary to affect a coordinated and successful Testing, Training and Startup.
 - b. Written testing plan with proposed data logs for each item of equipment to be tested.
 - c. A discussion of any coordination required with the OWNER's staff and/or any system or equipment outage requirements.
 - d. The Plan shall be updated and/or revised as necessary prior to subsequent Construction Progress Meetings.
 - e. Testing shall not be scheduled earlier than 30 days after approval of the Plan.
3. Provide one Startup Plan per construction Phase

1.2 SERVICES DURING CONSTRUCTION

A. General:

1. Manufacturer's Representative:

- a. The CONTRACTOR shall provide the services of competent and experienced technical representatives of the manufacturers of all equipment and systems furnished under the contract, for as many days as may be necessary for assembly, installation, testing assistance and operator training.
- b. Manufacturer's field representatives shall observe, instruct, guide, and direct CONTRACTOR's erection or installation procedures, or perform an installation check, as required.
- c. In each case, the CONTRACTOR shall arrange to have the manufacturer's representative revisit the job site as often as necessary until operator training is complete and testing and startup problems have been resolved to the satisfaction of the ENGINEER.
- d. This requirement applies to manufacturers of all equipment furnished (excluding manually operated valves smaller than 24 inches in size, and any other items of equipment specifically exempted by the ENGINEER in writing), whether or not specifically set forth in the Technical Specifications.
- e. The CONTRACTOR shall maintain a service record on each item of equipment and shall deliver these service records to the ENGINEER prior to acceptance of operational testing.

B. Fulfillment of Specified Minimum Services:

1. The CONTRACTOR shall obtain prior written approval from the ENGINEER for providing manufacturers' services.

01 75 06-2

Testing, Training and Startup

Washwater Equalizer Tank Replacement Project

2. All requests to the ENGINEER for prior approval shall (1) be in writing, (2) be submitted not less than 10 calendar days prior to the providing of the subject services, (3) state the service to be provided, and (4) state the reason(s) why the timing of the service is appropriate.
 3. Request made to the ENGINEER less than 10 calendar days prior to the manufacturers' services may not receive consideration and response prior to the times the services are provided.
 4. Visits of manufacturers and their representatives to the jobsite or training classroom without prior approval as provided herein may not act to fulfill the specified minimum man-day requirements.
- C. Certificate of Proper Installation:
1. Equipment requiring factory tests shall not be delivered to the jobsite until the CONTRACTOR submits acceptable certified test results to the ENGINEER.
 2. Equipment shall not be considered ready for functional testing until after the following certifications have been submitted and accepted by the ENGINEER.
 - a. Manufacturer Representatives:
 - 1) The CONTRACTOR shall require that each manufacturer's representative furnish to the ENGINEER a written and signed report addressed to the OWNER certifying that the equipment has been properly installed, adjusted, lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, has been operated satisfactorily under full-load conditions and is ready for full-time operation.
 - 2) For pumps, compressors, blowers, engines, motors, and other rotating or reciprocating equipment, the report shall certify that the equipment operates within the manufacturer's allowable limits for vibration.
 - 3) The report shall also certify that all controls, protective devices, instrumentation, and control panels furnished as part of the manufacturer's equipment package are properly installed and calibrated; and that the control logic for equipment startup, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating.
 - 4) The CONTRACTOR shall also sign said certification.
 - 5) The CONTRACTOR shall submit "Manufacturer's Certification of Proper Installation" on the OWNER form.
 - b. Electrical and Instrumentation Subcontractor:
 - 1) The CONTRACTOR shall require that the electrical and/or instrumentation Subcontractor shall furnish a written and signed report to the ENGINEER certifying that the motor control logic for the equipment item that resides in motor control centers, control panels, control boards, microprocessors, distributed processing units, computers, and the like furnished by the electrical and/or instrumentation Subcontractor has been properly tested and calibrated.
 - 2) The report shall certify that the control logic for equipment startup, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating.
 - 3) The CONTRACTOR shall also sign said certification.

1.3 STARTUP AND TESTING

A. General:

01 75 06-3
Testing, Training and Startup

Washwater Equalizer Tank Replacement Project

1. The CONTRACTOR shall provide the effective coordination of all parties necessary for the successful project startup.
 2. The ENGINEER shall not be responsible to instruct the CONTRACTOR in the startup of the project, however, the ENGINEER will be available prior to and during startup to provide operational and technical support to the CONTRACTOR.
 3. The CONTRACTOR shall furnish all labor, consumables (power, water, chemicals, air, etc.) tools, equipment, instruments, and services required and incidental to completing all functional, performance and operational testing of installed equipment.
 4. The CONTRACTOR shall submit the proposed test procedures to the ENGINEER for review at least 30 days prior to testing.
 5. The CONTRACTOR shall give the ENGINEER written notice confirming the date of testing at least five working days before the time the equipment is scheduled to be tested.
 6. All testing shall be witnessed by the ENGINEER to be considered valid.
 7. Test Reports:
 - a. CONTRACTOR shall submit written detailed results of all functional, performance and operational testing.
 - b. Upon successful completion of Operational testing all equipment installation, testing and maintenance records shall be submitted to the ENGINEER.
 - c. Said records shall be bound separately for each piece of equipment or system and shall be collected by type of record.
 8. For factory tests, written test results shall be submitted to the ENGINEER at least 10 days prior to shipment.
- B. Functional testing:
1. All items of mechanical and electrical equipment shall be functionally tested by the CONTRACTOR after installation for proper operation.
 2. A minimum of ten (10) days prior to the start of functional testing, the CONTRACTOR shall submit interconnection diagrams for the equipment and for the alarms, controls and instruments associated with the equipment. This requirement shall not relieve the CONTRACTOR of meeting any requirements in the technical specifications for earlier submittal of the interconnection diagrams.
 3. Minimum Test Requirements
 - a. The functional test of each piece of mechanical equipment shall continue for not less than eight (8) continuous hours without interruption.
 - b. The functional test shall include checking for proper rotation, alignment, speed, flows, pressure, vibration, sound level, etc. Initial equipment and system adjustment and calibrations shall be performed in the presence of and with the assistance of the manufacturer's representative.
 - c. The functional test shall include a demonstration of the proper performance of all alarms, local and remote controls, instrumentation, equipment functions, and all other electrical, mechanical and piping systems.
 - d. All parts shall operate satisfactorily in all respects, under continuous full load, and in accordance with the specified requirements, for the full duration of the eight-hour test period.
 - e. If any part of a unit shows evidence of unsatisfactory or improper operation during the eight-hour test period, correction or repairs shall be made and the full eight-hour test operation, as specified herein, shall be repeated after all parts operate satisfactorily.

C. Performance testing:

1. Where performance testing is required by the Technical Specifications, the testing shall be supervised by the manufacturer's representative. These services shall continue until such times as the applicable equipment or system has been successfully tested for performance and has been accepted by the ENGINEER for operational testing.
2. Performance testing shall take place after functional testing is successfully completed in accordance with Paragraph 1.3 B.
3. Performance testing shall demonstrate that the equipment meets all performance requirements specified.

D. Startup/operational testing:

1. Upon successful completion of operator training and the functional, performance and leakage testing, the CONTRACTOR shall startup the plant facilities and test the equipment operation and performance by conducting a seven (7) day, continuous operational test of the completed facilities as an operational process unit to demonstrate to the ENGINEER's satisfaction that all equipment and systems required by these specifications will operate in the manner in which they are intended to perform.
2. The OWNER will provide CONTRACTOR-trained operating personnel for the duration of the operational test. Said operation shall be conducted and under the supervision and direction of the CONTRACTOR and/or manufacturer's representative.
3. Operational Defects:
 - a. All defects in materials or workmanship which appear during the operational test shall be immediately corrected by the CONTRACTOR.
 - b. In the event of a malfunction or deficiency that results in shutdown or partial operation of a system or process unit or results in performance that is less than that specified, the startup duration shall be repeated for that corresponding system or process unit and any other affected equipment so its proper operation and performance as required by the Contract Documents is demonstrated for a minimum of seven (7) continuous and trouble free days.
4. If the operational test is interrupted through no fault of the CONTRACTOR the test may resume at the earliest mutually agreeable time.
5. No unit process or part thereof shall be placed in service until it has successfully completed operational testing.
6. During plant startup, the CONTRACTOR shall provide the appropriate construction trades and the services of authorized Manufacturer's representatives for operational testing and as necessary, to correct faulty equipment operation.
7. After completion of all startup/operational testing, the CONTRACTOR shall repaint, hose, scrub, clean up and otherwise return the work to a "like new" condition, prior to OWNER acceptance.

1.4 TRAINING OF OWNER PERSONNEL

A. General:

1. Operation and maintenance training of OWNER's personnel shall be provided for mechanical, electrical, instrumentation and control equipment as listed in this Section or elsewhere in the Specifications.
2. For the purposes of this requirement, operations training is considered to be separate from maintenance training. Instructions are to be tailored to the needs of each group.

01 75 06-5

Testing, Training and Startup

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

3. These training services shall be conducted by the manufacturer's representative and shall ensure measurable and observable means that OWNER personnel are qualified to perform equipment task requirements, including essential knowledge, skills and abilities.
 4. Training shall be conducted by competent representatives who are certified by the manufacturer to be thoroughly familiar with the subject matter as well as instructional methods.
 5. Training materials shall be submitted to the OWNER (see Paragraph 1.4 C below) for review. Acceptance of training materials is required prior to start of training.
 6. All training shall be completed prior to beginning operational testing.
 7. The OWNER shall have the right to videotape any or all training sessions, or may designate separate sessions or portions thereof for the sole purpose of videotaping.
- B. Training coordinator:
1. The CONTRACTOR shall designate and provide one or more persons to be responsible for coordinating and expediting training duties.
 2. The person or persons so designated shall be present at all training coordination meetings with the OWNER.
- C. Training schedule:
1. The CONTRACTOR's coordinator shall coordinate the training periods with OWNER's personnel and manufacturer's representatives, and shall submit a training schedule and the training materials for each piece of equipment or system for which training is to be provided.
 2. The training schedule shall be submitted not less than 21 calendar days prior to the time that the associated training is to be provided and shall be based on the then current Plan of Operation.
 3. Equipment and/or systems shall be deemed suitable for use in training upon satisfactory completion of functional testing.
 4. All training with regards to a unit process or part thereof shall be completed prior to the start of operational testing.
 5. As a minimum, training shall be provided on the following equipment and systems:
 - a. Instrumentation
 6. The CONTRACTOR shall provide distinct and separate training sessions for both operations and maintenance personnel, meeting the following criteria:
 - a. Maintenance Training:
 - 1) Maintenance training shall be provided for all items in 1.4.C.5 above.
 - 2) The CONTRACTOR shall provide two (2) separate training sessions on a day agreed to by the ENGINEER.
 - 3) Training shall emphasize theory of operations, troubleshooting, and preventative maintenance and repair procedures.
 - 4) The discussion shall encompass issues relating to instrumentation, electrical, and mechanical systems.
 - b. Operations training:
 - 1) Operations training shall be provided for each piece of equipment listed in Paragraph 1.4.C.5 above.
 - 2) The CONTRACTOR shall provide two (2) separate training sessions for each three (3) operating shifts.
 - 3) Sessions are to be provided for each shift within the following time periods.
 - a) Day Shift 7:00 a.m. - 3:00 p.m.

01 75 06-6

Testing, Training and Startup

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- c. Training session schedules shall be approved by the ENGINEER.
- d. Training shall emphasize theory of operations, startup instructions, emergency and normal shutdown instructions, lockout procedures, troubleshooting, preventative maintenance, and alarm and control logic.
- 7. The CONTRACTOR shall confirm each training period a minimum of three working days prior to the schedule time.
- 8. If a manufacturer's representative fails to conduct a scheduled training class, the CONTRACTOR hereby agrees to compensate the OWNER for labor costs, including overhead, for all OWNER personnel in attendance for the entire scheduled training period.
- 9. If the CONTRACTOR or the manufacturer's representative fails to provide training that qualifies the OWNER personnel to perform equipment task requirements, the CONTRACTOR hereby agrees to provide remedial training to ensure OWNER personnel proficiency at no additional cost to the OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 RECORD KEEPING

- A. The CONTRACTOR shall maintain as a minimum, the following records:
 - 1. Equipment manufacturer's shop drawings.
 - 2. Daily logs indicating all equipment testing and startup activities.
 - 3. Log and time sheets of all manufacturer's representatives performing services on the jobsite.
 - 4. Updated equipment testing and startup schedules.
 - 5. Records of system cleaning.
 - 6. Hydrostatic and pressure test records.
 - 7. Equipment alignment and vibration measurements and corrective actions.
 - 8. Equipment lubrication records.
 - 9. Insulation resistance measurements.
 - 10. Electrical phase, voltage and amperage measurements.
 - 11. Electrical breaker inspection, test, and adjustment records.
 - 12. Logs of abnormal circuits and lifted wires.
 - 13. Testing and validation of all central and alarm functions.
 - 14. Data sheets of all testing and calibration of instrumentation devices and control loops including documentation of set points.
 - 15. Equipment and system release logs (from construction to startup).
 - 16. Daily work reports.

3.2 GENERAL PROCEDURES

- A. The general work procedures listed below outline the work to be performed by the CONTRACTOR. Additional procedures applicable to specific equipment items are specified elsewhere.
- B. Technical assistance and support:

01 75 06-7
Testing, Training and Startup

Washwater Equalizer Tank Replacement Project

1. Obtain the assistance of the appropriate construction trades and the manufacturer or vendor, as required for technical assistance during equipment installation, testing, and startup by the CONTRACTOR and for training of the OWNER's Operation and Maintenance personnel.
 2. Furnish names and telephone numbers of manufacturer's and vendor's current technical service representatives for use by the ENGINEER.
- C. Instructions:
1. Maintain an adequate manufacturer's instruction file so that the information will be readily available during equipment testing and startup.
 2. Prior to equipment testing, finalize, and transmit to the ENGINEER the applicable technical manuals as required under Section 01 33 03, Submittal Procedures of the Contract Specifications.
- D. Removal of rust preventives:
1. Prior to equipment testing, remove all rust preventives and oils used to protect the equipment during the construction period whenever these protective materials will be detrimental to operation or equipment maintenance.
- E. Removal of temporary bracing:
1. Prior to equipment testing, remove all temporary supports, bracing, or other foreign objects that were installed in vessels, transformers, rotating machinery, or other equipment to prevent damage during shipping, storage, and erection, and repair any damage sustained.
- F. Tie-ins at the contract limits:
1. Provide proper notification, preparation, and coordination for safe tie-ins and minimal interference with the plant operation.
 2. Obtain approval and make the necessary tie-ins at the unit limits as required by the Contract Documents and as approved by the ENGINEER.
 3. Prior to startup, remove the temporary blind flanges, plugs, bulkheads, seals, etc.
- G. Leak and pressure tests:
1. Provide the ENGINEER with 3-day advance notification in writing of the schedule for non-operating field leak tests or field pressure tests on piping and field fabricated equipment, unless otherwise directed by the ENGINEER.
 2. Provide the water, air and any special media required for the test purposes.
 3. Prior to startup, conduct all leak and pressure tests in accordance with applicable codes, regulations, and the Contract Documents, and as approved by the ENGINEER. The CONTRACTOR is advised that the tests shall be witnessed by the ENGINEER, to be considered valid.
 4. Maintain a record of the leak and pressure test data and work completed.
 5. Dispose of the test media in a manner that is acceptable to and approved by the OWNER and applicable regulatory agencies.
 6. Isolate in-line equipment as necessary for protection against test pressure.
- H. Flushing and chemical/mechanical cleaning:
1. Prior to equipment operation, conduct all flushing, blowing, and chemical/mechanical cleaning operations without using the permanently installed equipment.
 2. Provide any special media needed for flushing and/or cleaning purposes.

01 75 06-8

Testing, Training and Startup

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

3. Dispose of all media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
 4. All systems shall be free of trash and construction debris before initiating startup.
 5. Maintain a record of the work completed.
- I. Screens, strainers, and blind flanges:
1. Provide and install temporary strainers, screens, and blind flanges as necessary to protect the equipment and to test the equipment and pipelines.
 2. Prior to startup, remove all of the temporary blinds and temporary appurtenances.
 3. Clean the screens and strainers as required during startup.
 4. At the end of startup, clean all of the permanently installed screens and strainers.
- J. Drying out:
1. Prior to startup, dry out the facilities as specified or recommended by the equipment manufacturer to prevent contamination of catalysts, operating materials, and/or product.
 2. Dry out systems, protective coatings, refractories, and linings as specified or recommended by the equipment manufacturers.

3.3 SPECIFIC PROCEDURES

- A. In addition to the work responsibilities described in Subsection 3.2, the procedures outlined below further define the work responsibilities of the CONTRACTOR for specific systems and items of equipment.
- B. Tanks:
1. Test all tanks and internals, as required to demonstrate conformance to the Contract Documents. Dispose of test media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
 2. Prior to startup, conduct chemical cleaning or flushing operations as specified. Dispose of wastes and cleaning media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
 3. Prior to startup, install all chemical identification, warning, and safety signs and labels.
- C. Electrical power and lighting systems:
1. Provide the ENGINEER with 3-day advance notification in writing of the test schedule. The CONTRACTOR is advised that the tests shall be witnessed by the ENGINEER.
 2. Perform insulation resistance tests on all wiring 120 volt and larger. Do not meggar instruments or solid-state devices.
 3. Perform insulation resistance tests on all motor and transformer windings from phase to phase and phase to ground.
 4. Perform grounding system tests to determine the continuity of connections and the value of resistance to ground.
 5. Fill electrical gear with oil and/or other media as recommended by the equipment manufacturer.
 6. Prior to substantial completion and startup, test and set switchgear and circuit breaker relays for proper coordination and operation.
 7. The CONTRACTOR shall obtain the services of a qualified "independent testing service", member of the National Electric Testing Association, to perform a thermographic survey on all switchgear buses, insulators and power connections

01 75 06-9

Testing, Training and Startup

Washwater Equalizer Tank Replacement Project

- when energized and under at least 20 percent load. Significant hot spots shall be further checked by infrared pyrometer for exact temperature rise. The CONTRACTOR shall troubleshoot and correct the thermographic hot spots. Correction shall be verified by repeating the thermographic survey at no additional cost to the OWNER.
8. The CONTRACTOR shall obtain the services of a qualified "independent testing service", member of the National Electric Testing Association, to inspect and test the protective relays and the 800-ampere and larger drawout breakers for proper installation, adjustment, and operation in accordance with the manufacturer recommendations.
 9. The CONTRACTOR shall obtain the services of a qualified "independent testing service", member of the National Electrical Testing Association, to perform DC high potential tests on all cables that will operate at more than 2,000 volts to ground.
 10. Obtain local electrical inspector's approval where required.
 11. Energize all substations, with approval of the Utility Company and the ENGINEER after completion of all electrical testing.
 12. Prior to startup, perform tests and adjustments on all switchgear and motor control equipment to demonstrate proper operation and conformance to the Contract Documents and manufacturer's recommended settings.
 13. Prior to startup, test installation of emergency power and lighting systems for proper operation, including light intensity.
 14. Prior to startup, provide the ENGINEER with a record of all test data and the work completed.
 15. Vacuum clean all electrical equipment prior to startup and acceptance.
- D. Piping systems:
1. Provide the ENGINEER with 3-day advance notification in writing of test schedule.
 2. Hydrostatically or pneumatically test all piping as required by the codes and contract documents.
 3. After successful testing of the piping, slowly drain the system and then flush the system. Orifice plates shall be installed after testing. If installed with the piping, they will be removed and replaced with spacers or pipe spools of equal length prior to the pressure test.
 4. Dewater the system, remove blind flanges, and perform tightness tests, as required by the ENGINEER.
 5. Insulate or paint piping, flanges, threaded joints, or field welds after the specified testing of each item has been completed unless instructed otherwise by the ENGINEER.
 6. Leave exposed all welded joints (longitudinal, girth, and nozzle) in underground piping that have not been shop tested until the specified testing has been completed. After final testing of these joints, cover the system.
 7. Prior to substantial completion and startup, check pipe hangers, supports, guides, and pipe specialties for the removal of all shipping and erection stops and for the correctness of the cold and hot settings for the design service, make adjustments as necessary to obtain proper installation. Provide the ENGINEER with instructions for the hot settings.
 8. As necessary during equipment testing and at the end of substantial completion and startup, clean or replace the screens and filter elements as appropriate for the filter type and service.
 9. Prior to startup, verify, to the extent required by the ENGINEER, that specified valve packing has been provided on valves installed in the plant.

10. Prior to startup, install all of the valve and piping system identification labels.
11. Prior to startup, check and record the position of all process system valves.
12. Prior to startup, correct support, vibration, and thermal expansion problems detected during the preliminary equipment testing.
13. Prior to the startup, retorque all hot and cold service bolting as required to ensure a permanent and proper installation.
14. Prior to startup, demonstrate to the ENGINEER's satisfaction that each piping system (e.g., chemical, sample, utility, irrigation process, etc.) functions as designed and required by the Contract Documents.

++ END OF SECTION ++

01 75 06-11
Testing, Training and Startup

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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01 75 06-12
Testing, Training and Startup

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 77 03

OPERATIONAL COMPLETION AND PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 GENERAL

- A. The Work will be considered operationally complete when all technical and administrative submittals, testing, training and startup are completed satisfactorily in accordance with the Contract Documents.
- B. Operational completion shall apply to the project in its entirety.

1.2 CERTIFICATION OF OPERATIONAL COMPLETION

- A. Prior to requesting the ENGINEER's inspection for certification of each phase as operationally complete, the CONTRACTOR shall certify in writing that each phase of the Work is operationally complete and shall submit a list of known items still to be completed or corrected (punchlist) prior to Contract Completion.
- B. The following items shall be completed:
 - 1. OWNER has been advised of any pending insurance changeover requirements.
 - 2. Specific warranties, maintenance agreements, final certifications and similar documents have been submitted.
 - 3. All tools, spare parts, extra stocks of materials, and similar physical items have been delivered to OWNER.
 - 4. Instruction of OWNER's operation/maintenance personnel, and start up testing has been completed.
 - 5. Submittal and acceptance of all O&M manuals.
 - 6. Changeover of locks to OWNER's cores/keys.
- C. Punchlist:
 - 1. When the CONTRACTOR considers that the Work, or a portion or phase thereof which the OWNER agrees to accept separately, is operationally complete, the CONTRACTOR shall certify in writing that the work is operationally complete and shall prepare and submit to the ENGINEER a comprehensive list of items to be completed or corrected prior to Contract Completion (punchlist).
 - 2. The ENGINEER may add additional work items to the punchlist.
 - 3. Failure to include an item on the punchlist does not alter the responsibility of the CONTRACTOR to complete all Work in accordance with the Contract Documents.
 - 4. Upon receipt of the CONTRACTOR's punchlist, the ENGINEER will make an inspection to determine whether the Work or designated portion thereof is operationally complete.
 - 5. If the ENGINEER's inspection discloses any item, whether or not included on the CONTRACTOR's list, that is not in accordance with the requirements of the Contract Documents, the CONTRACTOR shall, upon notification by the ENGINEER and before an issuance of the Certificate of Operational Completion is provided, complete or correct such item.

01 77 03-1

Operational Completion and Project Closeout

Washwater Equalizer Tank Replacement Project

6. The CONTRACTOR shall then submit a request for another inspection by the ENGINEER.
7. When the Work or designated portion thereof is accepted by the ENGINEER to be operationally complete, the ENGINEER will prepare a Certificate of Operational Completion.
8. The date of Operational Completion shall be the date of the ENGINEER's inspection and acceptance.

1.3 DESCRIPTION OF PROJECT CLOSEOUT

- A. Closeout is hereby defined to include general requirements near the end of the Contract Time, in preparation for Final Acceptance, Final Payment, normal termination of Contract, occupancy by OWNER and similar actions evidencing completion of the Work.
- B. Specific requirements for individual units of Work are specified in Sections of Divisions 2 through 48.

1.4 FINAL CLEANUP

- A. At completion, leave project clean and ready for use.
 1. Legally dispose of waste materials, debris and rubbish off the site.
 2. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from exposed and enclosed surfaces.
 3. Repair, patch and touch up all affected curbs, gutters, and sidewalks to match adjacent surfaces.
 4. Broom clean paved surfaces, rake clean other surfaces of grounds. Vacuum clean all interior surfaces, rake clean other surfaces of grounds.

1.5 RECORD DRAWINGS

- A. The CONTRACTOR shall prepare and submit Contract Record Drawings for the OWNER.
 1. The CONTRACTOR shall make a record of changes during construction on prints of the Drawings provided by the OWNER for this purpose (Contract Record Drawings) as described in Section 01 33 03, Submittal Procedures.
 2. The reproducible drawings on which changed conditions are recorded shall be returned to the ENGINEER prior to project completion.

1.6 GUARANTEES

- A. The General Conditions cover the CONTRACTOR's responsibility to remedy defects due to faulty workmanship and materials which appear within one year from the date of Final Acceptance.
- B. Special guarantees are required by various Sections of the Specifications. Assemble written guarantees, label and submit to the ENGINEER.
 1. Provide the "Warranty Form" included in the General Conditions.
 2. Equipment guarantees shall be written in the manufacturer's standard form and shall be countersigned by the Subcontractor or supplier and the CONTRACTOR.
 3. All other guarantees shall be written on the Subcontractor's or supplier's letterhead and shall be countersigned by the CONTRACTOR.

1.7 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Spare parts and maintenance materials are required by various Sections of the Specifications.
 - 1. Parts and materials shall be packaged so as to preclude damage in normal handling and storage.
 - 2. Packages shall be labeled with full description of contents and project name and clearly identified as to which item of equipment they belong to. CONTRACTOR shall maintain a spare parts inventory list which shall be provided to the OWNER prior to Final Acceptance.
 - 3. Submit packaged parts and materials to ENGINEER.
 - 4. Submit the value of all spare parts.

1.8 FINAL INSPECTION

- A. Prior to requesting ENGINEER's final inspection for certification of Final Acceptance and Final Payment, complete the following and list known exceptions (if any):
 - 1. Submit Final Payment request with final releases and supporting documentation not previously submitted and accepted.
 - 2. Submit copy of final punchlist of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, endorsed and dated by ENGINEER.
 - 3. Submit Consent of Surety.
 - 4. Revise and submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Certify in writing that the work has been completed in accordance with the Contract Documents, and request ENGINEER's final inspection.
- C. Reinspection:
 - 1. Within seven (7) days after receipt of the CONTRACTOR's notice that the work has been completed, including punchlist items resulting from earlier inspections, and excepting incomplete items delayed because of acceptable circumstance, the ENGINEER will reinspect the work.
 - 2. Upon completion of reinspection, ENGINEER will either prepare a certificate of Final Acceptance or advise the CONTRACTOR of work not complete or obligations not fulfilled as required for Final Acceptance.
 - 3. If necessary, inspection procedure will be repeated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

01 77 03-3

Operational Completion and Project Closeout

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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01 77 03-4

Operational Completion and Project Closeout

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 01 78 36

PRODUCT WARRANTY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Description of Work

1. SUPPLIER shall provide warranty coverage as defined herein. If SUPPLIER is not the equipment manufacturer, then both SUPPLIER and equipment manufacturer shall provide warranty. In each case, warranties and support shall be provided directly by the equipment manufacture and not the local manufacturer's representative. All warranties shall cover both parts and labor unless specifically noted otherwise herein, and each shall commence upon OWNER approval of successful completion of Start-up Testing per Section 01 75 06, Testing, Training and Startup.
2. SUPPLIER agrees to hold OWNER harmless from liability of any kind arising from direct damage due to defects in workmanship and materials during the specified warranty periods. SUPPLIER shall make all repairs and replacements promptly upon receipt of written orders for the same from OWNER. If within 10 days after OWNER has notified SUPPLIER of a failure/defect, SUPPLIER has not started to make the necessary corrections, OWNER is hereby authorized to make the corrections or to order the work to be done by a third party, and the costs of the corrections shall be paid by SUPPLIER. Repetitive malfunction of equipment or material and equipment shall be cause for replacement and an extension of the applicable warranty period(s) for replaced material and equipment to match the term and conditions of the original warranty provided. Include in the Technical Proposal any tests and procedures required to continue the warranty following violation of a warranty or contract operating condition.
3. OWNER reserves the right to renegotiate warranty terms and conditions at any time.

B. General Equipment Warranty

1. SUPPLIER shall provide warranty of the equipment and systems, covering all mechanical elements within the equipment or system scope of supply, if not specified in equipment and systems specifications, for a minimum of one (1) year from successful completion of start-up testing or standard SUPPLIER warranty period whichever is longer. SUPPLIER shall make all repairs or replacements necessitated by equipment or material failure within the warranty period at no cost to OWNER.

C. Warranty Exclusions

1. Occurrence of any of the following shall void the warranties described in this section:
 - a. Physical abuse or misuse of equipment or materials.

01 78 36-1
Product Warranty

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- b. Unauthorized alteration of any parts originally supplied by SUPPLIER relating to the equipment or system.
- c. Failure strictly and exclusively to adhere to SUPPLIER specified preventative maintenance procedures, including the use of anything other than SUPPLIER approved lubricants or materials.
- d. Failure to adhere to SUPPLIER-approved maintenance program.
- e. Failure to maintain and provide operating records. OWNER is responsible for maintaining plant operating records from the initial start-up date until a warranty claim is made, and these records shall be available for review upon request.

D. Equipment Failure Claim Criteria

1. Provided that the equipment or system has been operated and maintained within ranges of the design criteria listed herein and SUPPLIER's recommendations (including the conditions above and the requirements listed by SUPPLIER in the Proposal Form for Procurement Contract), equipment failure is defined as failure to provide the required flow or quality characteristic for which the equipment or system was purchased.
 - a. Notification and Verification of Warranty Claims
 - 1) OWNER must provide a written notice of defect to SUPPLIER within thirty (30) days of identifying a defect.
 - 2) OWNER shall provide the following information:
 - a) A description and other documentation of the defect.
 - b) Identifying information.
 - c) Operating and repair history of the equipment.
 - 3) SUPPLIER has five (5) days to provide written response and action plan to OWNER to investigate the claim. The action plan shall be mutually agreed upon by both SUPPLIER and OWNER before implemented.
 - 4) Additional testing, onsite or offsite, may be conducted by SUPPLIER at its own cost. If the testing and investigation proves the equipment system is performing as designed and is meeting all guaranteed values, OWNER is responsible for all reasonable testing costs borne by SUPPLIER.
 - b. Satisfaction of Warranty Claims
 - 1) If the claim investigation concludes that the equipment is defective and not meeting the guaranteed performance, SUPPLIER shall make corrections, repair, replace, or other measures that provide identical or better performance than the equipment specified for the initial system within thirty (30) calendar days of receiving the written claim and resulting investigation. All costs, including materials, taxes, transit, insurance, freight, and installation for the corrections, repairs, replacements, or new equipment shall be borne by SUPPLIER with exception of the pro-rata terms defined in 1.1.D. SUPPLIER shall also provide an experienced technician for installation oversight.
 - 2) All repaired, replaced, or new equipment will assume the balance of the original warranty period defined in 1.1.D. The replacement equipment shall be compatible with the existing system and the latest generation of equipment offered by SUPPLIER.

01 78 36-2
Product Warranty

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- 3) If SUPPLIER is unable to correct the failure condition through system corrections, repair or equipment replacement, then SUPPLIER shall be responsible for all costs associated with system corrections to regain specified performance. All correction action shall be completed within three (3) attempts or six (6) months of written action plan, whichever occurs first.
- 4) If the corrective action described is insufficient to correct the deficiency, then SUPPLIER must remove the nonconforming equipment or system and assume all costs associated with subsequent installation of an alternate system selected by OWNER that meets the performance requirements.

E. Warranty Services

1. SUPPLIER shall provide the following services during the warranty period:
 - a. Remote monitoring, if available, the equipment performance and performance reports (weekly for first six months, and then every two weeks) highlighting concerns and suggestions for improvement.
 - b. Onsite visits twice per year, with adequate onsite time to review equipment operation, for the first two years. Visits shall include observation of operations, assessment of equipment, and supplemental training of personnel. SUPPLIER representative shall be an engineer or startup technician. SUPPLIER representative's resume shall be submitted for approval by OWNER prior to scheduling visits.
 - c. Each onsite visit shall include adequate testing and analysis to determine operability or the equipment or system. The analysis is not required to be destructive but shall be determined by SUPPLIER as tests that are indicative of operation and gradual loss of effectiveness.
 - d. 24/7 continuous telephone and PLC code support if applicable.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

+ + END OF SECTION + +

01 78 36-3
Product Warranty

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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01 78 36-4
Product Warranty

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 02 41 03

DEMOLITION

PART 1 - GENERAL

1.1 DEFINITIONS

- A. "Demolish": CONTRACTOR shall remove from the site as property of CONTRACTOR. Demolition includes disconnecting, removal, loading, repairs, cleanup, transportation, unloading, disposal permits and fees, disposal, and all other items required to remove the material from the site.
- B. "Salvage": CONTRACTOR shall remove from area of Work and place in location designated by ENGINEER. Equipment is property of OWNER. Salvage includes disconnecting, removal, repairs, cleanup, loading, transportation, unloading, and all other items required to remove and relocate the material.
- C. "OWNER to Remove": OWNER will remove from area of Work prior to CONTRACTOR commencing demolition Work for this area.
- D. "Relocate": CONTRACTOR shall relocate material shown to new locations shown on Drawings or stated herein. Relocation includes disconnecting, removal, reconnecting, attaching, repairs, and all other items required to relocate material to new location.
- E. "Abandon": CONTRACTOR shall disconnect and leave in place as specified.
- F. "Materials": Any and all items and objects that are scheduled, specified, or shown to be demolished, salvaged, removed, relocated, or abandoned.

1.2 SUBMITTALS

- A. Action Submittals:
 - 1. Product Information: Grout, sealants, and bonding agents to be used for patching.
- B. Informational Submittals:
 - 1. Plan and schedule phased demolition, including limits of demolition, as part of and consistent with the Progress Schedule.
 - 2. Methods of demolition and equipment proposed to demolish materials.
 - 3. Copies of any authorizations and permits required to perform Work.
 - 4. Copies of Hazardous Materials Inspection Reports.
 - 5. Repair procedures for demolition of materials beyond limits shown on Drawings.

02 41 03-1
Demolition

PART 2 - PRODUCTS

2.1 GENERAL

- A. CONTRACTOR shall provide all materials and equipment in suitable and adequate quantity as required to accomplish the Work shown, specified herein, and as required to complete the Project.

PART 3 - EXECUTION

3.1 GENERAL

- A. Drawings are based on available information. The Work may differ slightly from what is shown. CONTRACTOR shall be responsible for determining the work required by inspecting the site.

3.2 SAFETY REQUIREMENTS

- A. All Work shall be done in conformance with all applicable rules and regulations pertaining to safety.
- B. Hazardous Materials:
 - 1. See General Conditions.
 - 2. Existing facilities, or portions thereof, to be demolished may contain hazardous materials such as asbestos cement piping, residual chemicals in existing or abandoned piping, lead-based paint, mercury seals, or other unknown hazardous materials.

3.3 SEQUENCE

- A. Be responsible for the sequence of Work.
- B. Conform to Special Project Constraints as applicable.

3.4 COORDINATION

- A. Coordination with ENGINEER:
 - 1. Only materials specified herein, shown on the Demolition Photographs or the Drawings, or approved by ENGINEER in the field shall be demolished, salvaged, removed, relocated, or abandoned.
 - 2. Verify materials scheduled to be demolished, salvaged, removed, relocated, or abandoned with ENGINEER prior to performing Work.
 - 3. Do not remove materials without prior approval of ENGINEER.
 - 4. Provide at least 3 working days' notice to ENGINEER prior to start of Work.
 - 5. Notify ENGINEER to turn off affected services or facilities before starting Work.
 - 6. Provide temporary services during interruptions to affected services or facilities as acceptable to ENGINEER.
 - 7. ENGINEER will indicate limits of Work if not clearly shown.
- B. Coordination with Utility Owners:

02 41 03-2
Demolition

1. Notify utility owners to turn off affected services or facilities before starting Work.
2. Provide not less than 72 hours notice to utility owners prior to shutdown, unless otherwise directed by utility owners.
3. Provide temporary services during interruptions to affected services or facilities as acceptable to utility owners.

3.5 LIMITS

- A. Drawings define minimum portions of materials to be demolished. Unless otherwise shown, rough cuts or breaks may be made to limits of demolition shown. If rough cuts or breaks are made exceeding limits shown, CONTRACTOR shall repair the cuts or breaks back to the dimensions shown on Drawings at CONTRACTOR's expense.
- B. If limits are not clear on the Drawings or Demolition Photographs, limits shall be as directed by ENGINEER.
- C. All areas not within the limits of demolition Work shown on the Drawings, or as specified herein, shall be left undisturbed, unless necessary for demolition of materials.

3.6 DEMOLITION

- A. General:
 1. Inspect condition of materials to be demolished prior to bidding to assess potential for salvage value.
 2. Remove all materials associated with existing equipment that is to be demolished.
 3. Materials within limits of demolition will become the property of CONTRACTOR.
 4. All materials from the demolition process shall be removed safely from the project site as soon as possible. They shall be disposed of in accordance with applicable federal, state, and city regulations. CONTRACTOR is responsible for determining these regulations and shall bear all costs associated with disposal of the materials.
- B. Pavement and Curbs:
 1. Provide saw cut at all concrete and pavement surfaces and curb removal limits and where neat connection lines are required.
 2. Surfaces exposed by demolition activities shall be repaired and finished to provide a uniform, smooth, level transition between adjacent surfaces.
- C. Concrete, CMU, and Reinforcing:
 1. In areas where concrete or CMU portions are to be removed from a structure, the edge of removal shall be cut with a concrete saw to leave a perpendicular edge or by core-drilling where a circular hole is required.
 2. Damaged concrete shall be removed to solid concrete. Damaged concrete shall include concrete that is soft, spalled, cracked, or otherwise damaged as determined by ENGINEER.
 3. Depth of removal shall be as determined by ENGINEER unless otherwise shown or specified.
 4. Reinforcing shall be cut and removed unless otherwise shown or instructed by ENGINEER.
 5. Spalled edges may be required to be resawn at the discretion of the ENGINEER.
 6. Protect adjacent structures and equipment from damage during Work.

02 41 03-3
Demolition

7. Exposed surfaces following demolition activities shall be repaired and finished to provide a uniform, smooth, and level transition between adjacent surfaces.
 8. Remove and repair designated cracked and damaged concrete areas shown in accordance with this section and Section 03 30 03, Cast-in Place Concrete.
- D. Concrete Embedded Items:
1. Except for core drills, demolish anchor bolts, reinforcing steel, conduit, and other materials that are concrete embedded to a minimum of 1 inch below final finished surface. For core drills, coat rebar exposed by core drilling with System No. 304 in accordance with Section 09 91 03, Painting.
 2. Plug empty pipes and conduits with fireproof sealant to maintain fire ratings for floors or walls.
 3. Patching:
 - a. Demolish damaged concrete. Damaged concrete shall be removed to solid concrete. Damaged concrete shall include concrete that is soft, spalled, cracked, or otherwise damaged as determined by ENGINEER.
 - b. Coat with approved bonding agent.
 - c. Patch with nonshrink, nonmetallic grout.
- E. Piping:
1. Pressurized Services: Install restrained caps or plugs at the demolished ends, unless otherwise shown.
 2. Gravity Services: Install concrete plugs, 5-foot minimum length.
- F. Utilities:
1. Excavate utility lines serving structures to be demolished.
 2. Demolish electrical, sanitary, and storm drainage lines serving structures to be demolished.
 3. Support or relocate utility lines exposed by Work.
 4. For water and gas lines to be demolished or capped and terminated, provide a permanent leakproof closure. Closure type shall be as recommended by utility owner.
- G. Electrical:
1. Remove conduits and wiring from materials to be demolished back to nearest junction box.
 2. For existing circuits to remain operational, intercept existing conduit at the most convenient location, or as shown, and splice and extend conduit to new location. Install new conductors as required to accomplish intended results. New conductors shall be continuous without splices between junction boxes.
 3. For existing circuits no longer needed, demolish conductors from conduits.
 4. Demolish all surface-mounted conduit which is no longer needed.
 5. For conduit below grade or concealed within walls, cap and abandon in place.

3.7 SALVAGE

- A. Salvage materials for OWNER's own use where shown.
- B. Remove materials with extreme care so as not to damage.
- C. Promptly remove materials from Work area.

02 41 03-4
Demolition

- D. Store materials in location designated by ENGINEER.
- E. Clean and protect materials from dust, dirt, natural elements, and store as directed.

3.8 RELOCATION

- A. ENGINEER will determine condition of materials prior to removal.
- B. Remove all materials associated with items to be relocated.
- C. Existing materials shall not be damaged during removal.
- D. Properly store and maintain materials in same condition as when removed.
- E. Clean and protect materials from dust, dirt, natural elements, and store as directed.

3.9 ABANDONMENT

- A. Structures: Break holes into or core drill floor slabs, catch basins, and other below-grade concrete structures to be abandoned in place to allow water to freely migrate through.
- B. Piping and Conduits:
 - 1. General: Piping and conduits to be abandoned shall be capped with a watertight plug at demolished end in a manner that will prevent entrance of soil, groundwater, or moisture.
 - 2. Pressurized Services: Install restrained caps or plugs at the demolished ends, unless otherwise shown.
 - 3. Gravity Services: Install concrete plugs, 5-foot minimum length.

3.10 REPAIR AND REPLACEMENT

- A. Any damaged materials scheduled to be salvaged or relocated shall be repaired by the CONTRACTOR to the satisfaction of ENGINEER or replaced at the CONTRACTOR's expense.
- B. Any damage to areas not within the limits of demolition Work shown on the Demolition Photographs, Drawings, or as specified herein shall be repaired or replaced to original precontract conditions at the CONTRACTOR's sole expense.

3.11 DISPOSAL

- A. Dispose of materials offsite in licensed landfills and in accordance with all local, state, and federal regulations. CONTRACTOR is responsible for obtaining any and all necessary permits for disposal.

++ END OF SECTION ++

02 41 03-5
Demolition

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02 41 03-6
Demolition

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 03 11 03

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Falsework and formwork, as required to construct cast-in-place concrete, including placing of all items such as sleeves, anchor bolts, inserts and all other items to be embedded in concrete for which placement is not specifically provided under other Sections.
- B. REFERENCES
 - 1. American Concrete Institute (ACI)
 - a. ACI 301, Specifications for Structural Concrete for Buildings.
 - b. ACI 347, Guide for Concrete Formwork.

1.2 SYSTEM DESCRIPTION

- A. Coordination:
 - 1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the formwork.
 - 2. Coordinate formwork specifications herein with the requirements for finished surfaces specified in Section 03 30 03, Cast-In-Place Concrete.

1.3 SUBMITTALS

- A. Submit for information purposes the following: Copies of manufacturer's data and installation instructions for all proprietary materials, including form coatings, manufactured form systems, ties and accessories.
- B. Shop Drawings: Forming, shoring and bracing drawings for footings, walls and roofs.
- C. Calculations: Calculations verifying the selection of form ties, horizontal and vertical stiff-backs or braces for wall panels, forming and form openings, falsework or roof forms, or any other part of forming, shoring or bracing which may be considered critical by the ENGINEER. The drawings, with supporting calculations, must be signed and sealed by a Civil or Structural Engineer registered in the State of California.

1.4 QUALITY ASSURANCE

- A. Allowable Tolerances: Construct formwork to provide completed concrete surfaces complying with tolerances specified in ACI 347, Chapter 3.3, except as otherwise specified.
- B. Furnish and install all items for permanent or temporary facilities in accordance with manufacturer's instructions.

03 11 03-1
Concrete Formwork

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood overlaid with MDO or HDO specifically designed for concrete forms, metal, metal-framed plywood-faced or other acceptable panel materials, to provide continuous, straight, smooth as-cast surfaces. Furnish in largest practical sizes to minimize number of joints. Provide form material with sufficient thickness to remain watertight and withstand pressure of newly placed concrete without bow or deflection.
1. At circular structures wall forms shall conform to the circular shape of the structure. Straight panels not exceeding 2 feet in horizontal width and installed with angular deflection not greater than 3-1/2 degrees per joint may be substituted for circular forms.
- B. Forms for Unexposed Finish Concrete: Form concrete surfaces that will be unexposed in the finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least 2 edges and 1 side.
- C. Form Ties:
1. Form ties on exposed surfaces shall be located in a uniform pattern or as indicated on the Drawings. Form ties shall be constructed so that the tie remains embedded in the wall, except for a removable portion at each end. Form ties shall have conical or spherical type inserts, inserts shall be fixed so that they remain in contact with forming material, and shall be constructed so that no metal is within 1 inch of the concrete surface when the forms, inserts, and tie ends are removed. Wire ties will not be permitted. Ties shall withstand all pressures and limit deflection of forms to acceptable limits.
 2. Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1 inch and sufficient dimensions to permit proper patching of the tie hole.
 3. Ties for water-holding structures or dry structures with access such as basements, pipe galleries, etc., that are below finish grade, shall have either an integral steel water stop 0.103 inch thick and 0.625 inch in diameter that is tightly and continuously welded to the tie, or a neoprene water stop 3/16-inch thick and 15/16 inch in diameter whose center hole is 1/2 the diameter of the snap tie, or a molded plastic water stop of comparable size. Flat snap ties complying with above requirements and other sections of this Specification may be used. The water stop shall be considerably larger in area than the tie cross sectional area, and shall be oriented perpendicular to the tie and symmetrical about the center of the tie. The ties shall be constructed to provide a positive means of preventing rotation or disturbance of the center portion of the tie during removal of the ends.
- D. Alternative Form Ties – Through-Bolts:
1. Alternate form ties consisting of tapered through-bolts at least 1 inch in diameter at smallest end, or through-bolts that utilize a removable tapered sleeve of the same minimum size may be used at the CONTRACTOR's option. Clean and roughen, fill, and seal form tie hole as shown on the Drawings; or where not shown on the Drawings, the CONTRACTOR shall provide a shop drawing submittal of his proposed method of sealing the through-bolt hole by sandblasting or mechanically cleaning and roughening the entire interior surface of the hole, epoxy coating the roughened

03 11 03-2
Concrete Formwork

Washwater Equalizer Tank Replacement Project

surface and driving a vinyl plug and then dry packing the entire hole on each side of the plug with nonshrink grout, meeting these Specifications. Dry packing shall be done while the epoxy is tacky or remove the epoxy by mechanical means and reapply new epoxy. The CONTRACTOR shall be responsible for watertightness and any repair needed. Any leaks or dampness on the exterior of through-bolt patches during or after water testing shall require repair or replacement of the patch.

2. The elastic plug to be inserted into the form tie hole as shown on the Drawings shall be a Dayton Sure Plug, or approved equal, sized to allow insertion using the insertion tool to elongate the plug, place it at the correct location, and allow the plug to return to its original length and diameter upon removal to form a watertight seal. The plugs shall be as manufactured and supplied by Dayton Superior, Dayton OH, phone: 888/977-9600.

- E. Forms Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

1. For concrete structures which will be in contact with potable water, the manufacturer shall certify that the form coating used is NSF 61 approved.

2.2 DESIGN OF FORMWORK

- A. The CONTRACTOR shall design all formwork prior to fabrication. The design shall account for all the tolerances, form ties, finishes, architectural features, rebar supports, construction joint locations, and other features and other nonstructural formwork requirements specified. Forms shall contain pouring and observation windows to allow placement of concrete through windows or shall be staged to allow visual observation at all times of the fresh concrete to ensure correct placement and vibration. Provide a formwork and placement design that will limit free fall of concrete in forms 8-inch or less in width to 5 feet; and for forms wider than 8 inches, limit this fall to 8 feet, except as hereinafter specified. Review methods with ENGINEER prior to start of work. Use placement devices, such as chutes, pouring spouts, pumps, as required.
- B. Wall forms shall be designed such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.
- C. Reuse of forms will be permitted only if a "like new" condition, unless otherwise approved in writing, is maintained. The ENGINEER shall be notified 1 full working day prior to concrete placement so that the forms can be inspected. The CONTRACTOR shall correct any defective work, found in the ENGINEER's inspection, prior to delivery of concrete to the project. Formwork surfaces that were in good condition and accepted for use, but were damaged during removal and handling shall not be reused on additional pours. The CONTRACTOR is expected to take care in the handling of forms and to obtain approval of form surfaces prior to each reuse.
- D. Roof forms and falsework supports for structural slabs shall be sufficiently rigid and strong to support the wet concrete and the men and equipment necessary for its

03 11 03-3
Concrete Formwork

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

placement without appreciable deflections. A minimum of 50 PSF for live load shall be allowed in the design.

- E. All forms, falsework, shoring, and other structural formwork required shall be structurally designed by the CONTRACTOR and the design shall comply with all applicable safety regulations, current OSHA regulations, and other codes. Where federal or state agencies require a licensed engineer to prepare and/or seal all formwork, falsework or shoring designs, the CONTRACTOR shall hire this engineer and pay all costs. The designs shall be made available to any governing agency upon request. Comply with applicable portions of ACI 347, ACI 318 current edition, and these Specifications. All design, supervision, and construction for safety of property and personnel shall be the CONTRACTOR's full responsibility.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and the conditions under which Work is to be performed with installer and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 FORM CONSTRUCTION

- A. Construct forms complying with ACI 347; to the exact sizes, shapes, lines and dimensions shown; as required to obtain accurate alignment, location and grades; to tolerances specified; and to obtain level and plumb work in finish structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes. Finish shall be as determined by approved mock-up or sample panel, if specified.
- B. Fabricate forms for easy removal without damaging concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
- C. Provide temporary form windows where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate form windows on forms in locations as inconspicuous as possible, consistent with requirements of the Work. Form intersecting planes of openings to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.
- D. Falsework:
 - 1. Erect falsework and support, brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.

03 11 03-4
Concrete Formwork

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2. Provide wedges, jacks or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce finished Work of required dimensions.
- E. Forms for Exposed To View Concrete:
1. Do not use metal cover plates for patching holes or defects in forms.
 2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
 3. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
 4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
 5. Form molding shapes, recesses, rustication joints and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.
- F. Corner Treatment:
1. Form exposed corners of beams, walls, foundations, bases and columns to produce smooth, solid, unbroken lines, except as otherwise shown. Except as specified below for reentrant or internal corners, exposed corners shall be chamfered.
 2. Form chamfers with $\frac{3}{4}$ -inch x $\frac{3}{4}$ -inch strips, unless otherwise shown, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Use rigid PVC chamfers for all architecturally formed concrete. Extend terminal edges to require limit and miter chamfer strips at changes in direction.
 3. Reentrant or internal corners and unexposed corners need not be formed chamfered.
- G. Openings and Built-In Work:
1. Provide openings in concrete formwork shown or required by other Sections or other contracts.
 2. Accurately place and securely support items to be built into forms.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

3.3 FORM COATINGS

- A. Coat form contact surfaces with a non-staining form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces that will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.
- B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.4 INSTALLATION OF EMBEDDED ITEMS

- A. Set and build into the formwork, anchorage devices and other embedded items, shown, specified or required by other Sections and other contracts. Use necessary setting drawings, diagrams, instructions and directions.
- B. Edge Forms and Screeds Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support screeds.

3.5 FIELD QUALITY CONTROL

- A. Before concrete placement, check the formwork, including tolerances, lines, ties, tie cones, and form coatings. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
- B. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed Work is within specified tolerances.
- C. If forms are unsatisfactory in any way, either before or during placing of concrete, postpone or stop placement of concrete until the defects have been corrected, and reviewed by ENGINEER.

3.6 REMOVAL OF FORMS

- A. Conform to the requirements of ACI 301, Chapter 2 and ACI 347, Chapter 3.7 except as specified below.
 - 1. Removal of Forms and Supports: Continue curing in accordance with Section 03 30 03, Cast-In-Place Concrete, Paragraph 3.7. Forms are to remain in-place for the time specified below following the end of concrete placement. The durations shown represent a cumulative number of days, or hours, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above or below 50°F.

<u>Temperature:</u>	<u>Above 50°F</u>	<u>Below 50°F or when retarders are used</u>
Walls	12 hours	48 hours
Columns	12 hours	48 hours
Sides of Slabs	6 hours	12 hours
Structural Floor or Roof Slabs	Do not remove forms until site-cured test cylinders develop 100% of 28-days strength.	

- 2. When wall or column forms also support formwork for slab or beam soffits, the removal times of the latter should govern.
 - 3. When high-early strength concrete is specified, a schedule for removal of forms will be developed in the field from the age/ strength relationships established for the materials and proportions used by tests in accordance with ACI 301, Section 2.3.4.
 - 4. When construction loads are approximately equal to the structural live load, the forms for structural slabs, joists, and beams shall remain in place until the concrete has reached the specified compressive strength.
- B. Leave form-facing material in place a minimum of 4 days after concrete placement, unless otherwise approved by ENGINEER.

03 11 03-6
Concrete Formwork

Washwater Equalizer Tank Replacement Project

3.7 PERMANENT SHORES

- A. Provide permanent shores as defined in ACI 347 Chapter 3.7. Reshores will not be permitted.

3.8 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in the Work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces. Form surfaces shall be subject to ENGINEER'S approval.

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03 11 03-7
Concrete Formwork

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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03 11 03-8
Concrete Formwork

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 03 15 16

CONCRETE JOINTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes installation of concrete joints including, construction joints, expansion joints and fillers, waterstops, and contraction (control) joints.

1.2 REFERENCES

- A. American Concrete Institute (ACI)
 - 1. ACI 301, Specifications for Structural Concrete for Buildings.
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM A36, Standard Specification for Structural Steel.
 - 2. ASTM D1752, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - 3. ASTM D570, Standard Test Method for Water Absorption of Plastics.
- C. NSF/ANSI Standard 61 Drinking Water Systems Components.

1.3 SYSTEM DESCRIPTION

- A. All joints subject to hydrostatic pressure shall be provided with continuous waterstop.

1.4 SUBMITTALS

- A. Product Data: Submit for approval, Manufacturer's specifications and installation instructions for all materials required.
- B. Shop Drawings: Submit for approval:
 - 1. Layout of all construction joint locations prior to the submittal of steel reinforcing drawings. The concrete pour sequence and placement schedule shall be stated in the construction joint shop drawing layout.
 - 2. Detail for joining polyvinyl chloride waterstops.
- C. Samples: Submit for approval:
 - 1. Waterstops for joints.
 - 2. Expansion joint fillers.

1.5 QUALITY ASSURANCE

- A. Install all manufactured items in accordance with manufacturer's instructions.

03 15 16-1
Concrete Joints

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- B. Store materials off the ground and protected from moisture, dirt and other contaminants. Protect installed and uninstalled materials from UV exposure in accordance with manufacturer's instruction.

PART 2 - PRODUCTS

2.1 WATERSTOPS

- A. Polyvinyl Chloride:
1. At potable water facilities, provide NSF-61 Certified PVC waterstops.
 2. Reference Standard: ASTM D570.
 3. Construction Joints: Minimum of 3/8-inch thick, ribbed, width as shown, or if not shown, 6-inch minimum, center bulb type may be provided but is not required.
 4. Control Joints: Minimum of 3/8-inch thick, ribbed, center bulb type, width as shown, or if not shown, 6-inch minimum.
 5. Expansion Joints: Minimum thickness of 3/8-inch and 9-inch minimum width. Provide with "O" or "U" shaped center bulb. The "O" shall have an outside diameter of 3/4-inch minimum unless shown otherwise.
 6. Product and Manufacturer: Provide polyvinyl chloride waterstops of one of the following:
 - a. W.R. Meadows
 - b. Sika Greenstreak
 - c. Or approved equal
- B. Hydrophilic:
1. Provide chloroprene rubber waterstops, 3/8-inch thick.
 2. Product and Manufacturer: Provide one of the following:
 - a. Sika Hydrotite.
 - b. Or approved equal.
- C. Retrofit Waterstop:
1. Polyvinyl chloride or thermoplastic vulcanizate waterstop used between existing concrete and new concrete: Minimum of 3/8-inch thick, ribbed, 4-inch nominal width, 3-inch minimum height, T or L shaped.
 2. Provide epoxy gel bed below retrofit waterstop.
 3. Attach waterstop to existing concrete with stainless steel expansion anchors or concrete screws and stainless-steel batten bar with minimum dimensions of 1 1/2-inch by 3/16-inch.
 4. Product and Manufacturer: Provide one of the following:
 - a. Sika Greenstreak 581.
 - b. Earth Shield JP 320L.
 - c. Or approved equal.

2.2 PREFORMED EXPANSION JOINT FILLER

- A. Bituminous type conforming to ASTM D994 or D1751, unless otherwise shown or specified.

03 15 16-2
Concrete Joints

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2.3 CONCRETE CONSTRUCTION JOINT ROUGHENER

- A. Provide a water-soluble non-flammable, surface-retardant roughener.
- B. Product and Manufacturer: Provide one of the following:
 - 1. Rugasol-S, as manufactured by Sika Corporation for horizontal joints.
 - 2. MBT EAC-S, as manufactured by Master Builders for horizontal joints.
 - 3. MBT Tuf-Cote (Deep Etch), as manufactured by Master Builders for vertical joints.
 - 4. Or approved equal.

2.4 EPOXY BONDING AGENT

- A. Provide an epoxy-resin bonding agent, two component type.
- B. Product and Manufacturer: Provide one of the following:
 - 1. Sikadur 32 Hi-Mod LPL, as manufactured by Sika Corporation.
 - 2. Dural LPL, as manufactured by the Euclid Chemical Company.
 - 3. Epoxite Binder (Code # 2390), as manufactured by A.C. Horn, Incorporated.
 - 4. Or approved equal.

2.5 RUBBER BONDING AGENT

- A. Product and Manufacturer: Provide one of the following:
 - 1. Scotch-Grip 1300 Rubber Adhesive, as manufactured by 3M Company.
 - 2. Or approved equal.

2.6 MORTAR

- A. Mortar must be composed of cement, sand and water. Materials for mortar must comply with Section 03 30 03, Cast-in-Place Concrete. The proportion of sand to cement measured by volume must be 2 to 1 respectively. Mortar must contain only enough water to allow placing.

2.7 BOND BREAKER

- A. Tape for Joints: Adhesive-backed glazed butyl or polyethylene tape, same width as joint that will adhere to premolded joint material or concrete surface.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate and conditions under which Work is to be performed with installer and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 CONSTRUCTION JOINTS

- A. Comply with ACI 301, Chapter 2.2, and as specified below.

03 15 16-3
Concrete Joints

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- B. Locate and install construction joints as shown. Locate additional construction joints as required to satisfactorily complete all Work.
- C. Horizontal Joints:
1. Roughen concrete at the interface of construction joints by sandblasting to expose the aggregate (1/4-inch minimum amplitude) and remove accumulated concrete on rebar immediately subsequent to form stripping. When sandblasting adjacent to installed waterstops, shield installed waterstops from the sandblasting operation. Immediately before placing fresh concrete, thoroughly clean the existing contact surface using a stiff brush or other tools and a stream of water under pressure. The surface shall be clean and wet, but free from pools of water at the moment the fresh concrete is placed.
 2. Remove laitance, waste mortar or other substance that may prevent complete adhesion.
 3. At the base of walls with waterstops, place a 3-inch thick coat of mortar over the surface of the old concrete. Place fresh concrete before the mortar has attained its initial set.
- D. Vertical Joints:
1. Remove accumulated concrete on rebar.
 2. Roughen concrete at the interface of the construction joints to expose the aggregate (1/4-inch minimum amplitude) through one of the following:
 - a. Apply roughener to the form in a thin, even film by brush, spray or roller in accordance with the manufacturer's instructions. After roughener is dry, concrete may be placed. When concrete has been placed and the form removed, wash loosened material off with high-pressure water spray to obtain roughened surface subject to approval by ENGINEER.
 - b. Sandblast after concrete has fully cured.
 - c. Waterblast after concrete has partially cured.
 - d. Perform cleaning so as not to damage waterstop, if one is present.

3.3 EXPANSION JOINTS

- A. Locate and install expansion joints as shown. Install bituminous joint filler in accordance with manufacturer's instructions. Install caulking and sealants as specified in Section 07 92 03, Joint Sealants.

3.4 WATERSTOPS

- A. General:
1. Comply with ACI 301, Chapter 2, and as specified below. Make all joints in accordance with manufacturer's instructions.
 2. Obtain ENGINEER'S approval for waterstop locations not shown.
 3. Provide waterstops in all basements, tanks and other substructures up to an elevation at least 12 inches above grade or to an elevation at least 12 inches above highest liquid level in tanks, whichever is higher, except where otherwise shown or noted.
- B. Polyvinyl Chloride Waterstop:

03 15 16-4
Concrete Joints

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Tie waterstops to reinforcing steel at 12-inches on center, in each direction, so that it is securely and rigidly supported in the proper position, centered in the joint, during concrete placement. Hog rings shall be used to facilitate placing and tying of waterstops to reinforcing steel forms or form-ties.
 2. Continuously inspect waterstops during concrete placement to ensure their proper positioning.
 3. Provide fused waterstops using equipment as supplied by or recommended by the manufacturer. Joints shall be inspected for strength and pinholes after splicing. Splices shall be strong enough to develop a pulling force of 75 percent of the strength of the waterstop, and shall be watertight.
 4. Cover and protect installed waterstops from UV if the pour of concrete will be delayed more than 30 days.
 5. Shield installed waterstops from sandblasting when performing surface roughening adjacent to installed waterstops.
- C. Hydrophilic Waterstop: Install where shown in accordance with manufacturer's recommendations.

3.5 BONDING WITH EPOXY ADHESIVE

- A. Use adhesive for the following:
 1. Bonding of fresh concrete to concrete cured at least 45 days or to existing concrete.
 2. Bonding of horizontal surfaces, which will receive a topping.
- B. Handle and store epoxy adhesive in compliance with the manufacturer's printed instructions, including safety precautions.
- C. Mix the epoxy adhesive in complete accordance with the instructions of the manufacturer.
- D. Before placing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy adhesive not less than 1/16-inch thick. Place fresh concrete while the epoxy material is still tacky, without removing the in-place grout coat, and as directed by the epoxy manufacturer.

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03 15 16-5
Concrete Joints

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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03 15 16-6
Concrete Joints

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 03 21 03

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Fabrication and placement of reinforcement including bars, ties and supports, and welded wire fabric for concrete, encasements and fireproofing.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Manufacturer's specifications and installation instructions for all materials and reinforcement accessories.
 - 2. Drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315, Parts A and B. For walls, show elevations to a minimum scale of 1/4-inch to 1-foot. For slabs, show top and bottom reinforcing on separate plan views. Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement, unless otherwise noted. Keep splices to a minimum. Avoid splices in regions of maximum tension stresses whenever possible.
- B. Certificates: Submit one (1) copy of steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

1.3 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. American Concrete Institute (ACI):
 - a. ACI 315, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
 - b. ACI 318, Building Code Requirements for Reinforced Concrete.
 - 2. Concrete Reinforcing Steel Institute:
 - a. Manual of Standard Practice, includes ASTM standards referred to herein.
- B. Allowable Placing Tolerances: Comply with ACI 318, Chapter 7 - Details of Reinforcement.

1.4 DELIVERY, HANDLING AND STORAGE

- A. Deliver concrete reinforcement materials to the site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

03 21 03-1
Concrete Reinforcing

Washwater Equalizer Tank Replacement Project

- B. Store concrete reinforcement material at the site to prevent damage and accumulation of dirt or excessive rust. Store on heavy wood blocking so that no part of it will come in contact with the ground.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60 for all non-welded bars. ASTM A706, Grade 60 for welded bars.
- B. Smooth Steel Dowels: ASTM A36.
 - 1. Epoxy coated conforming to ASTM A775 or ASTM A934.
- C. Mechanical Couplers: Reinforcement bars may be spliced with a mechanical connection. Provide a full mechanical connection which shall develop in tension or compression, as required, at least 125% of specified yield strength (f_y) of the bar in accordance with ACI 318 Section 12.14.3.2. The locations of the connections are subject to the approval of the ENGINEER.
 - 1. Dayton Superior Bar Lock S/CA Series.
 - 2. Or approved equal
- D. Threaded Splicing Systems: Dowel Bar Splicer System shall comply with ICC Report #4028. The completed splice shall exceed 160% of the specified yield strength (f_y) of the bar.
 - 1. Dayton Superior DB/DI parallel threaded couplers.
 - 2. Or approved equal
- E. Steel Wire: ASTM A82.
- F. Welded Wire Fabric: ASTM A185. Furnish in flat sheets, not rolls.
- G. Column Spirals: Hot-rolled rods for spirals, ASTM A615.
- H. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.
 - 1. Use wire bar type supports complying with CRSI recommendations, except as specified below. Do not use wood, brick, or other unacceptable materials.
 - 2. For slabs on grade, use 5000 psi concrete blocks.
 - 3. At all formed surfaces, provide supports complying with CRSI "Manual of Standard Practice" as follows: Plastic protected or stainless steel legs.
 - 4. For all PVC lined concrete surfaces, provide supports complying with CRSI "Manual of Standard Practice" as follows: Either plastic or metal plastic protected legs.

2.2 FABRICATION

- A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI, "Manual of Standard Practice". In case of

03 21 03-2
Concrete Reinforcing

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.

- B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the Work:
1. Bar lengths, bends, and other dimensions exceeding specified fabrication tolerances.
 2. Bends or kinks not shown on approved Shop Drawings.
 3. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate and conditions under which concrete reinforcement is to be placed with installer, and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Comply with the applicable recommendations of specified codes and standards, and CRSI, Manual of Standard Practice, for details and methods of reinforcement placement and supports.
- B. Clean reinforcement to remove loose rust and mill scale, oil, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Position, support, and secure reinforcement against displacement during formwork construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
1. Place reinforcement to obtain the minimum concrete cover as shown. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcement accurately in position during concrete placement operations. Slab and wall bars shall be tied at every intersection around the periphery of the slab or wall and not less than every 48 inches in the field at walls and 60 inches in the field at slabs.
 2. Bar supports shall be placed no further than 4 feet apart in each direction. Supports must be completely concealed in the concrete and shall not discolor or otherwise mar the surface of the concrete.
 3. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
 4. Do not secure reinforcing steel to forms with wire, nails or other ferrous metal. Do not permit metal supports subject to corrosion to touch or be within the required clearance to formed or exposed concrete surfaces.
- D. Install welded wire fabric in as long lengths as practical. Lap adjoining pieces at least one full mesh and lace splices with wire. Do not make end laps midway between supporting beams or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.

03 21 03-3
Concrete Reinforcing

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- E. Provide sufficient numbers of supports of strength required to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment or similar construction loads.
- F. Splices: Provide reinforcement lap splices by placing bars in contact, and tying tightly with wire. Comply with requirements shown for minimum lap of spliced bars.
- G. Mechanical Couplers in Lieu of Lap Splicing:
 - 1. Provide mechanical butt splices in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Flame dry bars before butt splicing. Provide adequate jigs and clamps or other devices to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.
- H. Reinforcement Around Openings: Place an equivalent area of steel around the pipe or opening and extend on each side sufficiently to develop bond in each bar. See the Details on Drawings for bar extension length each side of opening. Where welded wire fabric is used, provide extra reinforcing using fabric or deformed bars.
- I. Field Bending: Field bending of reinforcing steel bars is not permitted when rebending will later be required to straighten bars. Rebending of bars at the same place where strain hardening has taken place due to the original bend will damage the bar. Consult with the ENGINEER prior to any pour if the CONTRACTOR foresees a need to work out a solution to prevent field bending.

3.3 INSPECTION OF REINFORCEMENT

- A. Do not place concrete until the reinforcing steel is inspected and permission for placing concrete is granted by ENGINEER. All concrete placed in violation of this provision will be rejected.

++ END OF SECTION ++

03 21 03-4
Concrete Reinforcing

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 03 30 03

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Place, finish, cure, strip, and repair concrete.

1.2 REFERENCES

- A. American Concrete Institute (ACI)
1. ACI 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 2. ACI 214, Recommended Practice for Evaluation of Strength Test Results of Concrete.
 3. ACI 301, Specifications for Structural Concrete for Buildings, (includes ASTM Standards referred to herein).
 4. ACI 304, Guide for Measuring, Mixing, Transporting and Placing Concrete.
 5. ACI 305, Hot Weather Concreting.
 6. ACI 306, Cold Weather Concreting.
 7. ACI 309, Guide for Consolidation of Concrete.
 8. ACI 311, Guide for Concrete Inspection.
 9. ACI 318, Building Code Requirements for Reinforced Concrete.
 10. ACI 347, Guide to Formwork for Concrete
 11. ACI 350, Environmental Engineering Concrete Structures.

1.3 SYSTEM DESCRIPTION

- A. Class A Concrete shall be steel reinforced and includes:
1. Foundations.
 2. Walls.
 3. Slabs.
 4. Beams.
 5. Girders.
 6. Columns.
 7. Equipment bases.
 8. Pipe supports.
- B. Class B Concrete shall be placed without forms or with simple forms, with little or no reinforcing, and includes:
1. Concrete fill.
 2. Curbs and gutters.
 3. Sidewalks.
 4. Thrust blocks.
 5. Encasements.

03 30 03-1
Cast-in-Place Concrete

1.4 SUBMITTALS

- A. Samples: Submit samples of materials as specified and as otherwise may be requested by ENGINEER, including names, sources and descriptions.
- B. Product Data: Submit for approval the following:
 - 1. Manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
 - 2. List of concrete materials and concrete mix designs proposed for use. Include the results of all tests performed to qualify the materials and to establish the mix designs.
- C. Laboratory Test Reports: Submit copies of laboratory test reports for materials and mix design tests
- D. Delivery Tickets: Furnish to ENGINEER copies of all weighmaster certificate delivery tickets for each load of concrete delivered to the site. Provide items of information as specified in ASTM C94, Section 16. Delivery tickets shall be signed by a Certified Weighmaster.

1.5 QUALITY ASSURANCE

- A. Tests for Concrete Materials: Submit written reports to ENGINEER, for each material sampled and tested, prior to the start of Work. Provide the Project identification name and number, date of report, name of CONTRACTOR, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.
- B. If the concrete mix designs specified herein have not been used previously by the ready-mix supplier, mix proportions and concrete strength curves for regular cylinder tests shall be established by an approved ready-mix supplier or an independent testing laboratory based on the relationship of 7, 14 and 28 day strengths versus slump values of 2, 4 and 6 inches, all conforming to these Specifications. A laboratory, independent of the ready-mix supplier, shall be required to prepare and test all concrete cylinders. The costs for preparation of mix designs, not previously used by the ready-mix supplier, and testing of concrete and materials shall be borne by CONTRACTOR.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement:
 - 1. Portland cement, ASTM C150, Type II; or blended hydraulic cement, ASTM C595, Type 1P (MS).
 - 2. Do not use cement which has deteriorated because of improper storage or handling.
- B. Aggregates: ASTM C33 and as herein specified.

03 30 03-2
Cast-in-Place Concrete

1. Do not use aggregates containing soluble salts, substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed concrete surfaces.
 2. Fine Aggregate: Provide clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
 3. Coarse Aggregate: Provide clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - a. Crushed stone, processed from natural rock or stone.
 - b. Coarse Aggregate Size: Size to be ASTM C33, Nos. 57 or 67, except that No. 467 may be used for footings, foundation mats and walls 16 inches or greater in thickness.
- C. Water: Clean, free from injurious amounts of oils, acids, alkalis, organic materials or other substances that may be deleterious to concrete or steel.

2.2 CONCRETE ADMIXTURES

- A. Provide admixtures produced by established reputable manufacturers, and use in compliance with the manufacturer's printed instruction. Do not use admixtures that have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by ENGINEER.
- B. Air-Entraining Admixtures: ASTM C260.
1. Product and Manufacturer: Provide one of the following:
 - a. Sika AER, as manufactured by Sika Corporation.
 - b. MasterAir AE 200, as manufactured by BASF.
 - c. Daravair, as manufactured by W.R. Grace & Conn.
 - d. Or approved equal.
- C. High-Range Water-Reducing Admixture ("Superplasticizer"): ASTM C494, Type F/G.
1. Superplasticizer shall be used in all Class A Concrete. Do not use high range water-reducing admixture containing more chloride ions than are contained in municipal drinking water. Add only at the job site to concrete in compliance with the manufacturer's printed instruction.
 2. Product and Manufacturer: Provide one of the following:
 - a. Sikament 320, as manufactured by Sika Corporation.
 - b. MasterGlenium, as manufactured by BASF.
 - c. Daracem-100, as manufactured by W.R. Grace & Conn.
 - d. Or approved equal.
- D. Water-Reducing Admixture: ASTM C 494, Type A.
1. A water-reducing, aqueous solution of a modification of the salt of polyhydroxylated organic acids. Do not use admixture containing any lignin, nitrates or chlorides added during manufacture.
 2. Product and Manufacturer: Provide one of the following:
 - a. Eucon WR-75, as manufactured by The Euclid Chemical Company.
 - b. MasterPozzoloth, as manufactured by BASF.
 - c. WRDA series, as manufactured by W.R. Grace & Conn.
 - d. Or approved equal.

- E. Pozzolanic Admixtures:

03 30 03-3
Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

1. Pozzolanic admixtures shall not be used in structures with concrete in contact with potable water, but may be used in other concrete.
 2. Provide Mineral admixtures, when used, meeting the requirements of ASTM C618 Class F.
 3. A substitution by weight, of the portland cement by pozzolan, so that the total tricalcium aluminate content of the resulting cement plus pozzolan is not greater than 8%, will be considered. However, the pozzolan shall not exceed 20% by weight of the cement plus pozzolan.
- F. Set-Control Admixtures: ASTM C494, as follows:
1. Type B, Retarding.
 2. Type C, Accelerating.
 3. Type D, Water-reducing and Retarding.
 4. Type E, Water-reducing and Accelerating.
 5. Type F, Water-reducing, high range admixtures.
 6. Type G, Water-reducing, high range, and retarding admixtures.
- G. Color Pigments:
1. Color pigments for colored concrete must be of iron oxides complying with ASTM C979.
- H. Crystalline Waterproofing Additive:
1. Xypex Admix C-500 by Xypex Chemical Corporation.
 2. Or approved equal
- I. Calcium Chloride: Do not use calcium chloride in concrete, unless otherwise authorized in writing by ENGINEER. Do not use admixtures containing calcium chloride where concrete is placed against galvanized steel.

2.3 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes of concrete. Mixes subject to the following limitations:
1. Class A Concrete
 - a. Specified 28-day Compressive Strength: 4,000 psi minimum.
 - b. Air content: 5% $\pm$ 1%. For concrete placed at least 2 feet below the adjacent grade, an air-entraining admixture is not required unless otherwise specified.
 - c. Slump, before addition of superplasticizer: 3½ inches $\pm$ ½ inches
 - d. Slump, after addition of superplasticizer: 8-inch maximum

Coarse Aggregate Size	Cementitious Content-Pounds Per Cubic Yard	Water-Cement Ratio by Weight
¾"	625 min, 800 max	0.375
1"	600 min, 800 max	0.385
1 ½"	590 min, 800 max	0.400

- e. Use superplasticizer in all Class A Concrete. Use water reducers in combination with superplasticizers as required for mixing.
2. Class B Concrete
 - a. Specified 28-day Compressive Strength: 2,500 psi.

03 30 03-4
Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

- b. Maximum Water-Cement Ratio by Weight: 0.49.
 - c. Slump: 3-inch Minimum, 5-inch Maximum.
- B. Use an independent testing facility acceptable to ENGINEER for preparing and reporting proposed mix designs.
- C. Admixtures:
 - 1. Use air-entraining admixture in all concrete, except interior slabs subject to abrasion, unless otherwise shown or specified. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content within the prescribed limits.
 - 2. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control.
- D. Colored Concrete:
 - 1. The dosage of colored pigments for colored concrete must not exceed 10 percent by weight of cementitious materials in the concrete mix design.
 - 2. When test panels are specified, cementitious materials and aggregates from the same sources used in the authorized test panel must be used for the colored concrete in the completed work.

2.4 EPOXY BONDING AGENT

- A. For use in all dry-packed holes, concrete repair and for unplanned cold-joints.
- B. Provide an epoxy-resin bonding agent, two component, polysulfide type.
- C. Product and Manufacturer: Provide one of the following:
 - 1. Sikadur 32, Hi-Mod LPL, as manufactured by Sika Corporation.
 - 2. Eucopoxy LPL, as manufactured by the Euclid Chemical Company.
 - 3. Or approved equal.

2.5 CONCRETE CURING MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 10 ounces per square yard and complying with AASHTO M182, Class 3.
- B. Moisture-Retaining Cover: One of the following, complying with ASTM C171.
 - 1. Waterproof paper.
 - 2. Polyethylene film.
 - 3. White burlap-polyethylene sheet.
- C. Curing Compound: ASTM C309 Type 1-D (water retention requirements):
 - 1. Product and Manufacturer: Provide one of the following:
 - a. Super Aqua Cure VOX, as manufactured by The Euclid Chemical Company.
 - b. Sealtight 1100, as manufactured by W.R. Meadows, Incorporated.
 - c. Or approved equal.
- D. Concrete Densifier and Chemical Hardener (Surface Applied)
 - 1. Product and Manufacturer: Provide one of the following:

03 30 03-5

Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

- a. LS, as manufactured by Consolideck.
- b. Liqui-Hard, as manufactured by W. R. Meadows.
- c. Duro-Nox LS, as manufactured by Nox-Crete.
- d. Or approved equal.

2.6 EMBEDDED ITEMS

- A. Provide and install items such as plates, angles, inserts, bolts and similar items not specified elsewhere under this Section. Carbon steel embedded items shall be hot dip galvanized after fabrication.
- B. Abrasive Stair Nosings
 - 1. Provide single-component stair nosing
 - 2. 3-inch width
 - 3. Aluminum Extrusion, with provisions for anchoring into concrete
 - 4. Extruded with multiple channels, dovetail shaped, filled with aluminum oxide grit set in epoxy resin
 - 5. Designed for installation before concrete sets, at the front edge of the stair
 - 6. Provide continuous stair nosings, width of stairway less 3 inches on each side. No splices in stair nosings.
 - 7. Manufacturers/Models:
 - a. Balco; Model R-315P
 - b. Babcock Davis; Model BSTTB
 - c. Or Equal

PART 3 - EXECUTION

3.1 CONCRETE MIXING

- A. Provide concrete produced by the ready-mixed process.
- B. Comply with the requirements of ASTM C 94, and as herein specified. Proposed changes in mixing procedures, other than herein specified, must be accepted by ENGINEER before implementation.
 - 1. Plant equipment and facilities: Conform to National Ready- Mix Concrete Association "Plant and Delivery Equipment Specification."
 - 2. Mix concrete in revolving type truck mixers that are in good condition and which produce thoroughly mixed concrete of the specified consistency and strength.
 - 3. Do not exceed the proper capacity of the mixer.
 - 4. Mix concrete for a minimum of two minutes after arrival at the job site, or as recommended by the mixer manufacturer.
 - 5. Mix concrete during transit only as recommended by the mixer manufacturer.
 - 6. Mix at proper speed until concrete is discharged.
 - 7. Maintain adequate facilities at the job site for continuous delivery of concrete at the required rates.
 - 8. Provide access to the mixing plant for ENGINEER at all times.

03 30 03-6
Cast-in-Place Concrete

3.2 TRANSPORTING CONCRETE

- A. Transport and place concrete not more than 90 minutes after water has been added to the dry ingredients or before 250 revolutions of the drum or blades, whichever occurs first.
- B. If an admixture is used to retard the set time and the concrete temperature does not exceed 85 degrees F, the travel and placing time may be extended to 120 minutes or 300 revolutions of the drum or blades, whichever occurs first.
- C. Take care to avoid spilling and separation of the mixture during transportation.
- D. Do not place concrete in which the ingredients have been separated.
- E. Do not retemper partially set concrete.
- F. Use suitable and approved equipment for transporting concrete from mixer to forms.

3.3 CONCRETE PLACEMENT

- A. General: Place concrete continuously so that no concrete will be placed on concrete, which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as specified in Section 03 15 16, Concrete Joints. Deposit concrete as nearly as practical in its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure that will cause segregation.
 - 1. Screed concrete that is to receive other construction to the proper level to avoid excessive skimming or grouting.
 - 2. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the job site and dispose of it in an acceptable location.
 - 3. Do not place concrete until all forms, bracing, reinforcement, and embedded items are in final and secure position.
 - 4. Do not place in cold weather, unless adequate precautions are taken against frost action.
 - 5. Do not place footings, piers or pile caps on frozen soil.
 - 6. Unless otherwise approved, place concrete only when ENGINEER is present.
 - 7. Allow a minimum of 3 days of curing before placing new concrete against a slab or wall already in place.
- B. Concrete Conveying:
 - 1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practical by methods that will prevent segregation and loss of concrete mix materials.
 - 2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, ice and other deleterious materials.
 - 3. Pumping concrete is permitted, however do not use aluminum pipe for conveying.

03 30 03-7

Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

C. Placing Concrete into Forms:

1. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place concrete at such a rate that concrete that is being integrated with fresh concrete is still plastic.
2. Do not permit concrete to free fall within the form from a distance exceeding 8 feet, except as noted in Section 03 11 03, Concrete Formwork. Use "elephant trunks" or "wall pipes" to prevent free fall and excessive splashing on forms and reinforcement.
3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.
4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the applicable recommended practices of ACI 309. Vibration of forms and reinforcing will not be permitted.
5. Vibrators shall have a frequency of at least 8,000 vpm, with amplitude required to consolidate the concrete in the section being placed. At least one stand-by vibrator in operable condition shall be at the placement site prior to initiating placement of the concrete.
6. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.
7. The forms shall contain sufficient windows or be limited in height to allow visual observation of the concrete and the vibrator operators shall be required to see the concrete being consolidated to ensure good quality workmanship or the CONTRACTOR shall have a person who is actually observing the vibration of the concrete at all times and advising the vibrator operators of any changes needed to assure complete consolidation.
8. Do not place concrete in beam and slab forms until the concrete previously placed in columns and walls is no longer plastic.
9. Force concrete under pipes, sleeves, openings and inserts from one side until visible from the other side to prevent voids.

D. Placing Concrete Slabs and Footings:

1. Deposit and consolidate concrete in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Consolidate concrete placed in beams and girders of supported slabs, and against bulkheads of slabs on ground, as specified for formed concrete structures.
4. Bring surfaces to the correct level. Smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the surfaces prior to beginning finishing operations.

E. Bonding for Next Concrete Pour: Per Section 03 15 16, Concrete Joints.

03 30 03-8
Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

F. Quality of Concrete Work:

1. Make all concrete solid, compact and smooth, and free of laitance, cracks and cold joints.
2. All concrete for liquid retaining structures, and all concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
3. Cut out and properly replace to the extent ordered by ENGINEER, or repair to the satisfaction of ENGINEER, surfaces which contain cracks or voids, are unduly rough, or are in any way defective. Thin patches or plastering will not be acceptable.
4. Repair all leaks through concrete, and cracks, holes or other defective concrete in areas of potential leakage and make watertight.
5. Repair, remove, and replace defective concrete as ordered by ENGINEER at no additional cost to OWNER.

G. Cold Weather Placing:

1. Protect all concrete Work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.
2. When the air temperature has fallen to or may be expected to fall below 40°F, provide adequate means to maintain the temperature, in the area where concrete is being placed, at between 50°F and 70°F for at least seven days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Maintain the heat and protection, if necessary, to ensure that the ambient temperature does not fall more than 30°F in the 24 hours following the seven-day period. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.
3. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55°F and not more than 85°F at point of placement.
4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost and ice before placing concrete.
5. When temperatures are expected to be below 32°F the night before the concrete is placed, then all reinforcing steel, forms and the ground shall be preheated, for a minimum of 12 hours, under a minimum temperature of 50°F.
6. Do not use salt and other materials containing antifreeze agents or chemical accelerators, or set-control admixtures, unless approved by ENGINEER, in mix designs.
7. Weather predictions made by the nearest NOAA station, and corrected for the local elevation and environmental conditions, may be used to determine whether cold weather protection shall be required. Thermometers will be used by ENGINEER and these readings shall determine whether cold weather protection shall be required and whether cold weather protection is adequate.

H. Hot Weather Placing:

1. When hot weather conditions exist as any combination of high air temperature, low relative humidity and wind velocity that would seriously impair the quality and strength of concrete, place concrete as recommended by ACI 305 and as herein specified.

03 30 03-9

Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 85°F. No concrete shall be placed if its temperature exceeds 90°F. Mixing water may be chilled, or chopped ice may be used, or liquid nitrogen may be added. Ice, when introduced into the mixer shall be in such form that it will be completely melted and dispersed throughout the mix at the completion of the mixing time. The addition of ice shall not increase the specified water to cement ratio.
 3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 4. Thoroughly wet forms before placing concrete. Forms shall be free of standing water when concrete is placed.
 5. Do not use set-control admixtures, unless approved by ENGINEER in mix designs.
 6. Fog spray shall be used during finishing operations whenever necessary to avoid surface plastic shrinkage cracking. Fog spray shall also be used after finishing and before the specified curing is commenced to avoid surface plastic shrinkage cracking.
 7. Obtain ENGINEER'S approval of other methods and materials proposed for use.
- I. Removal of Forms:
1. The CONTRACTOR shall be responsible for all damage resulting from improper and premature removal of forms. Satisfy all applicable OSHA requirements with regard to safety of personnel and property.
 2. Forms and shoring for elevated structural slabs or beams shall remain in place in accordance with ACI 318, Chapter 6, and until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders unless noted otherwise in Section 03 11 03, Concrete Formwork. Removal of all supports prior to obtaining adequate field cured cylinder results and reshoring shall not be permitted.
- J. Backfill Against Walls:
1. Do not place backfill against walls until the concrete has obtained a compressive strength equal to the specified 28-day compressive strength. Where backfill is to be placed on both sides of the wall, the backfill shall be placed simultaneously on both sides to prevent differential pressures.
 2. Since the walls of some structures are laterally restrained or supported by suspended slabs and/or slabs on grade and are not designed as cantilever retaining walls, the CONTRACTOR shall submit a schedule of wall shoring, bracing, and backfilling that is coordinated with the concrete curing, test cylinder reports and the design assumptions and obtain a review from the ENGINEER prior to proceeding.
- K. Patching:
1. Patching of concrete shall provide an acceptable and structurally sound surface finish uniform in appearance or the CONTRACTOR shall upgrade the finish by other means at no additional cost.
 2. Tie Holes: All tie holes, except where sealant is indicated, shall be filled with dry pack nonshrink grout. White cement shall be added as needed so the color of grout after curing matches the color of adjacent concrete. Tie holes shall be thoroughly sandblasted or roughened. Flush the patch area with water and allow to dry. Coat the surface of the existing concrete with an approved bonding agent prior to filling with nonshrink grout. Complete the repair in the time duration specified by the bonding agent manufacturer. The grout shall be rammed into place in thin layers

03 30 03-10
Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

and leveled to the plane of the surrounding concrete. Cure in accordance with the manufacturer's recommendations.

3. Defective Areas: Remove all defective concrete such as honeycombed areas and rock pockets out to sound concrete. Small shallow holes caused by air entrapment at the surface of the forms shall not be considered defects unless the amount is so great as to be considered not the standard of the industry and due primarily of poor workmanship. If chipping is required, the edges shall be perpendicular to the surface. Feather edges shall not be permitted. The defective area shall be filled with a nonshrink, nonmetallic, grout. Use an approved bonding agent on horizontal patches prior to placing nonmetallic, non shrink grout. Since some bonding agents may not be compatible for some vertical surface patching techniques, demonstrate all methods for repair of vertical surfaces using the actual materials, methods, and curing procedures required by the manufactures of the materials on the project site. The CONTRACTOR shall consult with representatives of the bonding agent manufacturer and the nonshrink grout manufacturer, and these representatives shall be onsite and assist in the demonstration.
4. Blockouts at Pipes or Other Penetrations: Conform to details shown or submit proposed blockouts for review. Use nonshrink, nonmetallic grout.

3.4 FINISH OF FORMED SURFACES

A. Rough Form Finish:

1. Standard rough form finish is with concrete surface having the texture imparted by the form material, with tie holes and defective areas repaired and patched with mortar of 1 part cement to 1½ parts sand & all fins and other projections exceeding ¼ inches in height rubbed down or chipped off.
2. Use rough form finish for the following:
 - a. Exterior vertical surfaces up to 1 foot below grade.
 - b. Interior exposed vertical surfaces of liquid containers up to 1 foot below liquid level.
 - c. Interior and exterior exposed beams and undersides of slabs.
 - d. Other areas shown.

B. Smooth Form Finish:

1. Produce smooth form finish (Class A, as defined by ACI-347) by selecting form materials that will impart a smooth, hard, uniform texture. Arrange panels in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas as above with all fins or other projections completely removed and smoothed.
2. Use smooth form finish for surfaces that are to be covered with a coating material. The material may be applied directly to the concrete or may be a covering bonded to the concrete such as waterproofing, damp proofing, painting or other similar system.

C. Smooth Rubbed Finish:

1. Provide smooth, rubbed finish to concrete surfaces which have received smooth form finish as follows:
 - a. Rubbing of concrete surfaces not later than the day after form removal.
 - b. Moistening of concrete surfaces and rubbing with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

03 30 03-11

Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

2. Except where surfaces have been previously covered as specified above, use smooth rubbed finish for the following:
 - a. Interior exposed walls and other vertical surfaces.
 - b. Exterior exposed walls and other vertical surfaces down to 1 foot below grade.
 - c. Interior and exterior horizontal surfaces, except exterior exposed slabs and steps.
 - d. Interior exposed vertical surfaces of liquid containers down to 1 foot below liquid level.
 - e. Other areas shown.
- D. Sack Rubbed Finish:
1. Before applying the sack-rubbed finish, fill all tie rod holes and large cavities and remove or correct all fins and irregularities as specified in the Smooth Rubbed Finish.
 2. Produce a sack rubbed finish by rubbing the concrete surface with a clean rubber float or wad of burlap and mortar. Use mortar made of premixed sacking mortar or one part portland cement and 1.5 parts, by volume, clean sand passing a No. 16 sieve, mixed with sufficient water to provide a consistency equal to that of a thick cream. Use the same type and brand cement as used in the concrete or colored premixed sacking mortar. The mortar finish color shall match the surrounding concrete. If necessary, blend white cement into the mortar to match the surrounding concrete surface.
 3. Thoroughly wet the surface of the concrete and then perform sack rubbing while the surface is damp but not wet. Thoroughly rub the mortar over the area with a rubber float or wad of burlap, filling all pits. While the mortar is still plastic in the pits, rub the surface with the rubber float or burlap using a dry mix of the above proportions, removing all excess plastic material and placing enough dry material in the pits to stiffen and solidify the mortar, then finish the mortar fillings flush with the surface. At the end of the rubbing, no mortar or material shall remain on the surface other than that within the pits.
 4. Ensure the completed surface is free of surface voids and blemishes, and is uniform in appearance and texture, except for the difference in texture between the filled voids and the remainder of the surface.
 5. A thorough wash-down with stiff bristle brushes shall follow the final bagging or stoning operation. No extraneous materials shall remain on the surface of the wall. The wall shall be sprayed with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after the application.
 6. Use a sack rubbed finish for the following areas or as indicated in the Drawings:
 - a. Interior exposed walls and other vertical surfaces.
 - b. Exterior exposed walls and other vertical surfaces down to 1 foot below grade.
 - c. Interior and exterior horizontal surfaces, except exterior exposed slabs and steps.
 - d. Or other areas shown.
- E. Related Unformed Surfaces:
1. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.5 MONOLITHIC SLAB FINISHES

A. Float Finish:

03 30 03-12
Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently. Check and level the surface plane to a tolerance not exceeding $\frac{1}{4}$ inch in 10 feet when tested with a 10-foot straightedge. Cut down high spots and fill all low spots. Uniformly slope surface to drains as shown. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.
 2. Use float finish for the following:
 - a. Interior horizontal surfaces of liquid containers, except those to receive grout topping.
 - b. Exterior below grade horizontal surfaces.
 - c. Surfaces to receive additional finishes, except as shown or specified.
- B. Trowel Finish:
1. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
 2. Consolidate the concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding $\frac{1}{8}$ inch in 10 feet when tested with a 10-foot straight edge. Grind smooth surface defects that would telegraph through applied floor covering system.
 3. Use trowel finish for the following:
 - a. Interior exposed slabs, unless otherwise shown or specified.
 - b. Slabs to receive resilient floor finishes.
- C. Non-Slip Broom Finish:
1. Immediately after trowel finishing, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use fiber-bristle broom, unless otherwise directed. Coordinate the required final finish with ENGINEER before application.
 2. Use Non-Slip Broom Finish for the following:
 - a. Exterior exposed horizontal surfaces subject to light foot traffic.
 - b. Interior and exterior concrete steps and ramps.
 - c. Horizontal surfaces which will receive a grout topping or a concrete equipment base slab.

3.6 CONCRETE CURING AND PROTECTION

- A. General:
1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.
 2. Start initial curing after placing and finishing concrete as soon as free moisture and bleed water sheen has disappeared from the concrete surface. Keep concrete continuously moist during initial curing.
 3. Begin final curing procedures immediately following initial curing and before the concrete has dried. The total curing duration shall not be less than ten (10) days. For concrete sections over 30-inch thick, continue curing for an additional seven (7) days, minimum. Avoid rapid drying at the end of the final curing period.

03 30 03-13

Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

B. Use one of the following methods as approved by ENGINEER:

1. Walls:

- a. Method 1: Leave concrete forms in place and keep entire surfaces of forms and exposed concrete surfaces wet for the entire curing duration. If forms are loosened and the contact between the concrete surface and forms is broken then the entire wall shall be wet cured.
- b. Method 2: Continuously sprinkle or fog with water 100 percent of the exposed surfaces for the curing duration immediately after removal of forms.
- c. Method 3: When approved by ENGINEER and as noted below, apply curing compound immediately after removal of forms.

2. Slab and Curbs:

- a. Method 1: Protect surface by water ponding for the entire curing duration.
- b. Method 2: Cover concrete surfaces and exposed edges with the specified absorptive cover, thoroughly saturating the cover with water, and keeping the absorptive cover continuously wet with sprinklers or porous hoses during the curing duration. Lap adjacent absorptive cover sections 3-inches minimum.
- c. Method 3: Cover the concrete surfaces and exposed edges with the specified moisture-retaining cover during the curing duration. Seal edges and seams with waterproof tape, adhesive or sand berm. Water must be introduced between the moisture-retaining cover and the concrete surface whenever moist drops cannot be detected on the concrete side of the cover or the concrete surface is noticeably dry.
- d. Method 4: Cover all exposed surfaces with 1-inch minimum layer of wet sand, earth, or sawdust and keep continuously wet for the curing duration.
- e. Method 5: Continuously sprinkle or fog exposed surfaces for the curing duration.
- f. Method 6: When approved by ENGINEER and as noted below, apply liquid curing compound immediately after final finishing when surface will no longer be damaged by traffic necessary to apply curing compound.

C. Liquid curing compound:

1. Apply the specified curing compound to concrete surfaces when permitted by ENGINEER. Slabs to receive terrazzo floors, concrete/grout topping or ceramic tile, concrete of water bearing structures, and concrete that will receive coatings shall not be cured with liquid curing compound. The compounds shall be applied by power spray equipment in accordance with the manufacturer's directions. Recoat areas, which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period. Remove curing compound from exposed surfaces at the end of the curing duration. For concrete surfaces, which will be in contact with potable water, the manufacturer shall certify that the curing compound used is NSF 61 approved.

D. Temperature of Concrete During Curing:

1. When the nighttime low temperature may drop to 40°F or below, maintain the concrete temperature between 50°F and 70°F continuously throughout the curing period, by heating, covering, insulation or housing as required.
2. When the daytime high temperature may rise to 90°F or above, maintain the concrete temperature at a minimum and reduce temperature variations by providing moist curing continuously for the concrete curing period.
3. During either of the conditions specified above, the minimum curing time shall be 10 days (240 hours), after which coverings, housings, and insulation shall remain on the

03 30 03-14

Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

work for an additional 3 days, to allow gradual temperature equalization with the atmosphere.

- E. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.7 FIELD QUALITY CONTROL

- A. The CONTRACTOR will employ a testing laboratory to perform field quality control testing. ENGINEER will direct the number of tests and cylinders required. Furnish all necessary assistance required by ENGINEER.
- B. Quality Control Testing During Construction:
 - 1. Perform sampling and testing for field quality control during the placement of concrete, as follows:
 - a. Sampling Fresh Concrete: ASTM C172.
 - b. Slump: ASTM C143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens.
 - c. Air Content: ASTM C231; one for the first concrete load, and one for every two concrete loads thereafter, or when required by an indication of change. Adjust mix if test results are unsatisfactory and resubmit for ENGINEER'S approval.
 - d. Compressive Strength Tests: ASTM C39; one set of 4 standard compression cylinders for each 100 cubic yards or fraction thereof, of each mix design placed in any one day; 1 specimen tested at 7 days, and 2 specimens tested at 28 days, 1 held. Cast, store and cure specimens as specified in ASTM C31.
 - 1) Adjust mix if test results are unsatisfactory and resubmit for ENGINEER'S approval.
 - 2) Concrete that does not meet the strength requirements is subject to rejection and removal from the Work, or to other such corrective measures as directed by ENGINEER, at the expense of CONTRACTOR.
 - e. Concrete Temperature: Test each time a slump test is made.
 - 2. Where questionable field conditions may exist during placing concrete or immediately thereafter, strength tests of specimens cured under field conditions will be required by ENGINEER to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded at the same time and from the same samples as the laboratory cured specimens.
 - a. Provide improved means and procedures for protecting concrete when the 28-day compressive strength of field- cured cylinders is less than 85% of companion laboratory-cured cylinders.
 - b. When laboratory-cured cylinder strengths are appreciably higher than the minimum required compressive strength, field-cured cylinder strengths need not exceed the minimum required compressive strength by more than 500 psi even though the 85 percent criterion is not met.
 - 3. The testing laboratory shall submit certified copies of test results directly to ENGINEER and CONTRACTOR after tests are made.
- C. Evaluation of Quality Control Tests:

03 30 03-15

Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

1. Do not use concrete delivered to the final point of placement that has slump or temperature outside the specified values, nor that which is older than specified in section 3.2.
 2. Compressive strength tests for laboratory-cured cylinders will be considered satisfactory if the averages of all sets of three consecutive compressive strength tests results equal or exceed the 28 day design compressive strength of the type or class of concrete; and, no individual strength test falls below the required compressive strength by more than 500 psi.
 3. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength and subject to replacement, reconstruction or to other action approved by ENGINEER.
- D. Testing Concrete Structure for Strength:
1. When there is evidence that the strength of the in-place concrete does not meet specification requirements, provide the services of a concrete testing service to take cores drilled from hardened concrete for compressive strength determination at no additional expense to OWNER. Provide tests complying with ASTM C42 and the following:
 - a. Take at least three (3) representative cores from each member or suspect area at locations directed by ENGINEER.
 - b. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85% and no single core is less than 75% of the 28 day required compressive strength.
 - c. Report test results, in writing, to ENGINEER on the same day that tests are made. Include in test reports the Project identification name and number, date, name of CONTRACTOR, name of concrete testing service, location of test core in the structure, type or class of concrete represented by core sample, nominal maximum size aggregate, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plane of the concrete as placed, and the moisture condition of the core at time of testing.
 2. Fill core holes solid with non-shrink, high strength grout, and finish to match adjacent concrete surfaces.
- E. Water Leakage Tests for All Water-Holding Structures:
1. All water-holding structures shall be subjected to leakage tests after the concrete has been cured and obtained its design strength, and before backfill, brick facing, or other work which will cover the concrete surfaces of the walls is begun. Water leakage tests shall be conducted by the CONTRACTOR as follows:
 - a. All water-holding structures shall be filled with water to the maximum liquid level shown on the Drawings prior to leak testing at a rate less than 4 ft/hr. After these structures have been kept full for 3-days, it will be assumed for the purpose of the test that the absorption of moisture by the concrete in the basin is complete. All valves and gates to the structure shall then be closed and the change in water surface measured over a 48-hour period. The vertical distance to the water surface shall be measured to within 1/16-inch from a fixed point on the containment structure above the water surface. Measurements shall be recorded at 24-hour intervals.
 - b. During the test period, all exposed portions of the structure shall be examined for dampness or leaks and all visible leaks or damp spots shall be marked; such

03 30 03-16
Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

leaks or damp spots shall be later patched or corrected in a manner acceptable to the ENGINEER prior to additional leakage testing. If the drop in water surface in the 48-hour period exceeds 0.05% of the normal volume of liquid contained in the water-holding structure, after accounting for evaporation, precipitation and temperature in open basins, or if damp spots or any seepage is present on the walls or other areas exposed to view where moisture can be picked up on a dry hand, the leakage shall be considered excessive and the leakage test will be considered to have failed. A floating, restrained, partially filled, calibrated, open container for evaporation and precipitation measurement should be positioned in open containment structures, and the water level in the container recorded. Determination of evaporation by a shallow pan-type measuring device is discouraged as the heating of the bottom of a shallow pan can cause accelerated evaporation of water when compared with that taking place from a deep containment structure.

- 1) Wet areas on top of wall footings shall not be considered cause of a qualitative failure of the leakage test unless the water can be observed to be flowing.
- c. If the leakage is excessive, and if damp spots and observed seepage is present on exposed surfaces, the water-holding structure shall be drained, all leaks and damp spots previously marked shall be patched, and the necessary repairs made, and the basin shall be retested. The CONTRACTOR's method of repair shall be subject to the requirements of these specifications and submitted for review and approval by the ENGINEER.
- d. The water-holding structure shall then be refilled and again tested for leakage and this testing and repair process shall be repeated as many times as necessary until the leakage test passes. This process shall be continued until the drop in water surface in specified test period with the basin full is less than the quantity specified above and all damp spots and seepage disappears when the structures are full of water. All repairs of faulty workmanship and materials, and additional tests, shall be made by the CONTRACTOR in an acceptable manner, at no additional cost to the OWNER. Both the correction for excessive leakage and the removal of the damp or wet spots on exposed surfaces shall be required to pass the leakage test.
- e. The purpose of this test is to determine the integrity of the finished concrete and to show that the exposed wall surfaces are visually acceptable. Therefore, all other equipment, e.g., stop gates, sluice gates, etc. or temporary bulkheads, should be made watertight prior to the test.
- f. As an alternative to having watertight bulkheads, gates or valves, the CONTRACTOR shall accurately measure the leakage through gates, valves, and bulkheads with methods acceptable to the ENGINEER.
- g. An assumed leakage through gates and valves based on the manufacturer's recommendations is not acceptable.

3.8 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for the passage of work by other contractors, unless otherwise shown or directed, after the work of other contractors is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the Work.

03 30 03-17

Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

B. Curbs:

1. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
2. Exterior curbs shall have rubbed finish for vertical surfaces and a broomed finish for top surfaces.

C. Equipment Bases:

1. Unless specifically shown otherwise, provide concrete bases for all pumps and other equipment. Construct bases to the dimensions shown, or as required to meet manufacturers' requirements and drawing elevations. Where no specific elevations are shown, bases shall be 6-inches thick and extend 3-inches outside the metal equipment base or supports. Bases to have smooth trowel finish, unless a special finish such as terrazzo, ceramic tile or heavy duty concrete topping is required. In those cases, provide appropriate concrete finish.
2. Include all concrete equipment base work not specifically included under other Sections.
3. In general, place bases up to 1-inch below the metal base. Properly shim equipment to grade and fill 1-inch void with non-shrink grout as specified in Section 03 60 03, Grout.

D. Installation of embedded items

1. Install all embedded items prior to concrete placement, or, if necessary, as soon after concrete placement as possible, before concrete is set.
2. Use temporary support and bracing to keep embedded items in place while concrete cures.
3. Protect all embedded items from damage during concrete installation.

3.9 CONCRETE REPAIRS

A. Repair of Formed surfaces:

1. Repair exposed-to-view formed concrete surfaces that contain defects which adversely affect the appearance of the finish. Surface defects that require repair include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolts; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.
2. Repair concealed formed concrete surfaces that may contain defects that adversely affect the durability of the concrete. Surface defects that require repair include cracks in excess of 0.01-inch wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corner.
3. Repair structural cracks and cracks in water-holding structures.

B. Method of Repair of Formed Surfaces:

1. Repair and patch defective areas with cement mortar immediately after removal of forms and as directed by ENGINEER.
2. Cut out honeycomb, rock pockets, voids over 1/2-inch diameter, and holes left by tie rods and bolts, down to solid concrete but, in no case, to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Before placing the

03 30 03-18

Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

cement mortar, thoroughly clean, dampen with water, and brush-coat the area to be patched with the specified bonding agent.

- a. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, the patching mortar color will match the color of the surrounding concrete. CONTRACTOR shall impart texture to repaired surfaces to match texture of existing adjacent surfaces. Provide test areas at inconspicuous locations to verify mixture, texture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.
3. Cracks which require repair shall be pressure grouted, epoxy injected, using one of the following in accordance with Section 03 01 06, Crack Repair by Epoxy Injection. Apply in accordance with the manufacturer's directions and recommendations.
 - a. Sikadur 35, Hi-Mod L.V. and Sikadur 31, Hi-Mod Gel, as manufactured by Sika Corporation Company.
 - b. Euco Epoxy #452 Epoxy System, as manufactured by The Euclid Chemical Company.
 - c. Or approved equal.
4. Fill holes extending through concrete by means of a plunger- type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure completely filling.
5. Sandblast exposed-to-view surfaces that require removal of stains, grout accumulations, sealing compounds, and other substances marring the surfaces. Use sand finer than No. 30 and air pressure from 15 to 25 psi.

C. Repair of Unformed Surfaces:

1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.
2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.
3. Repair finish of unformed surfaces that contain defects which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
4. Repair structural cracks and cracks in water-holding structures.

D. Methods of Repair of Unformed Surfaces:

1. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
2. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Use one of the following. Apply in accordance with the manufacturer's directions and recommendations.
 - a. Euco Poly-Patch, as manufactured by The Euclid Chemical Company.
 - b. Sikatop 122, as manufactured by Sika Corporation.
 - c. Or approved equal.

03 30 03-19

Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

3. Repair defective areas, except random cracks and single holes not exceeding 2-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least $\frac{3}{4}$ -inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with the specified bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same materials and proportions to provide concrete of the same type or class as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
 4. Repair isolated random cracks, as approved by ENGINEER, and single holes not over 2-inch diameter, by the dry-pack method. Groove the top of cracks, and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with the specified bonding agent. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of 1 part portland cement to 2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.
 5. Cracks which extend through the full member section, or any cracks determined by ENGINEER to require pressure grouting repair, shall be pressure grouted, epoxy injected, using one of the following in accordance with Section 03 01 06, Crack Repair By Epoxy Injection. Apply in accordance with the manufacturer's directions and recommendations.
 - a. Sikadur 35, Hi-Mod L.V. and Sikadur 31, Hi-Mod Gel, as manufactured by Sika Corporation.
 - b. Euco Epoxy #452 Epoxy System, as manufactured by The Euclid Chemical Company.
 - c. Or approved equal.
 6. Assure that surface is acceptable for flooring material to be installed in accordance with manufacturer's recommendations.
- E. Other Methods of Repair:
1. Repair methods not specified above may be used if approved by ENGINEER.

++ END OF SECTION ++

03 30 03-20
Cast-in-Place Concrete

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 03 60 03

GROUT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes epoxy, non-metallic, non-shrink, and ordinary Portland cement-sand grouts.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33, Standard Specification for Concrete Aggregates.
 - 2. ASTM C150, Standard Specification for Portland Cement.
 - 3. ASTM C595, Standard Specification for Blended Hydraulic Cements.
 - 4. ASTM C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout.

1.3 SYSTEM DESCRIPTION

- A. Furnish ordinary cement-sand grout for the following:
 - 1. Foundation grout.
 - 2. Construction joint grout.
 - 3. As shown in the Drawings.
- B. Furnish non-shrink, non-metallic grout for the following:
 - 1. Equipment bases, 25 hp or less.
 - 2. Base plates.
 - 3. Guardrail and railings.
 - 4. Through-bolt and form tie openings.
 - 5. As shown in the Drawings.
- C. Furnish epoxy grout for the following:
 - 1. Equipment bases, 26 hp or more and/or sole plates with vibration, thermal movement, etc.
 - 2. Blockouts for gate guides.
 - 3. Retrofit waterstop installation.
 - 4. As shown in the Drawings.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications and installation instructions for all proprietary materials.
 - 2. Proposed method for keeping existing concrete surfaces wet prior to placing grout.
 - 3. Forming method for fluid grout placements.
 - 4. Curing method for grout.
- B. Laboratory Test Reports and Certificates:
 - 1. For proprietary materials, submit copies of reports on quality control tests.

03 60 03-1
Grout

2. Submit certification that materials meet specification requirements for nonproprietary materials.
3. For ordinary cement-sand grout, copies of grout mix design and laboratory strength test reports.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver grout materials from manufacturers in unopened containers and bearing intact manufacturer's labels.
- B. Storage of Materials: Store grout materials in a dry shelter and protected from moisture.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. High-Strength Epoxy Grout.
 1. Use 100% solids, prepackaged, solvent-free, moisture insensitive, high-strength epoxy grout.
 2. Product and Manufacturer: Provide one of the following:
 - a. E³-HP, as manufactured by The Euclid Chemical Company.
 - b. Sikadur 42 Grout Pak, as manufactured by Sika Corporation.
 - c. Five Star HP Epoxy Grout by Five Star Products, Incorporated.
 - d. Or approved equal.
- B. Non-shrink, Non-metallic Grout:
 1. Prepackaged non-staining cementitious grout which shall meet the minimum requirements of ASTM C1107 and requiring only the addition of water at the jobsite.
 2. Product and Manufacturer: Provide one of the following:
 - a. NS, as manufactured by The Euclid Chemical Company.
 - b. Five Star Grout, as manufactured by Five Star Products, Incorporated.
 - c. Sika Grout 212, as manufactured by Sika Corporation.
 - d. Or approved equal.
- C. Ordinary Cement-Sand Grout: Prepare design mix for ordinary cement grout.
 1. Cement: Portland cement, ASTM C150, Type II; or blended hydraulic cement, ASTM C595, Type 1P.
 2. Aggregates: ASTM C33 and as herein specified.
 - a. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed concrete surfaces.
 - b. Fine Aggregate: Clean, sharp, natural sand, free from loam, clay, lumps or other deleterious substances.
 - 1) Dune sand, bank run sand and manufactured sand are not acceptable.
 - c. Coarse Aggregate: Coarse aggregate not permitted.
 3. Admixtures: Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed instruction. Do not use admixtures that have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by ENGINEER. Refer to Section 03 30 03 - Cast-In-Place Concrete, for additional admixture requirements.

03 60 03-2
Grout

4. Proportioning and Design of Mixes: Mixes are subject to the following limitations:
 - a. Specified 28-day Compressive Strength: 4,000 psi.
 - b. Minimum amount of water necessary for the mixture to flow under its own weight.
 - c. Fine Aggregate meeting ASTM C33.
 - d. Air Content Percentage: $\pm 1.5\%$.
 - e. Minimum Cement Content in Pounds per Cubic Yard: 658.
 - f. Slump at point of placement: 5 inch ± 1 inch.
5. Proportion mix by either laboratory trial batch or field experience methods, using materials to be employed on the Project for grout required. Comply with ACI 211.1 and provide a complete report, from an independent testing laboratory, to ENGINEER, at least 30 days prior to start of Work. Do not begin grout production until ENGINEER has approved mix.
6. Laboratory Trial Batches: When laboratory trial batches are used to select grout proportions, prepare test specimens and conduct strength tests as specified in ACI 301, Chapter 3 - Proportioning.
7. Field Experience Method: When field experience methods are used to select grout proportions, establish proportions as specified in ACI 301, Chapter 4.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and conditions under which grout is to be placed with installer and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. General:
 1. Mix, place and cure grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications, do not proceed until ENGINEER provides clarification.
 2. Manufacturers of proprietary products shall make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions. The cost of this service, if any, shall be borne by CONTRACTOR.
 3. When placing grout conform to temperature and weather limitations in Section 03 30 03, Cast-In-Place Concrete.
- B. Through-bolt and form-tie holes: Fill space with dry pack dense grout hammered in with steel tool and hammer. Coordinate dry pack dense grout application with bonding agent in Section 03 15 16 - Concrete Joints.
- C. Columns, Beams and Equipment Bases: Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material prior to setting base plates and machinery. After shimming columns, beams and equipment indicated to be grouted on the plans to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout.

03 60 03-3
Grout

Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with grout.

- D. Guardrails and Railings: After posts and rails have been properly inserted into holes or sleeves, fill the annular space between posts and cast-in-place sleeves and/or below base plates with non-shrink grout. Bevel grout at juncture with post so that moisture flows away from posts.
- E. Construction Joints: Ordinary cement-sand grout may be used in place of mortar over the contact surface of the old concrete at the interface of horizontal construction joints as outlined in Section 03 15 16, Concrete Joints, and Section 03 30 03, Cast-In-Place Concrete, of these Specifications.
- F. Curing: Cure all grout in accordance with manufacturer's written instructions. Wet cure ordinary cement-sand grout and non-shrink non-metallic grout for a minimum of three (3) days unless directed otherwise by the ENGINEER.

++ END OF SECTION ++

03 60 03-4
Grout

SECTION 05 05 03

MISCELLANEOUS METALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work necessary to furnish and install, complete, fabricated metalwork and castings as shown or as required to secure various parts together and provide a complete installation.

1.2 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for the fabrication and erection of the miscellaneous metal Work. Include plans, elevations and details of sections and connections. Clearly show all field connections. Show anchorage and accessory items.
- B. Product Data: Submit copies of manufacturer's specifications, load tables, dimensions, diagrams, anchor details, and installation instructions for manufactured products.
- C. Samples: Submit representative samples of manufactured products.

1.3 QUALITY ASSURANCE

- A. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.
- B. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units to the extent necessary for shipping limitations. Clearly mark units for reassembly and coordinated installation.
- C. Qualifications: Qualify welding operators in accordance with requirements of current AWS Standard Performance Qualification Procedures in the applicable structural welding code.
 - 1. Qualification Tests: Performed by a recognized testing laboratory.
- D. Certification: Certify welders of structural and reinforcing steel for all positions of welding in accordance with such procedure.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Like Items of Materials: Provide end products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, replacement, and manufacturer's service.

05 05 03-1
Miscellaneous Metals

- B. Lifting Lugs: Provide on equipment and equipment components weighing over 100 pounds.
- C. Furnish miscellaneous items:
 - 1. Miscellaneous metalwork and castings as shown, or as required to secure various parts together and provide a complete installation.
 - 2. Items specified herein are not intended to be all-inclusive. Provide metalwork and castings shown, specified, or which can reasonably be inferred as necessary to complete the project.

2.2 MATERIALS

- A. Carbon steel structural shapes:
 - 1. Wide flange sections: ASTM A992 Grade 50.
 - 2. Steel pipe columns: ASTM A53 Grade B.
 - 3. Hollow Structural Sections (HSS): ASTM A500 Grade B.
 - 4. Plates, Angles, Channels, and S Shapes: ASTM A36.
- B. Stainless Steel:
 - 1. Plates and Sheets: ASTM A240, Type 304L or 316
 - 2. Structural shapes: ASTM A276, A479 or A1069, Type 304L or 316.
 - 3. Fasteners and fittings: ASTM A320, Type 316
 - a. Where stainless steel bolts are in contact with dissimilar metals provide insulating sleeves and phenolic washers to electrically isolate the bolts and nuts.
- C. Aluminum, Structural Shapes and Plates: Alloy 6061-T6, meeting Aluminum Assoc. Specification for Aluminum Structures
- D. Cast Iron: A48, Class 30
- E. Light Gauge Steel Framing:
 - 1. Manufactured by SSMA ICC ESR-3064P, or equivalent, to meet the requirements of AISI S100.
 - 2. ASTM A570 or A446 with a minimum yield strength of 33 ksi for 18 gauge and 20 gauge, 50 ksi for 14 gauge and 16 gauge.
 - 3. Framing members shall have the section properties as listed on the Drawings.
- F. High-Strength Threaded Fasteners: Heavy hexagonal structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium carbon steel bolts, nuts and washers, complying with ASTM A325 or:
 - 2. Quenched and tempered alloy steel bolts, nuts and washers, complying with ASTM A490.
 - 3. Provide two ASTM F436 washers for all bolts.
 - 4. Provide beveled washers at connections of sloped/tapered sections.
 - 5. Unless noted otherwise, high-strength fasteners shall be used for all non-stainless steel fasteners.
- G. Cast-in-Place Anchor Rods:
 - 1. ASTM F1554, Grade 36 with weldability supplement S1, galvanized, unless shown otherwise.

05 05 03-2
Miscellaneous Metals

Washwater Equalizer Tank Replacement Project

2. Provide ASTM F436 washers at all nuts unless shown otherwise.
3. Provide anchor bolt sleeves as required or as shown for location adjustment.
4. Provide stainless steel anchors where shown on the Drawings or listed in another specific specification section.

H. Galvanizing:

1. Zinc coated hardware: ASTM A153.
2. Fabrications: ASTM A123.
3. Members designated as galvanized on the drawings or as directed by ENGINEER shall be galvanized after fabrication in accordance with ASTM A385. Weight of zinc coating shall not be less than 2.5 ounces per square foot of actual surface and have a coating thickness of 0.0042 inch. Coating weight will be subject to verification by ENGINEER. Thickness of coating will be measured by means of a magnetic thickness gauge.
4. Each fabricated assembly shall be totally immersed in the galvanizing bath. The galvanizing procedure shall be such as to avoid distortion of the assembly. Straightening of members after galvanizing will not be permitted. Assemblies shall be held in the galvanizing bath until the temperature of the assembly is equal to the temperature of the bath. All deviations shall require approval by ENGINEER.
5. Any galvanized surface which has the coating removed for any cause shall be touched up with a zinc-rich cold galvanizing compound so that the entire surface has a uniform coating of 2.5 ounces of zinc per square foot.
6. Galvanized work shall be subject to inspection by ENGINEER at any time to ensure strict compliance with this specification. Any areas found to show defects or signs of improper galvanizing application will be rejected. Repairs shall be made by CONTRACTOR without additional cost to OWNER.

I. Surface preparation and Finish:

1. Steel: Where not indicated to be galvanized, steel shall be primed in the shop. Comply with Section 09 91 03, Painting.

2.3 ALUMINUM STAIR TREAD

- A. Extruded bearing bars positioned and locked by cross bars. Treads shall be manufactured with a defined visible abrasive nosing and end plates capable of welding or bolting to stair stringers.
- B. Material:
1. All supports, cross members, etc. shall be aluminum
 2. Bearing bars: Alloy 6061-T6 or Alloy 6063-T6, conforming to ASTM B221.
 3. Fasteners and fittings: ASTM A320, Type 316
 - a. Where stainless steel bolts are in contact with dissimilar metals provide insulating sleeves and phenolic washers to electrically isolate the bolts and nuts.
- C. Manufacturer:
1. Grating Pacific.
 2. Borden Metal Products.
 3. Ohio Grating.

2.4 ANCHOR BOLT SLEEVE

- A. High Density Polyethylene Plastic:

05 05 03-3
Miscellaneous Metals

Washwater Equalizer Tank Replacement Project

1. Single unit construction with deformed sidewalls such that the concrete and grout lock in place.
 2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
 3. Material requirements shall conform to the following:
 - a. Plastic: High density polyethylene.
 - b. Density: 0.956, ASTM D1505.
 - c. Vicant Softening Point: 256°F, ASTM D1525
 - d. Brittleness Temperature: -180°F, ASTM D746
- B. Fabricated Steel Sleeve:
1. Material: A36 steel.
 2. Dimensions, welding, and sizes as shown.

2.5 FABRICATIONS

- A. Miscellaneous Framings and Supports:
1. Fabricate units to the sizes, shapes, and profiles shown, or if not shown, of the required dimensions to receive the adjacent gratings, plates, tanks, doors, or other work to be retained by the framing.
 2. Except as otherwise shown, fabricate from structural shapes, plates, and bars of compatible material, all-welded construction, using mitered corners, welded brackets and splice plates, and a minimum number of joints for field connection. Cut, drill, and tap units to receive hardware and other items to be anchored to the work.
 3. Equip units with integrally welded anchors for casting into concrete or integrating into masonry. Furnish inserts for casting in, if units must be installed after concrete or grout is placed. Anchor spacing shall be 24" on-center, unless otherwise shown.
 4. Galvanize where shown.
- B. Miscellaneous Fabricated Metals:
1. The following additional items are listed as a guide. Some items on list may not be required, and list may not be all-inclusive. Submittal data for materials and products must be approved before they are incorporated in the work.
 - a. Access Walkway
 - b. Aluminum Stairways.
 - c. Float Switch Supports
 - d. Lifting Eyes.
 - e. Pipe Supports.
 - f. Steel Bases and Anchors.
 - g. Weir Plates.
- C. Stainless Steel Fabrication: Following welding fabrication all stainless steel assemblies shall be cleaned, descaled and passivated in accordance with ASTM A380.
- D. Anchors, Fasteners, and Fittings: Provide zinc-coated carbon steel for steel fabrications, and stainless steel for aluminum and stainless steel fabrications, unless shown otherwise.
- E. Pipe Sleeves
1. Provide as follows:
 - a. Hot-dip galvanized, Schedule 40 steel pipe sleeves where shown for piping passing through concrete or masonry.

05 05 03-4
Miscellaneous Metals

- b. Holes drilled with rotary drill may be provided in lieu of sleeves in existing walls.
- c. Provide a center flange for water stoppage on sleeves in exterior or water-bearing walls.
- d. Provide a rubber caulking sealant or a modular mechanical unit to form a watertight seal in the annular space between pipes and sleeves.

PART 3 - EXECUTION

3.1 FABRICATION

A. General:

- 1. Exposed Surfaces Finish: Smooth, sharp, well-defined lines.
- 2. Provide necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
- 3. Conceal fastenings where practical.
- 4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
- 5. Fabricate materials as specified.
- 6. Weld connections, except where bolting is directed.
- 7. Methods of fabrication not otherwise specified or shown shall be adequate for stress and as approved.
- 8. Grind exposed edges of welds smooth on walkways, guardrails, handrails, stairways, channel door frames, steel column bases and where shown.
- 9. Round sharp edges to 1/8-inch minimum radius. Grind burrs, jagged edges, and surface defects smooth.

B. Aluminum:

- 1. Fabricate as shown, and in accordance with the Aluminum Association Standards and manufacturer's recommendations as approved.
- 2. Grind smooth sheared edges exposed in finished work.

3.2 WELDING

A. General

- 1. Meet codes for Arc and Gas Welding in Building Construction of the AWS and AISC for techniques of welding employed, appearance, quality of welds made, and the methods of correcting defective work.
- 2. Welding Surfaces: Free from loose scale, rust, grease, paint, and other foreign material, except mill scale which will withstand vigorous wire brushing may remain.
- 3. A light film of linseed oil may likewise be disregarded.
- 4. Do not weld when temperature of base metal is lower than zero degrees F.
- 5. Finished members shall be true to line and free from twists.
- 6. Prepare welds and adjacent areas such that there is:
 - a. No undercutting or reverse ridges on the weld bead.
 - b. No weld spatter on or adjacent to the weld or any other area to be painted.
 - c. No sharp peaks or ridges along the weld bead.
- 7. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

- B. Welding Operators: As specified in PART 1, Article 1.3 QUALITY ASSURANCE.

05 05 03-5
Miscellaneous Metals

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

3.3 INSTALLATION

- A. Set units accurately in location, alignment, and elevation, level, plumb, true, and square, measured from established lines and levels. Brace or anchor temporarily in formwork where units are to be built into concrete, masonry, or similar construction.
- B. Anchor securely as shown or as required for the intended use, using concealed anchors wherever possible.
- C. Fit exposed edges accurately together to form tight, hairline joints. Do not weld, cut, or abrade the surfaces of galvanized or anodized units which are intended for bolted or screwed connections.
- D. Field Welding: Where field welding is necessary, grind joints smooth and touch-up the shop paint. Comply with the applicable provisions of AWS D1.1 for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding.
- E. Field Coat all miscellaneous ferrous and steel metals per Specification Section 09 91 03 - Painting, System 300.
- F. Where aluminum is in contact with dissimilar metals, or embedded in masonry or concrete, protect surfaces as specified in Section 09 91 03 - Painting, System 305.

++ END OF SECTION ++

05 05 03-6
Miscellaneous Metals

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 05 05 06

ANCHORS, INSERTS, AND DOWELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes all post-installed anchors and inserts required to anchor parts of the Work to supporting concrete or masonry construction, and plaster. This Section also includes adhesives for anchoring reinforcing dowels into existing concrete.

1.2 REFERENCES

- A. American Society for Testing and Materials
 - 1. ASTM A36, Standard Specification for Carbon Structural Steel.
 - 2. ASTM A320, Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
 - 3. ASTM D746, Standard Test Method for Brittleness of Temperature of Plastics and Elastomers by Impact
 - 4. ASTM D1505, Standard Test Method for Density of Plastics by the Density-Gradient Technique
 - 5. ASTM D1525, Standard Test Method for Vicat Softening Temperature of Plastics
- B. 2018 International Building Code (IBC)
- C. American Concrete Institute (ACI)
 - 1. ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete
 - 2. ACI 355.4, Qualification of Post-installed Adhesive Anchors in Concrete

1.3 SYSTEM DESCRIPTION

- A. Provide the size, type, and length of anchor shown on the drawings or, if not shown, as specified in the detailed sections of these specifications.
- B. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, toggle bolt, or concrete insert is not shown or specified, provide the size, length and capacity required to carry the design load times a minimum safety factor of 4.
- C. For equipment anchors, if the design load is not specified by the manufacturer, provide anchors of diameter no less than the diameter of the hole minus 3/16 inch. When the design load is not specified by the manufacturer, provide structural calculations.

1.4 SUBMITTALS

- A. Product Data: Submit for approval copies of material certification, manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.

05 05 06-1

Anchors, Inserts and Dowels

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- B. Installer's Qualifications: When installing adhesive anchors subject to sustained tension loading or when specifically noted in the Drawings, submit for approval copies of the installer's qualifications certified by the ACI/CRSI Adhesive Anchor Installer Certification program.

1.5 QUALITY ASSURANCE

- A. Post-installed concrete anchors shall be ICC approved for seismic applications in cracked concrete and prequalified in accordance with ACI 355.2 or ACI 355.4.

PART 2 - PRODUCTS

2.1 ANCHOR BOLTS

- A. Nonsubmerged Use in areas of wet use, washdown areas, or areas outside heated buildings:
 - 1. Stainless steel Type 316, unless otherwise shown.
 - 2. Diameter, Length and Bend Dimensions: As required by equipment or machinery manufacturer. Unless otherwise required, provide 3/4-inch minimum diameter by 12-inches long and other geometry as shown.
 - 3. Furnish A320 nuts and washers of same material for each bolt, unless otherwise shown.
 - 4. Provide sleeves as required or as shown for location adjustment.
- B. Submerged Use:
 - 1. Submerged use is defined as any connection 1 foot 6 inches below the normal water surface elevation in a water holding basin.
 - 2. As specified for nonsubmerged use, for equipment, machinery or other connections except as follows:
 - a. Coating of anchor bolt threads is not required.
 - b. Where threads are covered with fusion bonded coating, provide nut of proper size to fit and provide connection of equal strength to embedded bolt.
- C. For anchoring fabricated metalwork, structural steel, or other components where connections will be protected or dry:
 - 1. Galvanized Steel, 36 ksi, minimum.
 - 2. Minimum Size: 3/4-inch diameter by 12-inch long, unless otherwise shown.
 - 3. At base plates with grout pads, furnish two nuts and two washers per bolt of same material as bolt, unless otherwise shown.

2.2 ANCHOR BOLT SLEEVE

- A. High Density Polyethylene Plastic:
 - 1. Single unit construction with deformed sidewalls such that the concrete and grout lock in place.
 - 2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
 - 3. Material requirements shall conform to the following:
 - a. Plastic: High density polyethylene.

05 05 06-2

Anchors, Inserts and Dowels

Washwater Equalizer Tank Replacement Project

- b. Density: 0.956, ASTM D1505.
- c. Vicant Softening Point: 256°F, ASTM D1525
- d. Brittleness Temperature: -180°F, ASTM D746

- B. Fabricated Steel Sleeve:
- 1. Material: A36 steel.
 - 2. Dimensions, welding, and sizes as shown.

2.3 STAINLESS STEEL FASTENERS LUBRICANT (ANTISEIZING)

- A. Provide for stainless steel nuts and machined bolts, anchor bolts, concrete anchors, and all other threaded fasteners.
- B. Lubricant shall contain substantial amounts of molybdenum disulfide, graphite, mica, talc, or copper as manufactured by:
- 1. Loc Tite Co., Permatex.
 - 2. Or equal

2.4 CONCRETE INSERTS

- A. For vertical support of grating or floor plate, provide cast-in metal fabrications as shown.
- B. Except as permitted below, or as otherwise shown, provide malleable iron inserts for hanging piping and conduit from concrete ceilings and soffits. Comply with Federal Specification WW-H-171-E (Type 18). Provide those recommended by the manufacturer for the required loading.
- C. Obtain inserts in sufficient time so as not to delay concrete or masonry work.
- D. Product and Manufacturer: Provide inserts of one of the following:
- 1. Figure 282, as manufactured by Anvil/Grinnell.
 - 2. Sharktooth Insert, as manufactured by Hohmann and Barnard, Incorporated.
 - 3. Or equal.

2.5 ADHESIVE (EPOXY) ANCHORS AND DOWELS

- A. Provide adhesive anchors where specifically shown and where adhesive anchors are allowed. Unless otherwise shown, adhesive anchors are allowed for anchoring:
- 1. Supports for pipe, conduit, and electrical boxes, devices, and panels, on floors and walls
 - 2. Handrails, guardrails, sunshades, stairs,
 - 3. Fixtures and equipment on floors and walls, and
 - 4. Single pipes and conduits <2 inch in diameter to ceilings and soffits.
- B. Adhesive shall be epoxy resin. Vinylester resin anchors are NOT allowed.
- C. Product and Manufacturer: Provide one of the following:
- 1. Installation to Concrete:
 - a. HIT-HY 200 as manufactured by Hilti, Inc.
 - b. SET-3G as manufactured by Simpson Strong-Tie, Inc.
 - c. Or approved equal meeting ACI 355.4.

05 05 06-3

Anchors, Inserts and Dowels

Washwater Equalizer Tank Replacement Project

2. Installation to solid-grouted Masonry:
 - a. HIT-HY 270 as manufactured by Hilti, Inc.
 - b. SET as manufactured by Simpson Strong-Tie, Inc.
 - c. Or approved equal.

2.6 EXPANSION ANCHORS

- A. Provide expansion anchors only where specifically shown and where expansion anchors are allowed. Unless otherwise shown, and except as noted below, expansion anchors are allowed for anchoring:
 1. Supports for pipe, conduit, and electrical boxes, devices, and panels, to floors and walls.
 2. Handrails, guardrails, and sunshades.
 3. Fixtures and equipment which have no moving parts, to floors and walls.
- B. Expansion anchors are NOT allowed in any submerged or chemical containment areas.
- C. Leveling nuts shall not be used with expansion anchors. If leveling nuts are required, provide adhesive anchors, unless otherwise shown.
- D. Wedge anchors: Provide one of the following:
 1. Installation to Concrete:
 - a. Hilti Kwik Bolt TZ by Hilti, Inc.
 - b. Strong-Bolt 2 by Simpson Strong-Tie, Inc.
 - c. Or approved equal meeting ACI 355.2.
 2. Installation to solid-grouted Masonry:
 - a. Hilti Kwik Bolt-3 by Hilti, Inc.
 - b. Wedge-All by Simpson Strong-Tie, Inc.
 - c. Or approved equal.
- E. Drop-in anchors, only where specific shown on the drawings: Provide one of the following:
 1. HDI by Hilti, Inc.
 2. Drop-In by Simpson Strong-Tie, Inc.
 3. Or equal.

2.7 SCREW ANCHORS

- A. Provide screw anchors only where specifically shown. Provide ICC approved screw anchors suited for seismic and cracked concrete applications.
- B. Installation to Concrete or Masonry:
 1. KH-EZ by Hilti, Inc.
 2. Titen HD by Simpson Strong-Tie, Inc.
 3. Or approved equal.

2.8 TOGGLE BOLTS

- A. Provide toggle bolts only where specifically shown, to fasten single pipes and conduits <1 inch and equipment weighing less than 50 lbs (4-bolts required) to hollow walls.

05 05 06-4

Anchors, Inserts and Dowels

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- B. Provide spring-wing toggle bolts, with two-piece wings, carbon steel bolts with zinc coating in accordance with Federal Specification FF-S-325.
- C. Product and Manufacturer: Provide toggle bolts of one of the following:
 - 1. The Rawlplug Company, Incorporated.
 - 2. Haydon Bolts, Incorporated.
 - 3. Or equal.

2.9 OTHERS

- A. Powder actuated fasteners and other types of anchors not specified herein shall not be used, unless approved by ENGINEER.

2.10 ACCESSORIES

- A. Provide Belleville washers, or approved equal, at anchorage connections used to transfer anchorage loads at sheet metal equipment housings.

PART 3 - EXECUTION

3.1 INSTALLATION OF ANCHORS

- A. Obtain anchor bolts in sufficient time so as not to delay concrete or masonry work.
- B. Adhesives shall be stored and installed at the service temperature ranges recommended by the manufacturer.
- C. Locate and accurately set the anchor bolts using templates or other devices as necessary.
- D. Protect threads and shank from damage during installation of equipment and structural steel.
- E. Post-installed anchors are NOT acceptable substitutes for cast-in-place anchor bolts.
- F. Assure that embedded items are protected from damage and are not filled in with concrete.
- G. Unless otherwise shown, the minimum diameter of anchor bolts for structural steel is $\frac{3}{4}$ inch, and for other applications, $\frac{3}{8}$ inch.
- H. Unless otherwise shown, provide the following minimum embedment, where "d" is the nominal anchor diameter:
 - 1. Cast-in-place anchors: 12d.
 - 2. Adhesive anchors: 12d.
 - 3. Expansion anchors: 8d.
- I. Unless otherwise shown, provide a minimum edge distance equal to six times the bolt diameter for adhesive anchors, eight times the bolt diameter for expansion anchors and a bolt spacing equal to twelve times the bolt diameter.

05 05 06-5

Anchors, Inserts and Dowels

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- J. Concrete shall have a minimum age of 21 days at the time of post-installed anchor installation.
 - 1. Concrete temperature at the time of adhesive anchor installation shall be at least 50°F.
- K. Existing reinforcing bars in the concrete structure may conflict with specific anchor locations. Unless noted on the Drawings that the bars can be cut, the CONTRACTOR shall review the existing structural drawings and shall undertake to locate the position of the reinforcing bars at the locations of the concrete anchors by ferroskan, ground penetrating rebar (GPR), x-ray, chipping or other means.
- L. Drilling equipment used and installation of post-installed anchors shall be in accordance with the manufacturer's printed instructions.
- M. For the adhesive and expansion anchors, CONTRACTOR shall comply with the manufacturer's printed installation instructions on the drilled hole diameter and depth.
- N. CONTRACTOR shall properly clean out the hole utilizing a wire brush and compressed air in accordance with the manufacturer's printed installation instructions to remove all loose material from the hole, prior to installing adhesive or expansion anchors. Drilled and cleaned anchor holes shall be protected from contamination until the anchor is installed. A drilled anchor hole shall be re-cleaned assuming the hole was just drilled, if in the opinion of ENGINEER or Inspector that the hole has become contaminated after initial cleaning.
- O. Unless otherwise indicated by the manufacturer, adhesive shall be dispensed through a tube or cartridge extension, beginning at the maximum depth of the hole and withdrawn as adhesive is injected, followed by insertion and rotating the anchor to the specified depth. Where necessary, spaces around anchors at the surface shall be sealed at horizontal to vertically overhead locations to prevent loss of the adhesive during curing.
- P. Anchors to be installed in the adhesive shall be clean, oil-free, and free of loose rust, paint, or other coatings.
- Q. Installed anchors shall be securely fixed in-place to prevent displacement. Unless shown otherwise on the Drawings, anchors shall be installed perpendicular to the concrete surface.
- R. Reinforcing adhesive dowel bars or all-threaded adhesive bars shall not be bent after being adhesively embedded in hardened, sound concrete.
- S. In lieu of the use of stacked standard washers, if threads of an anchor bolt protrude beyond the attachment, the installers shall use a fabricated filler plate of equal or greater size of the washer. Hole on the filler plate shall be 1/16 inch (or 2 to 3 mm) greater than the bolt size. Coat as appropriate in accordance with the material and installation location requirements.

05 05 06-6

Anchors, Inserts and Dowels

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

3.2 FIELD QUALITY CONTROL

- A. Anchors shall be installed by qualified personnel in accordance with the manufacturer's printed installation instructions. Installation of adhesive anchors shall be performed by personnel trained to install adhesive anchors.
- B. Installation of adhesive anchors horizontally or upwardly inclined to support sustained tension loads shall be performed by personnel certified by the ACI/CRSI Adhesive Anchor Installer Certification program.
- C. CONTRACTOR shall employ a special inspector to perform field inspection services in accordance with Chapter 17 of the IBC for all post-installed anchors.
 - 1. The special inspector must be periodically on the jobsite during post-installed anchor installation.
 - 2. Adhesive anchors installed to resist sustained tension loads shall be continuously inspected during installation by an inspector specially approved for that purpose by the building official.
- D. CONTRACTOR shall employ a testing laboratory to perform field quality testing of installed adhesive anchors. A minimum of 10% of randomly selected adhesive anchors and reinforcing dowel bars greater than 3/8 inch diameter are to be tension tested to the least of 50 percent of expected adhesive ultimate bond strength or 80 percent of steel yield strength of the anchor rod. Maintain the proof load at the required load level for a minimum of 10 seconds.
 - 1. Tension testing shall be performed in accordance with ASTM E488.
 - 2. The independent testing laboratory shall submit an anchorage testing plan for approval to ensure the testing requirements are fulfilled.
 - 3. If failure of more than 5 percent of the tested anchors or reinforcing dowel bars occurs, CONTRACTOR will be required to pay for the costs involved in testing the remaining 90%.
 - a. Concrete cracking in the vicinity of the anchor after loading shall be considered a failure.
- E. CONTRACTOR shall correct improper workmanship, remove and replace, or correct as instructed by the ENGINEER, all anchors or bars found unacceptable or deficient, at no additional cost to the OWNER.
- F. The independent testing and inspection agency shall complete a report on each area. The report should summarize the observations made by the inspector and be submitted to ENGINEER.
- G. Provide access for the testing agency to places where Work is being produced so that required inspection and testing can be accomplished.

++ END OF SECTION ++

05 05 06-7

Anchors, Inserts and Dowels

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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05 05 06-8

Anchors, Inserts and Dowels

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 05 05 09

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope:
 - 1. Provide all labor, materials, equipment, and incidentals as shown on the Drawings, specified and required to furnish and install structural steel, including connections, surface preparation and shop priming.
 - 2. Structural steel is that Work defined in AISC "Code of Standard Practice", Section 2, and as shown on the Drawings. The Work also includes:
 - a. Providing openings in and attachments to structural steel to accommodate the Work under this and other Sections and providing for the structural steel all items such as anchor bolts, studs and all items required for which provision is not specifically included under other Sections.
- B. Coordination:
 - 1. Review installation procedures under other Sections and coordinate the Work that must be installed with or attached to the structural steel.

1.2 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Complete details and schedules for fabrication and shop assembly of members and details, schedules, procedures and diagrams showing the sequence of erection.
 - a. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.
 - b. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.
 - 2. Copies of manufacturer's specifications and installation instructions for products listed below. Include laboratory test reports and other data as required to show compliance with the Contract Documents.
 - a. Structural steel of each type, including certified copies of mill reports covering the chemical and physical properties.
 - b. High strength bolts of each type, including nuts and washers.
 - c. Unfinished bolts and nuts.
 - d. Shop primer and touch-up field primer paint in accordance with Section 09 91 03, Painting.

1.3 QUALITY ASSURANCE

- A. Reference Standards and Codes: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. ASTM A36, Standard Specification for Carbon Structural Steel
 - 2. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

05 05 09-1
Structural Steel

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

3. ASTM A108, Specification for Steel Bar, Carbon and Alloy, Cold Finished
4. ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5. ASTM A153, Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi tensile strength
7. ASTM A325, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
8. ASTM A385, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
9. ASTM A490, Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
10. ASTM A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
11. ASTM A992, Standard Specification for Structural Steel Shapes
12. ASTM A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
13. ASTM F436, Standard Specification for Hardened Steel Washers
14. ASTM F592, Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs
15. ASTM F1554, Standard Specification for Anchor Bolts
16. ASTM F3125, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength
17. AWS D1.1, Structural Welding Code
18. AREA, Manual of Railway Engineering
19. AISC, Manual of Steel Construction
20. AISC 303, Code of Standard Practice for Steel Buildings and Bridges
21. AISC 360, Specifications for Structural Steel Buildings
22. Specifications for Structural Joints Using High-Strength Bolts, RCSC Specification

B. Design of Members and Connections:

1. All details shown on the Drawings are typical; similar details apply to similar conditions, unless otherwise shown on the Drawings or specified. Verify dimensions at the site without causing delay in the Work.
2. Examine conditions under which structural steel is to be provided, and notify ENGINEER, in writing, of unsatisfactory conditions existing or whenever design of members and connections may not be clearly shown on the Drawings. Do not proceed with the Work until unsatisfactory conditions or deficiencies have been corrected in a manner acceptable to ENGINEER.

C. Source Quality Control:

1. Materials and fabrication procedures shall be subject to inspection and tests in the mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve CONTRACTOR of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
2. Steel fabricator shall have at least 5 years experience in the fabrication of structural steel for projects substantially similar to those required for this project.

D. Qualifications for Welding Work:

1. Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code" D1.1, Section 5, Qualification.

05 05 09-2
Structural Steel

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2. Provide certification that all welders employed on or to be employed for the Work have satisfactorily passed AWS qualification tests within the previous 12 months. Ensure that all certifications are kept current.
3. All welds will be subject to visual inspection. Where visually deficient welds are observed, the welds will be tested using non-destructive methods by a certified testing laboratory. If welds are found to be satisfactory, OWNER will pay for testing. Where welds are found unacceptable or deficient, pay for testing, correct improper workmanship, remove and replace, or correct as instructed, all welds found unacceptable or deficient. Responsibility belongs to CONTRACTOR to pay for all corrections and subsequent tests required to confirm the integrity of the weld.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site at such intervals to ensure uninterrupted progress of the Work.
 1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay that Work.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on the structure in a manner that might cause distortion or damage to the members or the supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wide flange sections: ASTM A992 Grade 50.
- B. Steel pipe columns: ASTM A53 Grade B.
- C. Hollow Structural Sections (HSS): ASTM A500 Grade B.
- D. Plates, Angles, Channels, and S Shapes: ASTM A36, except where other type steel is shown on the Drawings.
- E. Crane Rails: As shown on the Drawings and as noted in the AISC Manual.
 1. Provide rails with tight end joints suitable for crane service with joint bars matching the rail sections, joint bar bolts and nuts complying with ASTM A325 with AREA alloy steel spring washers, and fixed or floating type rail clamps, as required to suit the conditions shown on the Drawings.
- F. Headed Studs and Deformed Bar Anchors:
 1. Studs: ASTM A108, complying with AWS Code Section 7, Type B; minimum yield strength 50,000 psi, minimum tensile strength 60,000 psi.
 - a. Uniform diameter.
 - b. Heads: Concentric and normal to shaft.
 - c. Weld end: Chamfered and solid flux.

05 05 09-3
Structural Steel

Washwater Equalizer Tank Replacement Project

2. Deformed anchor bars: ASTM A1064, complying with AWS Code Section 7 Type C. Minimum yield strength 70,000 psi. Minimum tensile strength 80,000 psi.
 - a. Straight, unless indicated otherwise.
 - b. Solid flux.
 3. After welding, remove ceramic ferrules and maintain free from any substance which would interfere with function, or prevent bonding to concrete.
- G. High-Strength Threaded Fasteners: Heavy hexagonal structural bolts, heavy hexagon nuts, and hardened washers, as follows:
1. Quenched and tempered medium carbon steel bolts, nuts and washers, complying with ASTM A325 or:
 2. Quenched and tempered alloy steel bolts, nuts and washers, complying with ASTM A490.
 3. ASTM F3125 high-strength bolts shall be used for twist-off / tension-controlled bolts.
 4. Provide ASTM F436 washers for all bolts in accordance with RCSC Specification for Structural Joints Using High-Strength Bolts.
 5. Provide beveled washers at connections of sloped/tapered sections.
 6. Unless noted otherwise, high-strength fasteners shall be used for all non-stainless steel fasteners. Pre-tension all high-strength fasteners unless noted otherwise. Pre-tension any connection with designation (SC) slip critical. Slip critical (SC) connections must be free of paint, oil, or other materials that reduce friction at contact surfaces. Galvanized or lightly rusted surfaces are acceptable.
- H. Cast-in-Place Anchor Rods:
1. ASTM F1554, Grade 36 with weldability supplement S1 for threaded rods galvanized.
 2. Provide ASTM F436 washers at all nuts.
 3. Embedded anchors shall be headed with a standard square plate washer tack welded to the anchor head, unless a larger washer is shown otherwise in the Drawings.
 4. Only provide threads at the top of the anchor as required for connections.
- I. Common Bolts:
1. ASTM A307, Grade A for headed bolts galvanized.
- J. Stainless Steel Fasteners:
1. ASTM F593 Type 304 or 316 stainless steel with matching nut and washer for non-liquid containing (dry) structures.
 2. ASTM F593 Type 316 stainless steel for liquid-containing structures.
- K. Electrodes for Welding: E70XX complying with AWS D1.1 Section 8.
- L. Galvanizing:
1. Zinc coated hardware: ASTM A153.
 2. Fabrications: ASTM A123.
 3. Members designated as galvanized on the drawings or as directed by ENGINEER shall be galvanized after fabrication in accordance with ASTM A385. Weight of zinc coating shall not be less than 2.5 ounces per square foot of actual surface and have a coating thickness of 0.0042 inch. Coating weight will be subject to verification by ENGINEER. Thickness of coating will be measured by means of a magnetic thickness gauge.
 4. Each fabricated assembly shall be totally immersed in the galvanizing bath. The galvanizing procedure shall be such as to avoid distortion of the assembly. Straightening of members after galvanizing will not be permitted. Assemblies shall

05 05 09-4
Structural Steel

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

be held in the galvanizing bath until the temperature of the assembly is equal to the temperature of the bath. All deviations shall require approval by ENGINEER.

5. Any galvanized surface which has the coating removed for any cause shall be touched up with a zinc-rich cold galvanizing compound so that the entire surface has a uniform coating of 2.5 ounces of zinc per square foot.
6. Galvanized work shall be subject to inspection by ENGINEER at any time to ensure strict compliance with this specification. Any areas found to show defects or signs of improper galvanizing application will be rejected. Repairs shall be made by CONTRACTOR without additional cost to OWNER.

M. Surface preparation and Finish:

1. Steel: Where not indicated to be galvanized, steel shall be primed in the shop per Section 09 91 03, Painting. Exposed, non-galvanized, steel shall be coated per Section 09 91 03, Painting.

2.2 FABRICATIONS

A. Shop Fabrication and Assembly:

1. General:
 - a. Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with AISC, Manual of Steel Construction, and as shown on the Shop Drawings. Provide camber in structural members as shown on the Drawings.
 - b. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence, which will expedite erection and minimize field handling of materials.
 - c. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in the final structure free of markings, burrs, and other defects.
2. Field Connections:
 - a. All field connections, unless otherwise specified below or noted, shall be made with high strength bolts, and shall be bearing type connections.
 - b. Field welding may be used only where noted or approved by ENGINEER.
3. High-Strength Bolted Construction:
 - a. Install high-strength threaded fasteners in accordance with AISC "Specification for Structural Joints Using High-Strength Bolts" (RCSC).
4. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - a. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
5. Shear Connectors: Install stud shear connectors in accordance with AWS D1.1 Section 4, and as recommended by the manufacturer.

B. Bracing:

1. Bracing shall have a minimum two bolt connection, or a shop welded connection of equivalent strength.
2. Vertical bracing and knee braces connecting to columns shall be on the centerline of the columns, unless otherwise noted.
3. Knee braces shall be at 45 degree angle, unless shown on the Drawings or noted.
4. All gussets shall be minimum 3/8-inch thick, unless otherwise shown on the Drawings.

05 05 09-5
Structural Steel

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- C. Columns: Column shafts shall have "finished" bearing surfaces at the base and at all splice lines.
- D. Hollow Structural Sections (HSS): HSS shall be properly sealed to protect the internal surfaces.
- E. Holes and Appurtenances for Other Work:
 - 1. Provide holes required for securing other work to structural steel framing, and for the passage of other work through steel framing members, as shown on the Shop Drawings. If large block-outs are required and approved by the ENGINEER, the webs shall be reinforced to develop specified shears. Provide threaded nuts welded to framing, and other specialty items as shown on the Drawings to receive other work.
 - 2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
 - 3. Refer to Paragraph 1.1.B, above, for the requirements of coordination with others.
- F. Grind smooth all rough welds and sharp edges shall be ground to approximately 1/8 inch radius.

2.3 WELDING

- A. Comply with AWS Code, and other requirements indicated herein, for all welding, techniques of welding employed, appearance and quality of welds, and methods used to correct defective work.
 - 1. Qualify joint welding procedures or test in accordance with AWS qualification procedures.
- B. Test and qualify welders, welding operators and tackers in compliance with AWS Code for position and type of welding to which they will be assigned.
 - 1. Conduct tests in presence of approved testing agency.
 - 2. Certification within previous 12 months will be acceptable, provided samples of the welder's work are satisfactory.
- C. Before Starting Welding:
 - 1. Carefully plumb and align members in compliance with specified requirements.
 - 2. Fully tighten bolts.
 - 3. Comply with Section 5 of AWS Code for assembly and surface preparation.
 - 4. Preheat base metal to temperature stated in AWS Code.
 - a. When no preheat temperature is given in AWS Code and base metal is below 50°F, preheat base metal to at least 70°F.
 - b. Maintain temperature during welding.
 - c. Preheat surface of all base metal within distance from point of welding equal to thickness of thicker part being welded or 3 inches, whichever is greater, to specified preheat temperature.
 - d. Maintain this temperature during welding.
 - 5. Each welder shall use identifying mark at welds.
- D. Make flange welds before making web welds.
- E. Where groove welds have back-up plates, make first three passes with 1/8 inch round electrodes.

05 05 09-6
Structural Steel

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Use backup plates in accordance with AWS Code, extending minimum of 1 inch either side of joint.
- F. Flame cut edges of stiffener plates at shop or field butt weld. Do not shear.
- G. Grind flush web fillets at webs notched to receive backup plates for flange groove welds.
- H. Low Hydrogen Electrodes: Dry and store electrodes in compliance with AWS Code.
- I. Do not perform welding when ambient temperature is lower than 0°F or where surfaces are wet or exposed to rain, snow, or high wind, or when welders are exposed to inclement conditions.
- J. Headed Studs and Deformed Bar Anchors:
 1. Automatically end welded in accordance with the AWS Code and manufacturer's recommendations.
 2. Fillet welding of headed studs and deformed bar anchors is not allowed unless approved by ENGINEER.
- K. Test in-place studs in accordance with requirements of AWS Code to ensure satisfactory welding of studs to members.
 1. Replace studs failing this test.
- L. When headed stud-type shear connectors are to be applied, clean top surface of members to receive studs in shop to remove oil, scale, rust, dirt, and other materials injurious to satisfactory welding. Do not shop paint or galvanize metal surfaces to receive field applied studs.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which structural steel Work is to be installed, and notify ENGINEER, in writing, of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 ERECTION

- A. General: Comply with the AISC Specifications and Code of Standard Practice, and as herein specified.
- B. Surveys: Provide services of a registered surveyor to check lines and elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices before steel erection proceeds. Discrepancies shall be reported immediately to ENGINEER, in writing. Do not proceed with erection until corrections have been made, or until compensating adjustments to the structural steel Work have been agreed upon with ENGINEER.

05 05 09-7
Structural Steel

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of the structures as erection proceeds.
- D. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete the Work. Provide sufficient planking to comply with OSHA requirement of a tightly planked substantial floor within two stories or 30 feet, whichever is less, below each tier of steel beams on which Work is performed.
- E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place Work.
 - 1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
 - a. Refer to Section 05 05 06, Anchors, Inserts and Epoxy Dowels, of these Specifications for anchor bolt installation requirements.
- F. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.
 - 1. Set loose and attached base plates and bearing plates for structural members on steel wedges or other adjusting devices.
 - 2. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
 - 3. Place non-shrink grout between bearing surfaces and bases or plates as specified in Section 03 60 03, Grout. Finish exposed surfaces, protect installed materials, and allow curing in strict compliance with the manufacturer's instructions, or as otherwise required.
 - 4. Leveling plates and wood wedges will not be permitted.
- G. Field Assembly: Set structural frames accurately to the lines and elevations as shown on the Drawings. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces, which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of the structure within tolerances as specified in AISC Manual. For members requiring accurate alignment, clip angles, lintels and other members shall be provided with slotted holes for horizontal adjustment at least 3/8-inch in each direction, or more when required.
 - 2. Splice members only where shown on the Drawings or specified.
- H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
- I. Comply with AISC Manual for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to field welds.
 - 1. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

05 05 09-8
Structural Steel

Washwater Equalizer Tank Replacement Project

- J. Gas Cutting: Do not use gas cutting torches for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members, which are not under stress, as acceptable to ENGINEER. Finish gas-cut sections equal to a sheared appearance when permitted.
- K. Crane Runways:
 - 1. Install runways complete with rails, crane stops and other required items. Set and adjust the gage, alignment and elevation of the crane rails to tolerances of AISC for crane rails, unless otherwise shown on the Drawings. Stagger joint locations in opposite rails. Rail joints shall, also, be at least 24-inches from crane girder joints. Provide flush joints at the top of all crane rails.
- L. Touchup Painting:
 - 1. Unless otherwise specified below, comply with all requirements of touch-up painting specified in Section 09 91 03, Painting.
 - 2. Immediately after erection, clean field welds, bolted connections, and all damaged and abraded areas of the shop paint. Apply paint to all exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness as specified in Section 09 91 03, Painting.

3.3 FIELD QUALITY CONTROL

- A. The CONTRACTOR will employ a testing laboratory approved by the ENGINEER to perform field quality control testing to inspect and to perform tests and prepare test reports in accordance with IBC section 1705.2 and AISC 360.
 - 1. The testing agency shall conduct and interpret the tests and state in each report whether the test specimens comply with the requirements, and specifically state all deviations.
 - 2. Provide access for the testing agency to places where structural steel Work is being fabricated or produced so that required inspection and testing can be accomplished.
 - 3. The testing agency may inspect structural steel at the plant before shipment; however, ENGINEER reserves the right, at any time before Final Acceptance, to reject material not complying with specified requirements.
- B. Correct deficiencies in structural steel Work that inspection and/or laboratory test reports indicate do not comply with the Specifications. Perform additional tests, as may be required to reconfirm any non-compliance of the original Work, and as may be required to show compliance of corrected Work.

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05 05 09-9
Structural Steel

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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05 05 09-10
Structural Steel

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 05 52 13

ALUMINUM HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers the supply and installation of welded or non-welded mechanical construction aluminum handrails and guardrails.

1.2 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings for the fabrication and erection of the handrails and guardrails. Include plans, elevations and details of sections and connections. Clearly show all field connections. Show anchorage and accessory items.
- B. Product Data: Submit copies of manufacturer's specifications, dimensions, anchor details, and installation instructions for manufactured products.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. Aluminum Associate (AA)
 - a. Aluminum Standards and Data
 - b. Specifications for Aluminum Structures
- B. Design Criteria:
 - 1. Fabricate units to support a live load of 50 pounds per linear foot and a non-concurrent load of 200 pounds at the top of the railing, in any direction.
 - 2. Expansion/Contraction:
 - a. Provide linear expansion joints at a maximum spacing of 20'-0" designed for 1/4" expansion and 1/4" contraction.
 - b. Provide expansion joints in handrail and railing systems where systems cross expansion joints in structure.
- C. Allowable Tolerances:
 - 1. Limit variation of cast-in-place inserts, sleeves and field-drilled anchor and fastener holes to the following:
 - a. Spacing: $\pm 3/8$ -inch.
 - b. Alignment: $\pm 1/4$ -inch.
 - c. Plumbness: $\pm 1/8$ -inch.
 - 2. Minimum Handrails and Railings Systems Plumb Criteria:
 - a. Limit variation of completed handrail and railing system alignment to 1/4-inch in 12' - 0" with posts set plumb to within 1/16-inch in 3 foot - 0 inches.
 - b. Align rails so variations from level for horizontal members and from parallel with rake of stairs and ramps for sloping members do not exceed 1/4-inch in 12' - 0 inches.

- D. Obtain all handrails and railings systems components and accessories from the same manufacturer.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect aluminum work from abuse, staining, or damage during shipment, storage, erection and installation.
- B. Store in a manner to prevent warping of materials.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Fabricate aluminum to conform to AA standards.
- B. Handrails and railings may be either of welded construction, or non-welded mechanical construction.

2.2 MANUFACTURERS AND PRODUCTS

- A. Golden Railings, Inc.; TCF Bolted System.
- B. Superior Aluminum Products; Series 800 Pipe Railing.
- C. Or Equal.

2.3 MATERIALS

- A. Rails and Posts:
 - 1. Conform to ASTM B221.
 - 2. 1-1/2" nominal diameter, minimum
 - 3. Provide Schedule 40 pipe minimum for rails and Schedule 80 pipe minimum for posts, unless conditions of detail and fabrication require heavier pipe weights to comply with performance criteria specified.
 - 4. All rail, posts and components shall be Aluminum Alloy 6005-T5 or 6063-T6
 - 5. Clear satin anodized finish, 0.7 mil minimum (AA-M10-C22-A41).
- B. Fittings and Accessories:
 - 1. Either weld rail and post components, or provide mechanical fittings to join rail and post components using bolted connections.
 - 2. Provide floor flanges where indicated
 - 3. Provide wall brackets with 3-inch minimum clearance between handrail and finished wall surface and as indicated for ladder rails.
 - 4. Fasteners and anchors shall be Type 304 stainless steel and of type as required by substrate
- C. Toeboard (Kick Plate):
 - 1. Extruded, beveled aluminum 4-inch height, aluminum alloy 6063-T6.
 - 2. Furnish required stainless steel clamps and fasteners for complete installation.

3. Manufacturer/Product:
 - a. Crane Veyor Corp., Toeboard No. C43880 with splice plates and corner connectors.
 - b. Or Equal.
- D. Weep Holes:
 1. Fabricate joints, which will be exposed to the weather so as to exclude water.
 2. Provide 15/64-inch diameter weep holes at the lowest possible point on all handrail and railing systems posts.
 3. Provide pressure relief holes at closed ends of handrail and railing systems.

PART 3 - EXECUTION

3.1 GENERAL

- A. Conform to applicable AA standards.
- B. At locations where welds will be made (if applicable), the anodizing shall be ground off to ensure a proper weld is made. The weld shall then be ground smooth and burn marks removed. Completed welds shall be painted to match the anodizing of the pipe.
- C. Bituminous Coating:
 1. Protect aluminum in contact with other metals, grout and concrete by a heavy brush coat of alkali-resistant bituminous coating or a non-porous tape or gasket.
 2. Coating is not required for aluminum in contact with stainless steel bolts.
 3. Apply bituminous coating at 15-mil minimum dry film thickness.
 4. Manufacturer/Product:
 - a. Carboline – Bitumastic No. 50
 - b. Tnemec – Series 46-465
 - c. Or Equal.

3.2 INSTALLATION

- A. Space posts at a maximum of 4'-0" on center, except when a different spacing is indicated on the Drawings.
- B. Install toe boards (kick plates) and anchor to each post with clamps and bolts. Allow 1/4-inch space between bottom of toe board and top of floor surface.
- C. Install handrail to walls with brackets spaced not greater than 5'-0" on center, except where otherwise indicated.
 1. For connecting to concrete walls, use anchors as indicated.
 2. For connecting to hollow masonry walls, use toggle bolts having square heads.
- D. Cleaning: Clean all aluminum surfaces, after installation, free of smudges, stains, or other deleterious substances.
- E. Protect aluminum, after cleaning, with clear methacrylate lacquer coating.

05 52 13-3

Aluminum Handrails and Railings

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

++ END OF SECTION ++

05 52 13-4

Aluminum Handrails and Railings

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 05 53 03

GRATING AND CHECKERED PLATE

PART 1 - GENERAL

1.1 SCOPE

- A. Furnish all materials, labor and equipment required to provide all gratings and floor plates in accordance with the Contract Documents.

1.2 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings for the fabrication and erection of all gratings and checkered plate specified herein. Include plans, elevations and details of sections and connections.
- B. Setting drawings and templates for location and installation of anchorage devices.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Grating, including support frames, fastenings and all necessary appurtenances for a complete installation shall be furnished as indicated on the Drawings.
- B. All exposed bearing ends of grating shall be enclosed in a perimeter band of the same dimensions and material as the main bars, including ends at all cutouts.
- C. Grating shall be fabricated into easily removable sections and shall be fastened at each corner and as required with fasteners provided by the grating manufacturer. No fasteners shall be permitted to project above the walking surface.
- D. Grating and Checkered Plate shall be designed for a loading of 150 psf, with a maximum deflection of $L/360$, unless otherwise required by the Drawings.
- E. Minimum grating depth shall be as shown on the drawings. Space bearing bars at 1-3/16 inch center to center. Band all edges with minimum 3/16 inch thick banding bar.
- F. Openings in Grating:
 - 1. Cut gratings for penetrations as indicated and as required for installing and operating equipment. Layout grating units to allow grating removal without disturbing items penetrating grating.
 - 2. At openings, notches, and cuts in grating, provide banding of same material and size as bearing bars, unless otherwise indicated. Weld band to each bearing bar.
- G. Notching of bearing bars at supports to maintain elevations will not be permitted.

05 53 03-1

Grating and Checkered Plate

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2.2 ALUMINUM GRATING

- A. I-bar type consisting of extruded bearing bars positioned and locked by cross bars.
- B. Material:
 - 1. All supports, cross members, etc. shall be aluminum.
 - 2. Bearing Bars: Alloy 6061-T6 or Alloy 6063-T6, conforming to ASTM B221
 - 3. Cross Bars or Bent Connecting Bars: Alloy conforming to either ASTM B221 or ASTM B210.
- C. Plank clips for grating hold-downs or other required attachments shall be aluminum or Type 304 stainless steel.
- D. Bolts shall be stainless steel Type 316. Where stainless steel bolts are in contact with dissimilar metals provide insulating sleeves and phenolic washers to electrically isolate the bolts and nuts.
- E. Manufacturer/Product:
 - 1. Grating Pacific, "I-Bar 19-SG-4"
 - 2. Borden Grating, "Squeeze Locked Grating"
 - 3. Ohio Grating, "I-Bar 19-SG-4"
 - 4. Or Equal.

2.3 GALVANIZED STEEL GRATING

- A. Weld forged rectangular design (spaced approximately 1-3/16 x 4 inches on center)
- B. Grating Size and Design:
 - 1. Main bars to be 3/16 inches thick.
 - 2. Depth as indicated on the drawings.
 - 3. Cross bars to be twisted square steel and resistance welded at right angles to the main bars.
 - 4. No notching or cutting of bearing bars before welding is permissible.
- C. Material:
 - 1. Galvanized steel: ASTM A36, hot dipped galvanized per ASTM A123 after fabrication
- D. Manufacturer/Product:
 - 1. Grating Pacific W-19-4
 - 2. Ohio Grating 19-W-4
 - 3. Or Equal.

2.4 CHECKERED PLATE

- A. Minimum thickness: As shown on the drawings
- B. Material:
 - 1. Plate to conform to ASTM B209 with anodized finish.
 - 2. Stainless steel support angles: Type 316 unless otherwise shown.

05 53 03-2

Grating and Checkered Plate

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- C. Raised Pattern Floor Plate: Provide pattern standard with the manufacturer to provide non-slip surface.
- D. Plates shall be stiffened by angles welded to the underside as shown on the drawings.
- E. Lifting Handles:
 - 1. Each checkered plate shall be provided with four lifting handles, as shown on the drawings.
- F. Maximum weight of each checkered plate shall be 150 pounds.

PART 3 - EXECUTION

3.1 FABRICATION

- A. All measurements and dimensions shall be based on field conditions and shall be verified by the CONTRACTOR prior to fabrication. Such verification shall include coordination with adjacent work.
- B. All fabricated work shall be shop-fitted together as much as practicable, and delivered to the field, complete and ready for installation. All miscellaneous items such as stiffeners, fillets, connections, brackets and other details necessary for a complete installation shall be provided.
- C. All work shall be fabricated and installed in a manner that will provide for expansion and contraction, prevent shearing of bolts, screws, and other fastenings, ensure rigidity, and provide a close fit of sections.
- D. Finished members shall conform to the lines, angles and curves shown on the Drawings and shall be free from distortions of any kind.
- E. All shearings shall be neat and accurate, with parts exposed to view neatly finished. Flame cutting is allowed only when performed utilizing a machine.
- F. All shop connections shall be welded unless otherwise indicated on the Drawings or specified herein. All fastenings shall be concealed where practicable.

3.2 INSTALLATION

- A. Assembly and installation of fabricated system components shall be performed in strict accordance with manufacturer's recommendations.
- B. All gratings shall be erected square, plumb and true, accurately fitted, adequately anchored in place, and set a proper elevations and positions.

++ END OF SECTION ++

05 53 03-3

Grating and Checkered Plate

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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05 53 03-4

Grating and Checkered Plate

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 09 91 03

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide and install coatings on all exposed surfaces as indicated herein, in other Specification Sections, and on the Drawings.

1.2 QUALITY ASSURANCE

- A. Experience: Both Coatings Manufacturer and Coatings Installer shall have a minimum 5 years' experience in production and application, respectively, of specified products. Coatings Installer shall be approved and endorsed, in writing, by Coatings Manufacturer.
- B. Regulations: Meet federal, state, and local requirements which apply to the work, including, but not limited to those regulations limiting the emission of volatile organic compounds.
- C. Coatings Manufacturer Recommendations: Coatings Installer shall follow all recommendations of the Coatings Manufacturer regarding storage, handling, surface preparation, application of coatings, recoat times, environmental conditions during storage, preparation and application of coatings, and all other Coatings Manufacturer recommendations.
- D. Warranty: Both Coatings Manufacturer and Coatings Installer shall provide a 1-year complete replacement warranty for all coatings. Manufacturer shall provide 5-year warranty for long-term performance of coatings in addition to 1-year warranty.

1.3 SUBMITTALS

- A. Shop Drawings: Coatings Manufacturer shall submit for approval the following:
 - 1. Copies of Manufacturer's technical information and application instructions for each material proposed for use. Specify exactly which product is being proposed for each coating type (as specified below). This may be accomplished through a reference table along with information on the various products, or by a separate, tabbed section with information on products being submitted for each system in a separate tab of a binder. Submittal of general Manufacturer's literature without detailing which product is proposed for each paint system will be unacceptable.
 - 2. Copies of Manufacturer's complete color charts for each coating system.
 - 3. Letter from the Coatings Manufacturer approving and endorsing Coatings Installer.
 - 4. Letter from Coatings Manufacturer stating that volatile organic compounds (VOCs) meet all Federal, State and Local requirements.
 - 5. Furnish copies of the final, approved submittal to the Coatings Installer so that it is clear which product is to be used for which each system.
- B. Reference Samples:

09 91 03-1
Painting

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Provide reference samples of paint colors and textures as required by the ENGINEER. Reference samples will show the color and texture of the final paint to be applied and shall be approved by the ENGINEER prior to painting. Reference samples should be applied to similar substrates to the final surfaces to be painted. If ENGINEER chooses to forego reference samples, CONTRACTOR must receive the allowance to forego reference samples before painting begins or all painted surfaces will be re-painted at the ENGINEER's discretion and at no additional cost to the OWNER.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protection: Protect all pre-coated items from coating damage during shipping.
- B. Store products in accordance with Manufacturer's directions.
- C. Store products in a neat, orderly fashion. Protect products from damage. Protect storage area from damage from stored products.

PART 2 - PRODUCTS

2.1 PRODUCT AND MANUFACTURER:

- A. Provide coating types as listed in the following table. The systems referenced in the table are those provided by TNEC and Sherwin-Williams. If manufacturers other than TNEC or Sherwin Williams are desired, the CONTRACTOR shall submit equivalent paint systems.

COATING TYPE	DESCRIPTION	Sherwin Williams Series	TNEC SERIES
Clear Polyamine Epoxy	Clear Polyamine Epoxy, high solids, moisture resistant, designed as a one-coat wood sealer.	GP3477	Series 201, Epoxoprime
Acrylic Filler	Waterborne Cementitious Acrylic designed for application on porous surfaces such as rough-faced concrete masonry units	CementPlex 875	Series 130, Envirofill
Interior Acrylic Latex	Single component, finish as required	ProMar 200	N/A
Industrial Acrylic	Single component, high density acrylic finish for interior, exterior surfaces	Pro Industrial High Performance Acrylic	Series 1029
Interior Latex Primer/ Sealer	Waterborne vinyl acrylic primer/sealer for interior gypsum wallboard/plaster. Capable of providing uniform seal and suitable for use with specified finish coats.	ProMar 200 Primer	Series 115
Exterior Acrylic Latex	Capable of providing uniform seal and suitable for use with specified finish	Extreme Bond Latex Primer	Series 1028

09 91 03-2
Painting

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

Primer/Sealer	coats.		
Polyamine Epoxy Sealer	Waterborne Polyamine Epoxy, penetrating, flexible and low-odor primer designed for sealing porous substrates.	Multi-Purpose Acrylic Primer	Series 151, Elasto-Grip FC
Acrylate	Modified Waterborne Acrylate designed for application on porous surfaces such as rough-faced concrete masonry units or wood surfaces. Flexible and breathable, moisture and UV resistant. Matte Finish	Loxon XP	Series 156, Enviro-crete
Polyamidoamine Epoxy	Polyamidoamine Epoxy designed for use on steel or other ferrous metals not in contact with potable water but submerged or immersed in wastewater or non-potable water.		Series V69 Hi-Build Epoxoline II
	Polyamidoamine Epoxy designed for use on steel or other ferrous metals in contact with potable water.	Macropoxy 5500	Series V140 Pota-Pox Plus
Polyurethane	Aliphatic Acrylic Polyurethane designed for exterior weathering, abrasion and corrosion resistance	HS Polyurethane 250 or Waterbased Acrolon	Series 1095, Endura-Shield
Silane Water Repellent Sealant	Silane/Siloxane penetrating water repellent blend designed for application on above-grade concrete, stucco, block, masonry and stone surfaces	Loxon 7% Siloxane	Series 636, Dur A Pell 20
Wood Sealer / Stain	Single component, 250 g/l wood stain in clear or standard colors	Minwax 250	
Wood Varnish Finish	Single component polyurethane varnish	Minwax	

- B. All coatings used shall comply with Federal, State and local VOC limits based on application location.

2.2 COLOR

- A. Color Pigments: Pure, nonfading, lead-free applicable types to suit the substrates and service indicated.
- B. Provide colors as described in the drawings or specifications, or as selected by ENGINEER from standard color palette. For piping system colors, reference pipe schedule.
- C. Where existing colors are to be matched or satisfactory color is not available from standard color palette, provide custom-mixed colors.

09 91 03-3
Painting

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- D. Provide samples of each color on the substrate to be coated for approval by the ENGINEER prior to beginning coating application.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Coatings Installer shall prepare all surfaces to be painted in strict accordance with Coatings Manufacturer's recommendations.
- B. Coatings Manufacturer representative shall observe Coatings Installer's methods of preparing surfaces and approve of the work prior to Coatings Installer beginning coating installation. If, after a period of time, Coatings Manufacturer is satisfied with Coatings Installers methods, Coatings Manufacturer can allow Coatings Installer to proceed without inspection following surface preparation. Coatings Manufacturer and installer will still both be held equally accountable for any coatings failure.
- C. Wood surface preparation
 - 1. Coatings Installer shall clean and prepare all wood surfaces in accordance with the Coating Manufacturer's recommendations. Patching may be required where approved by the Engineer. All joints in wood members including trim, siding, soffits, and joints between wood and dissimilar materials shall be filled with joint sealant prior to coating.

3.2 PROTECTION

- A. Protect all adjacent surfaces from overspray, dripping or other transfer of coatings not intended for those surfaces. Use masking, tape, drop cloths, plastic and other protective materials as appropriate.
 - 1. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, stainless steel surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.
 - 2. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors, fan housings, etc. to prevent coatings from falling inside.
 - 3. Correct all damages by cleaning, repairing or replacing, and repainting, as acceptable to ENGINEER.
- B. Completely remove all masking, tape, drop cloths, plastic and other protective materials within 48 hours of completion of application of finish coat. Take special care to remove masking and plastic which cover tank vent openings, HVAC registers, vents, motor vents, and other areas where airflow is critical to proper operation.

3.3 APPLICATION

- A. Paint all exposed surfaces not specifically excluded in 3.3.C, below. Provide and install Coatings in accordance with the following Table, unless otherwise specified in other Sections:

09 91 03-4
Painting

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

COATING SYSTEM NO.	SURFACE TO BE COATED	PRIMER COATING	NO OF PRIMER COATS	PRIME COAT THICKNESS (EACH COAT)	FINISH COATING	NO OF FINISH COATS	FINISH COAT THICKNESS (EACH COAT)
202	Gypsum Board (Interior)	Interior Latex Primer/Sealer	1	350 SF/Gal Application Rate	Interior Acrylic Latex (Semigloss)	2	400 SF/Gal Application Rate
300	Exposed Ferrous Pipe Systems and Exposed Steel Items	Polyamidoamine Epoxy	2	4-6 MDFT	Polyurethane	2	2-3 MDFT
301	Exposed, Non-metallic Pipe Systems	Exterior Latex Primer/Sealer	1	3-5 MDFT	Industrial Acrylic (Semigloss)	2	3-5 MDFT
302	Immersed Ferrous Pipe Systems and Steel Items	Polyamidoamine Epoxy*	1	6-10 MDFT	Polyamidoamine Epoxy*	1	6-10 MDFT
303	Immersed Non-metallic Pipe Systems	Latex Primer/Sealer*	1	4-6 MDFT	Industrial Acrylic (Semigloss)*	1	4-6 MDFT
304	Buried Ferrous and Steel Items	Polyamidoamine Epoxy	1	8-10 MDFT	Polyamidoamine Epoxy	1	8-10 MDFT
305	Aluminum Surfaces in Contact with Concrete	Polyamidoamine Epoxy	1	4-6 MDFT	None		

* Where in contact with potable water, coating shall be NSF-61 certified.

B. Items Delivered with Factory Applied Primer:

1. For items delivered with a factory applied primer and requiring painting under this Section, the factory applied primer may be used in lieu of field applied primer only under the following conditions:
 - a. The ENGINEER approves the use of the factory applied primer in lieu of field applied primer.
 - b. The factory applied primer is certified by the Coatings Manufacturer as compatible with the field applied finish coat.
 - c. The Coatings Manufacturer's recommended recoat time for the factory applied primer has not been exceeded.
2. If all of the above conditions are not met, the Coatings Installer shall re-prepare all surfaces to be painted in strict accordance with Coatings Manufacturer's recommendations and primer applied, in accordance with this Section.

C. Table Definitions:

09 91 03-5
Painting

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. SF/Gal: Square foot of coverage per gallon of coating used.
 2. MDFT: mil dry film thickness
 3. mil: 1/1000 of an inch paint thickness
 4. Ferrous Pipe: Includes Ductile Iron, Cast Iron, Steel, and Galvanized Steel piping
 5. Steel Items: Includes steel and galvanized steel items such as structural steel, doors, window frames, overhead coiling doors, bollard posts, steel gates, steel fences, and all other steel and galvanized steel items.
 6. Non-Metallic Pipe: Polyvinyl Chloride, Chlorinated Polyvinyl Chloride, Fiberglass Reinforced Plastic, High Density Polyethylene
 7. Exposed: Located above grade, exposed to the atmosphere not submerged. Includes surfaces inside and outside of buildings.
 8. Submerged: In an area which normally is under water or other liquid or is intermittently under water or other liquid.
 9. Buried: Located below grade, surrounded by backfill.
- D. Surfaces Not Requiring Painting:
1. Unless otherwise stated or shown below or in other sections, the following areas or items will not require painting or coating:
 - a. Concrete surfaces.
 - b. Reinforcing steel.
 - c. Copper, bronze, brass, Monel, aluminum, chromium plate, and stainless-steel surfaces, except where:
 - 1) Required for electrical insulation between dissimilar metals.
 - 2) Aluminum and stainless steel are embedded in concrete or masonry, or aluminum is in contact with concrete or masonry.
 - 3) Color coding of equipment and piping is required.
 - d. Existing piping, fittings and pipe supports.
 - e. Pipe unions or portions of piping systems where painting would make disassembly difficult or impossible.
 - f. Prefinished electrical, mechanical and architectural items such as motor control centers, switchboards, switchgear, panelboards, transformers, disconnect switches, HVAC equipment enclosures, ductwork, acoustical tile, cabinets, louvers, and wall panels.
 - g. Electrical conduits.
 - h. Cathodic protection anodes.
 - i. Insulated piping and insulated piping with jacket will require prime coat only.
 - j. Fiberglass reinforced plastic (FRP) surfaces with an integral ultra-violet resistant colored gel coat do not require painting, provided the color is as selected.
 - k. Glass, plexiglass or other transparent or translucent material intended to allow passage of light.
 - l. Civil/site materials such as asphalt, gravel, rock, chain-link fence, and plantings.

3.4 RECOAT TIMES:

- A. Coatings Installer shall observe all requirements of the Coatings Manufacturer regarding recoat times.

3.5 PAINT LOG

- A. Coatings Installer shall keep a paint log

09 91 03-6
Painting

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Specific details of the contents and format paint log shall be determined by the Coatings Installer and approved by the ENGINEER.
2. At a minimum, paint log shall record, on a daily basis for any day when coating work is performed:
 - a. Weather conditions, including 3-day forecast
 - b. Which surfaces were prepared for coating
 - c. Approval of surface preparation by the Coatings Manufacturer representative
 - d. Which surfaces or systems were coated that day
 - e. Who the installer was (specific names of persons on crew)
 - f. Which coating type was used
 - g. Which coat was installed
 - h. What the application rate or MDFT was (as approved by ENGINEER)
3. Paint log shall be kept on-site. Paint log shall be signed on a daily basis, for any day when coating work is performed, by the supervisor of the coatings installer field crew and by the ENGINEER.
4. Any painted surface which was not recorded in the paint log shall be stripped, re-prepared, and recoated at the ENGINEER's discretion.

3.6 WARRANTY INSPECTION

- A. Warranty inspection shall be conducted during the eleventh month following completion of the Work. All defective Work shall be repaired by the CONTRACTOR in accordance with this Specification and to the satisfaction of the ENGINEER and at the CONTRACTOR'S expense.
- B. Any location where paint has peeled, bubbled, or cracked and any location where rusting is evident shall be considered to be a failure of the system. The CONTRACTOR shall make repair at all points where failures are observed by removing the deteriorated paint, cleaning the surface, and recoating or repainting with the same system. If the area of failure exceeds 25 percent of the total coated or painted surface, the entire coating or paint system may be required to be removed and repainted in accordance with this specification as determined by the ENGINEER.
- C. All costs for CONTRACTOR'S inspection, Manufacturer's inspection and all costs for repair shall be borne by the CONTRACTOR.

++ END OF SECTION ++

09 91 03-7
Painting

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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09 91 03-8
Painting

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 10 05 03**IDENTIFICATION DEVICES****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. Scope: Furnish and install signs, placards, and labels for safety equipment, hazards, and equipment and piping identification.

1.2 SUBMITTALS

- A. Shop Drawings:
1. Provide manufacturer's literature showing available letter sizes and styles, standard and custom colors, and standard mounting details.
 2. Provide drawings showing layouts, actual letter sizes and styles, colors, and project-specific mounting details.

PART 2 - PRODUCTS**2.1 IDENTIFICATION LABELS**

- A. Pipe Labels and Flow Direction Arrows:
1. Label, Lettering Color, Size and Placement: In accordance with ANSI A13.1, and as listed below.
 2. Label Colors:

Fluid Service	Background Color	Letter Color
Finished or Potable Water	Dark Blue	White
Backwash Waste	Light Brown	Black
Settled Solids	Dark Brown	White
Other Pipes	Light Gray	Black

3. Label Size:

Outside Diameter of Pipe Covering, inches	Length of Color Field, inches	Size of Letters, inches
3/4 to 1-1/4	8	1/2
1-1/2 to 2	8	3/4
2-1/2 to 6	12	1-1/4
8 to 10	24	2-1/2
Over 10	32	3-1/2

4. Label Placement:

10 05 03-1
Identification Devices

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- a. Labels shall be positioned on the pipes so they can be easily read. Proper label placement is on the lower side of the pipe if the employee has to look up to the pipe, on the upper side of the pipe if the employee has to look down towards the pipe, or directly facing the employee if on the same level as the pipe. Labels should be located near valves, branches, where a change in direction occurs, on entry/re-entry points through walls or floors, and on straight segments with spacing between labels that allows for easy identification.
5. Message: Matching "Description" per Piping Schedule.
6. Size for finished outside diameter of pipe and insulation.
7. Snap-Around Type Labels:
 - a. Manufacture from or encase in outdoor grade plastic or vinyl that will resist damage or fading from washdown, sunlight, mildly corrosive atmosphere, dirt, grease, and abrasion.
 - b. Labels:
 - 1) For 6 Inches and Over Diameter Pipe: May furnish strap-on type fastened without use of tools with plastic or stainless steel straps.
 - 2) Firmly grip pipe so labels remain fixed in vertical pipe runs.
 - c. Manufacturers and Products:
 - 1) T & B/Westline, Rariton, NJ, Model WSS Snap-Around.
 - 2) Seton Name Plate Corp., New Haven, CT, Setmark Series.
 - 3) Or equal.
- B. Valve and Equipment Labels:
 1. Applies to valves and equipment with assigned tag numbers wherever specified.
 2. Lettering: Black bold face, 3/4-inch minimum high.
 3. Background: OSHA safety yellow.
 4. Materials: Either of the following:
 - a. Aluminum or stainless steel base with a baked-on finish that is suitable for use on wet, oily, exposed, abrasive, and corrosive areas.
 - b. Fiberglass with fiberglass-encased lettering.
 5. Furnish 1-inch margin on each end of label for mounting. On fiberglass labels furnish grommets at each end for mounting.
 6. Size:
 - a. As appropriate for lettering provided.
 - b. Provide same-size labels for equipment series which are adjacent.
 7. Message: Equipment names and tag numbers as used in Sections where equipment is specified and/or on Drawings.
 8. Manufacturers and Products:
 - a. T & B/Westline Co., Rariton, NJ; Type KQ.
 - b. Seton Name Plate Corp., New Haven, CT; Style EB.
 - c. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE IDENTIFICATION LABELS

- A. Provide pipe identification label with flow arrows on all exposed piping systems as follows:
 1. At all connections to equipment, valves, tees or wall penetrations.

10 05 03-2
Identification Devices

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2. At intervals along piping not greater than 18 feet on center with at least one label applied to each exposed horizontal and vertical run of pipe.
- B. Install pipe identification labels after all painting has been completed.

++ END OF SECTION ++

10 05 03-3
Identification Devices

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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10 05 03-4
Identification Devices

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 10 42 03

SAFETY EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
 - 1. The following safety equipment is to be provided and installed by CONTRACTOR so that it may be integrated into OWNER's safety program for operation of the facility into which it is installed.
 - 2. The following safety equipment does not represent a complete package of safety equipment required to operate the facility. Refer to OWNER's safety program for all required safety equipment and procedures.

1.2 SUBMITTALS

- A. Shop Drawings: Provide manufacturer's product data for each item including sizes, ratings, UL listings, OSHA certifications or other certifications, and mounting/installation information.
- B. Warranty: Provide manufacturer's 5-year warranty on all products provided.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect all equipment provided from all damage until such time as it is turned over to the OWNER.
- B. Safety equipment provided under this specification shall not be used by the CONTRACTOR in the construction of the facility. Safety equipment shall be turned over to the OWNER in new condition.

PART 2 - PRODUCTS

2.1 LIFE PRESERVERS

- A. General:
 - 1. Life preservers shall be Coast Guard and SOLAS approved and designed and manufactured in accordance with 46 CFR 160.
 - 2. Number of life preservers: 1.
- B. Features:
 - 1. Materials: Designed for outdoor storage and use in a corrosive environment. Made from high impact linear low-density polyethylene
 - 2. Size: 30-inch diameter
 - 3. Color: Orange

10 42 03-1
Safety Equipment

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

4. Buoyancy: Must be such that the life preserver can support a minimum of 22-pounds for up to 48 hours in fresh Water
 5. Lettering: "LIFE PRESERVER" painted on in black letters, 3 inches high
- C. Manufacturers and products:
1. Datrex: Model DX0300D
 2. Or equal
- D. Life Preserver Rope
1. Materials: 6mm polypropylene hollow braided rope with interlaced design
 2. 50-foot minimum rope length
 3. Spring hook connection
- E. Life Preserver Mount
1. Materials: stainless steel
 2. 2 1/4" wide, 6 1/2" tall
 3. Horseshow bracket type with plastic hook and bunjee
 4. Manufacturer: Hoffen Industries, Co, or equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all safety equipment per manufacturers written instructions.
- B. Install life preservers where indicated by Owner. Hang the preserver from aluminum hooks installed on the guardrail.

++ END OF SECTION ++

SECTION 26 05 03

GENERAL ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work:

1. Provide all labor, materials, equipment, and incidentals as shown on the Drawings, specified, and required to complete the electrical Work, including power distribution; grounding; lighting; and lightning protection; controls; instrumentation; supervisory control and data acquisition, equipment provided under other specification sections; etc.
2. Provide mobilization, project coordination, demolition, and maintenance of operation services as required for the work in accordance with the specifications and the drawings.
3. Equipment shall be rated and labeled by the manufacturer for the environmental conditions in which it is installed including the power disconnects, control stations, and wiring systems.
4. Provide conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under other Divisions.
5. Provide conduit, wiring and terminations for all field-mounted instruments furnished under other Divisions, including process instrumentation primary elements, transmitters, local indicators and control panels. Provide disconnect switches and lightning and surge protection equipment wiring at process instrumentation transmitters. Install vendor furnished cables specified under other Divisions.
6. Provide precast manholes, handholes and light pole bases with appropriately traffic-rated frames and covers.
7. Provide modifications to existing control systems as required to provide the control functions or inputs as shown on the Drawings. Verify all existing wiring and connections and provide installation of new auxiliary motor starter contacts, relays, switches, etc. Trace the circuits in the field and develop the wiring diagrams necessary for completion of the work. Document all changes made to the wiring diagrams and return a complete marked-up set of Record Drawings, with point-to-point terminal numbers, to the OWNER after the work is complete.
8. Perform testing of the electrical equipment in accordance with the requirements of the other Division 26 specifications. If the testing results are not within acceptable limits repair or replace all defective work and equipment at no additional cost to the OWNER. Make adjustments to the systems furnished under Division 26, Electrical in accordance with the equipment manufacturers requirements/recommendations.
9. Furnish all labor, materials, equipment, accessories, and components and install complete seismic restraint and support systems as indicated on the Drawings and as specified.
 - a. All racks, equipment stands, supports, hangers, bracing, and appurtenances shall conform to the latest applicable requirements of the State Building Code except as supplemented or modified by the requirements specified in this Section.
 - b. The electrical subcontractor shall engage the services of an independent structural engineer registered in the State, with specific experience in the design of seismic restraints and supports for electrical supporting systems hereinafter

26 05 03-1

General Electrical Provisions

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

referred to as support engineer. Provide seismic design, materials, and installation.

B. Demolition

1. Provide electrical demolition work associated with the removal of equipment from the existing facilities. The work shall include disconnecting and removing electrical disconnect switches, electrical wiring and conduit to equipment. Make equipment scheduled for removal free of electrical shock hazard.
2. Survey the existing electrical systems and equipment identified for removal with representatives from the other trades prior to performing any demolition work. Identify all conduit and equipment to be removed with tags or paint. Where a piece of equipment is to be removed all associated ancillary components (e.g., solenoid valves, pressure switches, etc.) and associated wiring and conduit shall also be removed.
3. Equipment scheduled to be turned over to the OWNER shall be carefully disconnected, removed and delivered to the OWNER at a location within 50 miles of the existing site. Provide labor, hoisting, and transportation of the equipment. All other miscellaneous electrical materials, devices, etc., associated with the equipment being turned over shall be demolished and removed from the site. The following equipment shall be turned over to the OWNER:
 - a. Instruments
4. Provide electrical relocation work associated with the relocation of equipment for the existing and new facilities, including disconnecting all existing wiring and conduits and providing new wiring and conduit to the relocated equipment. Make equipment scheduled for relocation free of electrical shock hazard in accordance with OSHA and local plant electrical safety requirements.
5. Unless otherwise specifically noted, remove unused exposed conduit and support systems back to point of concealment including abandoned conduit above accessible ceiling finishes. Remove unused wiring back to source (or nearest point of usage).
6. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned or being removed. Provide blank covers for abandoned outlets which are not removed.
7. Disconnect and remove abandoned panelboards, disconnect switches, control stations, distribution equipment, etc.
8. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers and other accessories.
9. Repair adjacent construction and finishes damaged during demolition and extension work.
10. Where electrical systems pass through the demolition areas to serve other portions of the premises, they shall remain or be suitably relocated, and the system restored to normal operation.
11. Coordinate electrical power outages to the electrical systems and equipment with the OWNER. Where duration of proposed outage cannot be allowed by the OWNER (4 hour duration maximum), phase the retrofit work to allow the system or equipment to be re-connected to the electrical power system within the time frame allowed by the OWNER or provide temporary power connections as required to maintain service to the systems or equipment. The temporary power can be from a generator or another part of the facility not affected by the outage provided there is sufficient spare capacity.

12. Continuous service is required on all circuits and outlets affected by these changes, except where the OWNER will permit an outage for a specific time. Obtain OWNER's consent before removing any circuit from continuous service.
13. The electrical and process equipment to be removed or relocated under this contract has been identified on the Drawings. The removal and or relocation of existing conduit, wire and equipment have not been detailed on the Drawings. Survey the affected equipment and building areas before submitting bid proposal.
14. Trace out existing wiring that is to be relocated or removed and perform the relocation or removal work as required for a complete operating and safe system.
15. Remove exposed conduits, wireways, outlet boxes, pull boxes and hangers made obsolete by the alterations, unless specifically designated to remain. Patch surfaces and provide blank covers for abandoned outlets which are removed.
16. All equipment, materials, controls, motor starters, branch and feeder breakers, panelboards, transformers, wiring, raceways, etc., furnished and installed to temporarily keep circuits energized shall be removed when the permanent installation is fully operational.
17. Disposition of removed materials and equipment
 - a. It is intended that material and equipment indicated to be removed and disposed of by the CONTRACTOR shall, upon removal, become the CONTRACTOR's property and shall be disposed of off the site by the CONTRACTOR, unless otherwise directed by the OWNER. A receipt showing acceptable disposal of any legally regulated materials or equipment shall be given to the OWNER.
 - b. PCBs, mercury and PCB/mercury contaminated equipment shall be removed, packaged, shipped and disposed of in accordance with all State and Federal regulations. Obtain the services of a firm licensed and regularly engaged in the removal of PCBs and PCB contaminated equipment. The firm shall be licensed in the State or States in which the contaminated material is handled, shipped and disposed. Pay all fees associated with the removal of the contaminated material and equipment and provide documentation showing acceptable disposal.

C. Coordination:

1. Review installation procedures, drawings and schedules under other Sections and coordinate with other trades the installation of electrical items that must be installed with or within formwork, walls, partitions, ceilings and panels.
2. Coordinate with other contractors and provide the installation of all conduits, inserts, and other items to be embedded in concrete, or built into walls, partitions, ceilings, or panels constructed by other contractors. Provide detailed sketches of the location of conduits and other built-in items prior to rough-in. Install conduits and other built-in items in such a manner and within such time periods as will not unnecessarily delay the work of other contractors.
3. Each bidder or their authorized representatives shall, before preparing their proposal, visit all areas of the existing buildings and structures in which work under this bid is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that their representative has visited the buildings and structures and noted the locations and conditions under which the work will be performed and that he/she takes full responsibility for a complete knowledge of all factors governing his/her work.
4. Review the electrical underground system and the civil yard piping. Install the electrical underground system in a manner that avoids conflicts with manholes, catch basins, etc. provided under other Divisions of the specifications.

5. Excavation, bedding material, forms, concrete and backfill for underground raceways; forms and concrete for electrical equipment furnished under Division 26, Electrical. The work shall be in accordance with Divisions 03, Concrete, and Division 31, Earthwork.

D. Contract Documents:

1. Interpretation of Drawings:

- a. Dimensions shown on the Drawings that are related to equipment are based on the equipment of one manufacturer. Confirm the dimensions of the equipment furnished to the space allocated for that equipment.
- b. The Drawings show the principal elements of the electrical Work. They are not intended as detailed working drawings for the electrical Work, but as a complement to the Specifications to clarify the principal features of the electrical systems.
- c. It is the intent of the Drawings and Specifications that all equipment and devices, furnished and installed under this Contract, be properly connected and interconnected with other equipment and devices so as to render the installations complete for successful operation, regardless of whether all the connections and interconnections are specifically mentioned in the Specifications or shown on the Drawings.
- d. Conduit and wiring is indicated schematically on the drawings to show the desired functionality. Refer to the One-Line diagrams, Control Block Diagrams, Panelboard schedules, Schematic Diagrams, Loop Wiring diagrams, Network Diagrams, and Process and Instrumentation Drawings for wiring requirements.
- e. Wiring details are not shown on the plan drawings. CONTRACTOR to determine the optimum field routing and provide all fittings and accessories necessary for a complete system.
- f. Schematic Diagrams:
 - 1) Schematic diagrams are provided for CONTRACTOR'S guidance in fulfilling the operational intent of the Contract Documents.
 - 2) Responsibility belongs to CONTRACTOR to meet all safety and electrical codes, and to provide all equipment, appurtenances and specialty items required to provide for complete and operable systems. Devices intended for safety interlocks to protect personnel shall be UL safety rated. Devices intended for safety interlocks to protect equipment shall be fail-safe.
 - 3) Review of control schemes submitted by CONTRACTOR does not relieve CONTRACTOR of his contractual responsibility to provide complete and successfully operating systems.
- g. Underground duct bank raceways may be a minimum of 2-inch regardless of the conduit sizes indicated on the wiring drawings.
- h. It is the intent of the Contract Documents that similar products are provided by the same manufacturer for uniformity on the Project.

2. Priority of the contract documents

- a. If, during the performance of the work, the CONTRACTOR finds a conflict, error or discrepancy between or among one or more of the Sections or between or among one or more Sections and the Drawings, furnish the higher performance requirements. The higher performance requirement shall be considered the equipment, material, device, or installation method which represents the most stringent option, the highest quality, or the largest quantity.
- b. In all cases, figured dimensions shall govern over scaled dimensions, but work not dimensioned shall be as directed by the ENGINEER and work not particularly

26 05 03-4

General Electrical Provisions

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- shown, identified, sized, or located shall be the same as similar work that is shown or specified.
- c. Detailed Drawings shall govern over general drawings, larger scale Drawings take precedence over smaller scale Drawings, Change Order Drawings shall govern over Contract Drawings and Contract Drawings shall govern over shop drawings.
 - d. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the CONTRACTOR, unless otherwise directed by the ENGINEER.
 - e. In accordance with the intent of the Contract Documents, the CONTRACTOR accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the CONTRACTOR's responsibility to comply with all Laws and Regulations at all times.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

- 1. Permits: Obtain all permits and pay fees required to commence Work and, upon completion of the Work, obtain and deliver to the ENGINEER a Certificate of Inspection and Approval from the authority having jurisdiction.
- 2. Codes: Material and equipment shall be installed in accordance with the current standards and recommendations of the National Electrical Code, the National Electrical Safety Code and with local codes which apply. Where discrepancies arise between codes, the most restrictive regulation shall apply.
- 3. Tests by Independent Regulatory Agencies: Electrical material and equipment shall be new and shall bear the label of the Underwriters' Laboratories, Inc., or other nationally-recognized, independent testing laboratory, wherever standards have been established and label service regularly applies.

B. Reference Standards: Electrical material and equipment shall conform in all respects to the latest approved standards of the following:

- 1. National Electrical Manufacturers Association (NEMA).
- 2. The American National Standards Institute (ANSI).
- 3. The Institute of Electrical and Electronic Engineers (IEEE).
- 4. Insulated Cable Engineers Association (ICEA).
- 5. National Electrical Code (NEC) current adoption.
- 6. National Electrical Safety Code (NESC).
- 7. American Society for Testing and Materials International (ASTM).
- 8. The Instrumentation, Systems and Automation Society (ISA).
- 9. National Fire Protection Agency (NFPA).
- 10. Underwriter's Laboratories, Inc. (UL).
- 11. Occupational Safety and Health Administration (OSHA).
- 12. Factory Mutual (FM)
- 13. International Electrical Testing Association (NETA)
- 14. State Building Code
- 15. International Building Code (IBC)
- 16. International Fire Code (IFC)

26 05 03-5

General Electrical Provisions

Washwater Equalizer Tank Replacement Project

17. International Energy Conservation Code (IECC)
18. The Building Officials and Code Administrators National Building Code (BOCA)
19. ASTM International
20. Institute of Electrical and Electronics Engineers (IEEE)
21. Joint Industrial Council (JIC)

- C. Warranty: Warrant all equipment furnished under Division 26, Electrical, in accordance with Division 01, General Requirements and individual Division 26, Electrical equipment sections. Minimum warranty period shall be one year from date of substantial completion for the project, or manufacture's standard warranty, whichever is longer.

1.3 SUBMITTALS

- A. Submit the following information for all equipment and materials supplied under these specifications. Refer to other Division 01, General Requirements, and Division 26, Electrical, specification sections for additional submittal requirements.
- B. Shop Drawings
1. Shop Drawings shall include the following information to the extent applicable to the particular item:
 - a. Manufacturer's name and product designation or catalog number, including environmental rating such as "Rated for Outdoor Use" or "Rated for Hazardous Location".
 - b. Electrical ratings.
 - c. Conformance to applicable standards or specifications.
 - d. Dimensioned plan, section, elevations and panel layouts showing means for mounting, conduit connection, and grounding.
 - e. Materials and finish specification, including paints.
 - f. Clearly identify all equipment and accessories proposed to be provided, including cross references to tag names as shown on the drawings.
 - g. List of components including manufacturer's names and catalog numbers.
 - h. Internal wiring diagram and drawings indicating all connections to components.
 - i. External wiring diagram showing numbered terminals and all external connections and wire requirements.
 2. Submit reports and test results in accordance with other Division 26, Electrical, sections.
 3. For all seismic design systems submit a P.E. certification Form prepared, stamped and signed by a professional engineer, registered in the State, verifying that the design and details meet the loading requirements and are in accordance with all applicable codes.
 4. Check shop drawings for accuracy and completeness prior to submittal. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform to this Section and the Drawings. List all exceptions to the specifications and the Drawings. Include the complete associated specification section with each paragraph marked INCORPORATED or REJECTED in the submittal documents. Shop drawings not so checked and noted shall be returned marked NOT APPROVED.
 5. The ENGINEER's review shall be for conformance with the design concept of the project and compliance with the Drawings. Errors and omissions on approved shop drawings shall not relieve the CONTRACTOR from the responsibility of providing materials and workmanship required by this Section and the Drawings.

26 05 03-6

General Electrical Provisions

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

6. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.
7. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered, or shop work started if shop drawings are marked "APPROVED AS NOTED - CONFIRM," "APPROVED AS NOTED - RESUBMIT" or "NOT APPROVED."

C. Operation and Maintenance Data

1. Submit operations and maintenance data for equipment furnished under this Division, in accordance with Division 01, General Requirements. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists including replacement part numbers.
2. Manuals shall include the following as a minimum:
 - a. A comprehensive, linked, table of contents.
 - b. Individually tabbed sections.
 - c. Name, address, and contact information for supplier and local support office.
 - d. A complete "As-Built" set of approved shop drawings.
 - e. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.
 - f. A table listing of the "as left" settings for all timing relays and alarm and trip setpoints.
 - g. System schematic drawings "As-Built," illustrating all components, piping and electric connections of the systems supplied under this Section.
 - h. Detailed service, maintenance and operation instructions for each item supplied.
 - i. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.
 - j. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.
 - k. Complete parts list with stock numbers, including spare parts.

1.4 PROJECT CLOSEOUT

- A. Record Drawings shall accurately show the installed condition of the following items:
 1. One line wiring diagram of the distribution system.
 2. Accurate and detailed in place conduit and cable layouts with schedule of conduit sizes and number and size of conductors.
 3. Underground raceway and duct bank routing and manhole and handhole locations with coordinates.
 4. Layouts of the power and lighting arrangements and the grounding system.
 5. Panel Schedule(s).
 6. Lighting Fixture Schedule(s).
 7. Grounding system wiring and components.
 8. Control schematic diagrams, with terminal numbers and all control devices identified, for all equipment.
 9. Point-to-Point Interconnection wiring diagrams with all terminals identified and all equipment, wire, and conduit tags indicated.
 10. Provide wire and conduit schedules indicating identification tags; termination points; wire/cable types, quantity, sizes; and terminal equipment tags.
 11. The Record Drawings shall reflect final equipment and field installation information.

26 05 03-7

General Electrical Provisions

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Instruct the manufacturers and vendors as to the maximum shipping sizes of equipment that can be accommodated at the site.

1.6 JOB CONDITIONS

A. Existing Conditions:

1. Examine the site and existing facilities in order to compare them with the Contract Documents with respect to the conditions of the premises, location of and connection to existing facilities and any obstructions which may be encountered.
2. Perform the Work with due regard to safety and in a manner that will not interfere with the existing equipment or in any way cause interruption of any of the functions of the plant.
3. The operation of existing facilities shall be maintained throughout construction. Any interruption of operation shall be approved by and coordinated with the owner.
4. Environmental conditions at the site are as follows:
 - a. Ambient air temperature: -2 to 42 degrees C (28 to 107 degrees F)
 - b. Elevation: 564 feet (MSL).
 - c. Humidity: 65%

B. Limitations:

1. Work shall be carried out with a minimum amount of disruption to the operation of the existing plant and with prior approval of OWNER. Submit for approval by OWNER, a detailed written procedure for work which affects operation of the existing plant, a detailed procedure for modifying any existing electrical equipment, including appropriate Personal Protective Equipment (PPE) required if equipment must remain energized while conducting work, anticipated time required to complete the Work, and the required shutdown time, if any.
2. Work requiring interruption to the operation of existing facilities shall be approved a minimum of two weeks in advance. Any interruption lasting longer than permitted by the owner for a given process will require an alternate contingency to maintain operation, such as portable standby generators completely at the cost to the CONTRACTOR including procurement operation, fuel, and maintenance.
3. Where the Work of CONTRACTOR ties in with existing installations, take prior precautions and safeguards in connecting the Work with the existing operating circuits so as to prevent any interruption to the existing operating circuits. The tying in of Work, installed under this Contract, with the existing circuits shall be performed only in the presence of OWNER. Advance notice will be required before any equipment is removed from service. Notify OWNER, in writing, of his intention to do such work, providing full details.

C. Structural Design Requirements:

1. Provide structural design of electrical equipment, systems, and components, anchorage, and supports, including manufacturer's certifications, in accordance with General Product Requirements under Division 01, including seismic design.
2. Design, furnish, and install complete anchorage systems in accordance with applicable codes for all electrical equipment specified in the appropriate sections in Division 26, Electrical. All hangers, supports, and appurtenances shall conform to the latest applicable requirements of the Local/State Building Code except as supplemented or modified by the requirements of this section. Support arrangements

26 05 03-8

General Electrical Provisions

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

shall be coordinated to eliminate interference with similar support systems to be installed by HVAC, Plumbing and for Process Pipe supports.

D. Demolition:

1. The demolition of electrical power distribution equipment, instrumentation/ control equipment, conduit, wire and appurtenances shall be in accordance with the specifications. All salvageable equipment shall be turned over to the OWNER and stored on site per OWNER requirements. All refuse must be hauled away and disposed of at CONTRACTOR's expense.

1.7 ENVIRONMENTAL RATINGS

A. Area Classifications:

1. Materials and equipment shall conform to the area classification(s) shown on the Drawings, specified, and required.
2. Materials identified below are the minimum required. The drawings may include additional requirements.
3. Corrosive Locations: The following areas shall be considered corrosive locations:
 - a. Indoor process areas.
 - b. Outdoor areas.

B. Enclosures, Cabinets, Panels, and Boxes:

1. All indoor DRY areas NEMA 12 gasketed.
2. All indoor WET areas NEMA 4X 316 Stainless Steel.
3. All indoor PROCESS areas NEMA 4X 316 Stainless Steel.
4. All CORROSIVE areas NEMA 4X 316 Stainless Steel.
5. All indoor CORROSIVE protected chemical storage and handling areas NEMA 4X non-metallic (polycarbonate only).
6. All OUTDOOR areas: NEMA 4X 316 Stainless Steel.
7. All FINISHED office areas NEMA 1.
8. HAZARDOUS classified areas: Listed and labeled suitable for the environment in which it is installed.
9. Outdoor enclosures with electronics and temperature sensitive instruments, shall be provided with sunshade structures. Provide appropriately sized air conditioner, if required. Submit temperature calculations for each outdoor enclosure. Sunshade structures shall be constructed as shown on drawings.

C. Raceways, Conduits, and Fittings:

1. All indoor DRY areas: Galvanized Rigid Steel.
2. All indoor WET areas: PVC Coated Galvanized Rigid Steel.
3. All indoor PROCESS areas: PVC Coated Galvanized Rigid Steel.
4. All indoor CORROSIVE areas: PVC Coated Galvanized Rigid Steel.
5. Indoor MBR building and Blower building as indicated on the drawings: Aluminum conduit and rigid Galvanized Steel Ventilated Cable Tray.
6. All exposed OUTDOOR AREAS: Galvanized Rigid Steel.
7. All underground direct buried: Schedule 80 PVC.
8. All underground concrete encased: Schedule 40 PVC.
9. All FINISHED office areas (120V): Intermediate Metal Conduit.
10. HAZARDOUS classified areas: Meet the NEC requirements for the environment in which it is installed.

D. Wires and Cables:

26 05 03-9

General Electrical Provisions

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. All Feeder wiring: XHHW-2.
 2. All indoor power wiring: XHHW-2.
 3. All 120V indoor light and convenience receptacle circuits wiring: THWN.
 4. Outdoor and where not indicated above or on the drawings: XHHW-2.
 5. 120 V control Wiring: THHW/THWN.
 6. Specialty wires and cables as indicated in individual specification sections, as indicated on the drawings, or as recommended by associated equipment manufacturers, upon ENGINEER approval.
- E. Electrical Equipment:
1. All electrical equipment shall be capable of operating successfully at full-rated load, without failure, at the environmental conditions at the site..
 2. All electrical devices and equipment shall have ratings based on 75 degrees C (167 degrees F) terminations, minimum.
 3. Mounting of electrical equipment on handrails is not allowed.
- F. Hangers and Supports
1. All indoor DRY NON-PROCESS areas: Galvanized Steel.
 2. All indoor WET areas: 316 Stainless Steel.
 3. All indoor PROCESS areas: Powder Coated Steel.
 4. All indoor CORROSIVE areas: 316 Stainless Steel.
 5. All exposed OUTDOOR AREAS: 316 Stainless Steel.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 SLEEVES AND FORMS FOR OPENINGS

- A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all slots for electrical work and form before concrete is poured.
- B. Determine exact locations for concealed conduit stub-ups. Obtain shop drawings and templates from equipment vendors or other subcontractors and locate concealed conduits before the floor slab is poured.
- C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the ENGINEER may allow the installations of such conduit to be exposed. Requests for this deviation must be submitted in writing. No additional compensation for such change will be allowed.
- D. Seal all openings, sleeves, penetration and slots.

3.2 CUTTING AND PATCHING

- A. Cutting and patching shall be done in a workmanlike manner and be in compliance with modifications and repair to concrete as specified in Division 01, General Requirements. Saw cut concrete and masonry prior to breaking out sections.

26 05 03-10

General Electrical Provisions

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- B. Core drill holes in concrete floors and walls as required.
- C. Coordinate work at such time as to require the minimum amount of cutting and patching.
- D. Do not cut joists, beams, girders, columns or any other structural members.
- E. Cut opening only large enough to allow easy installation of the conduit.
- F. Patching to be of the same kind and quality of material as was removed.
- G. The completed patching work shall restore the surface to its original appearance or better.
- H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.
- I. Remove rubble and excess patching materials from the premises.
- J. When existing conduits are cut at the floor line of wall line, they shall be filled with grout of suitable patching material.

3.3 INSTALLATION

- A. Work not installed according to the Drawings and Specification shall be subject to change as directed by the ENGINEER at CONTRACTOR's expense.
- B. Electrical equipment shall be protected against mechanical and water damage. Store all electrical equipment in dry permanent shelters. Do not install electrical equipment in place until structures are weather-tight.
- C. Damaged equipment shall be replaced or repaired by the equipment manufacturer, at the ENGINEER's discretion and at the CONTRACTOR's expense.
- D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted at the CONTRACTOR's expense.

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26 05 03-12

General Electrical Provisions

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 26 05 19

WIRES AND CABLES (600 VOLT MAXIMUM)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified, and required to furnish and install 600 V cable.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Comply with applicable provisions of Regulatory Agencies below and others having jurisdiction:
1. Codes: Install cable in accordance with the National Electrical Code and applicable local codes.
 2. Tests by Independent Regulatory Agencies: Cable shall bear the label of the Underwriters' Laboratories, Inc.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
1. ASTM B 3, Soft or Annealed Copper Wire.
 2. ASTM B 8, Concentric-Lay-Stranded Copper Conductors, Hard, Medium-hard or Soft.
 3. ICEA S-66-524, Cross-linked-thermosetting- polyethylene-insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 4. National Electrical Code (NEC) current adoption.
 5. UL Standard No. 44, Wires and Cables, Rubber-Insulated.
 6. UL Standard No. 83, Wires and Cables, Thermoplastic-Insulated.
 7. UL Standard No. 1277 Standard for Electrical Power and Control Tray Cables.
 8. IEEE 383 Standard for Qualifying Electric Cables and Splices.
 9. IEEE 1202 Standard for Flame Testing of Cables.
- C. Factory Production Tests:
1. All wire and cable shall be factory tested in accordance with the requirements of Underwriters' Laboratories.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Manufacturer's literature, specifications, and engineering data for 600 V insulated cable proposed for use.
 2. Manufacturer's literature, specifications, and engineering data for cable lugs, terminations, and accessories proposed for use.
 3. Manufacturer's literature for cable markers.
- B. Test Records: Submit for review copies of written records of field insulation resistance test results.

26 05 19-1

Wires and Cables (600 Volt Maximum)

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

PART 2 - PRODUCTS

2.1 MATERIALS

A. General

1. Material: Single conductor 98 percent conductivity soft-drawn copper cable conforming to ASTM B 3 and B 8.
2. Wire Sizes: Not smaller than No. 12 AWG for power and lighting and No. 14 AWG for 120 V control circuits
3. Stranding: All 600 V cable shall be stranded.
4. Conductors between variable frequency drives and motor shall be shielded VFD rated cable.
5. Conductor installed in plenums shall be PLENUM RATED.
6. Conductor installed in trays shall be TRAY RATED.
7. Refer to General Electrical Provisions specification for applications.

B. Insulated Cable in Raceways:

1. THHN/THWN insulated wire shall be flame-retardant, moisture and heat resistant thermoplastic insulation rated 90 degrees C (194 degrees F) in dry locations and 75 degrees C (167 degrees F) in wet locations and listed by UL.
2. XHHW-2 insulated wire shall be flame-retardant, moisture and heat resistant cross-linked polyethylene insulation rated 90 degrees C (194 degrees F) in dry locations and 90 degrees C (194 degrees F) in wet locations and listed by UL. XHHW wire shall not be permitted.
3. RHW-2/USE-2 insulated wire shall be flame-retardant, water resistant and heat resistant rubber cross-linked polyethylene insulation rated 90 degrees C/194 degrees F in dry locations and 90 degrees C (194 degrees F) in wet locations and listed by UL. RHW/USE wire shall not be permitted.
4. Equipment grounding conductors shall be NEC Type THW green and sized in accordance with NEC Table 250-122. Ground grid conductors shall be insulated unless shown otherwise on the Drawings.
5. Product and Manufacturer: Provide one of the following:
 - a. The Okonite Company
 - b. Encore Wire Corporation
 - c. Southwire Company
 - d. Service Wire Company
 - e. General Cable by Prysmian Group
 - f. Or Equal

C. Bare copper ground wire shall be stranded, annealed copper wire ASTM-B3.

D. Cable Connectors, Solderless Type:

1. For wire sizes No. 4 AWG and above, use either long-barrel, tin-plated compression type (hydraulically pressed) or bolted type with tinned-plated contact faces.
2. For wire sizes No. 250 kcmil and larger, use connectors with at least two cable clamping elements or compression indents and provision for at least two bolts for joining to apparatus terminal.
3. For wire sizes up to and including No. 6 AWG, use compression type.
4. Properly size connectors to fit fastening device and wire size.
5. Alarm and control wire shall be terminated using forked type connectors (upturned leg ends) at terminals. If terminal block is crimp type, then the wire shall be terminated with a crimped ferrule or solder dipped.

26 05 19-2

Wires and Cables (600 Volt Maximum)

Washwater Equalizer Tank Replacement Project

6. Product and Manufacturer: Provide one of the following:
 - a. CLIPLINE - Phoenix Contact
 - b. Thomas & Betts
 - c. Weidmuller
 - d. HYLUG - Burndy by Hubbell.
- E. Cable Splices:
 1. Unless otherwise indicated on the Drawings, splices shall not be made in the cables without prior written approval of the ENGINEER.
 2. For wire sizes No. 8 AWG and larger, splices shall be made up with long-barrel, tin-plated compression (hydraulically pressed) type copper splice fittings. Splices shall be taped and covered with materials recommended by the cable manufacturers. Final product shall provide conductivity and insulation equal to that of the conductors.
 3. For wire sizes No. 10 AWG and smaller, splices may be made up with preinsulated spring connectors.
 4. For wet locations, splices shall be waterproofed. Compression type splices shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductor. Spring connector splices shall be waterproofed with a sealant-filler.
 5. Product and Manufacturer: Provide one of the following:
 - a. Compression-Type Splices:
 - 1) HYLINK - Burndy by Hubbell
 - 2) Color-Keyed Compression Connectors - Thomas & Betts
 - 3) Or engineer approved equal
 - b. Spring Connectors:
 - 1) B-Cap Wire Connectors - Buchanan
 - 2) Thomas & Betts
 - 3) Or engineer approved equal
- F. Motor Connections:
 1. Motor connections shall be ring type mechanical compression terminations installed on the branch circuit wires and the motor leads and secured with bolt, nut and spring washer.
 2. Connection insulation: shall be insulated with a roll-on stub insulator or equal.
 3. Product and Manufacturer: Provide one of the following:
 - a. Raychem Type RVC
 - b. Thomas & Betts, Shrink-Kon MSCV20
 - c. Or engineer approved equal
 4. For wire sizes NO. 8 and larger, long barrel, tin plated copper compression (hydraulically pressed) type connections shall be installed on the branch circuit wires and the motor leads.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Burndy by Hubbell
 - 2) Or engineer approved equal
 - b. Connections shall be insulated with heavy duty heat shrinkable material Product and Manufacturer: Provide one of the following:
 - 1) Raychem Corp.
 - 2) Or engineer approved equal
- G. Cable/Wire Markers:
 1. Provide only heat shrinkage type cable/wire identification, which shall be type-written.

26 05 19-3

Wires and Cables (600 Volt Maximum)

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2. Wire number shall include the conduit number and be a consecutive number based on the number of wires in a conduit, starting with number 1; example C18J – 1, where as C18J is the conduit number and 1 is the first wire. If ten wires are in a conduit, the numbering would be C18J-1 through C18J-10. No two wires are to have the same number.
3. Product and Manufacturer: Provide one of the following:
 - a. PSPT-187 for a single conductor – Brady Corporation
 - b. Or engineer approved Equal

2.2 WALL AND FLOOR SLAB OPENING SEALS

- A. Wall and floor slab openings shall be sealed with UL approved expanding material which equals or exceeds the fire rating of the wall or floor construction such as "FLAME-SAFE".
 1. Product and Manufacturer: Provide one of the following:
 - a. Thomas & Betts
 - b. ProSet Systems
 - c. Specified Technologies Incorporated
 - d. Or engineer approved Equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all cables complete with proper identification and terminations at both ends. Check and correct for proper phase sequence and proper motor rotation.
- B. Provide voltage drop (VD) calculation for all circuits that exceed the following wire lengths. Provide appropriately sized wire to maintain less than 3% VD at the end of the run (20% VD for motor and transformer transients).
 1. 480V circuits over 400 feet wire length.
 2. 277V circuits over 200 feet wire length.
 3. 120V circuits over 100 feet wire length.
- C. Pulling:
 1. Use insulating types of pulling compounds containing no mineral oil.
 2. Pulling tension shall be within the limits recommended by the wire and cable manufacturer.
 3. Use a dynamometer where mechanical means are used.
 4. Cut off section subject to mechanical means.
- D. Bending Radius: Limit to a minimum of six times cable overall diameter.
- E. Install an equipment grounding conductor in all raceways.
- F. Seal openings in slabs and walls through which wires and cables pass.
- G. Slack: Provide maximum slack at all terminal points.
- H. Pull cables from the direction that requires the least tension. Use a feed-in tube and sheave designed for cable installation. Use sheaves with radii that exceed the cable manufacturer's recommended minimum bending radius. Use a dynamometer and

26 05 19-4

Wires and Cables (600 Volt Maximum)

Washwater Equalizer Tank Replacement Project

constant velocity power puller. Velocity should not be less than 15-ft./min. or more than 50-ft./min. Do not exceed the cable manufacturer's maximum recommended tension.

- I. If cable cannot be terminated immediately after installation, install heat shrinkable end caps.
- J. Fireproof exposed cables in manholes, vaults, pullboxes, switchgear and other areas not protected by conduit where medium voltage cables are present. Use fire-proofing tape and glass tape in accordance with the manufacturer's instructions. Fire-proofing tape shall be installed with one half-lapped layer of Scotch Brand 77 Electric Arc and Fireproofing Tape (3M Corp., or equal). Tape shall be secured with a two-layer band of Scotch Brand 69 Glass Electrical Tape (3M Corp., or equal) over the last wrap.
- K. Splices:
 - 1. Install cable continuous, without splice, from termination to termination.
 - 2. Where required, splice where shown on the Drawings or as approved by the ENGINEER and also where required for cable installation. All splices below grade, in manholes, handholes and wet locations shall be waterproofed.
 - 3. Where necessary, cable splices should be avoided by terminating cables on terminals in a junction box.
 - 4. Splices are not allowed in conduits.
 - 5. All splices shall be pre-approved by ENGINEER.
- L. Identification:
 - 1. Each cable and conductor shall be identified in each pull box and manhole with identification markers, which shall include the conduit number and/or cable number. The markers shall be self-laminating vinyl on white background and shall be printed using a Brady "Tagus T300" printer or equal.
- M. Phase Identification/Color Coding:
 - 1. All three phase circuits shall be identified, which shall include the conduit number and phase, at switchgear, motor control centers, manholes (5 KV), cables and panelboards as "PHASE A", "PHASE B", and "PHASE C". All conductors not identified with a tag number shall be identified with a tag indicating the source.
 - 2. Three phase 480 V systems shall be color coded as follows:
 - a. Phase A - Brown.
 - b. Phase B - Orange.
 - c. Phase C - Yellow.
 - d. Neutral (if applicable) - White.
 - 3. Single phase, 120/240 V circuits shall be color coded as follows:
 - a. Phase A - Black.
 - b. Phase B - Red.
 - c. Neutral - White.
 - 4. Three phase, 208 V systems shall be color coded as follows:
 - a. Phase A - Black.
 - b. Phase B - Red.
 - c. Phase C - Blue.
 - d. Neutral - White.
 - 5. No. 6 AWG and Smaller: Provide colored conductors.
 - 6. No. 4 AWG and Larger: Apply general purpose, flame retardant tape at each end, wrapped in overlapping turns to cover an area of at least 2 inches.
 - 7. All field wiring color shall be black unless otherwise noted.

26 05 19-5

Wires and Cables (600 Volt Maximum)

Washwater Equalizer Tank Replacement Project

3.2 TESTING

- A. Test each electrical circuit after permanent cables are in place to demonstrate that the circuit and connected equipment perform satisfactorily and that they are free from improper grounds and short circuits.
- B. Individually test 600 V cable mechanical connections after installation and before they are put in service with a calibrated torque wrench. Values shall be in accordance with manufacturers' recommendations.
- C. Individually test 600 V cables for insulation resistance between phases and from each phase to ground. Test after cables are installed and before they are put in service with a Megger whose rating is suitable for the tested circuit. Tests shall meet with the applicable specifications of IPCEA S-66-524 and NEMA WC7-1971. Tests shall be witnessed by the ENGINEER at the engineer's discretion.
- D. The insulation resistance for any given conductor shall not be less than the value recommended by the IPCEA or a minimum of one megohm for 600 V and less service, if not IPCEA listed. Any cable not conforming to the recommended value or which fails when tested under full load conditions shall be replaced with a new cable for the full length.
- E. Install in accordance with the National Electrical Code and other local Codes as required.
- F. Field testing and commissioning shall be done in accordance with the latest revision of the "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems" published by the International Electrical Testing Association (NETA Standard ATS-1999) unless otherwise modified by this Section. Minimum wire insulation resistance shall not be less than 250 Megohms.

++ END OF SECTION ++

26 05 19-6

Wires and Cables (600 Volt Maximum)

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 26 05 23

CONTROL AND INSTRUMENTATION CABLE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install instrumentation, data networks, coaxial, specialty I/O, Telephone cables, and security and CCTV system cables.

1.2 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Manufacturer's technical information for instrumentation cable proposed for use.
 2. Manufacturer's technical information for telephone cable and underground splicing for approval by the OWNER's Information Technology Department.

1.3 REFERENCE STANDARDS:

- A. American National Standards Institute (ANSI)
1. EIA TIA/EIA-569-A; Commercial Building Standards for Telecommunications Pathways and Spaces and related bulletins.
 2. EIA TIA/EIA-568-B; Commercial Building Telecommunications Cabling Standard and related bulletins.
 3. ANSI/TIA/EIA-568-C.0 – Generic Communications Cabling for Customer Premises.
 4. ANSI/TIA/EIA-568-C.1 – Commercial Building Communications Cabling Standard Part 1: General Requirements.
 5. ANSI/TIA/EIA-568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 6. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces.
 7. ANSI/TIA/EIA-606-A – Administration Standard for the Commercial Telecommunications Infrastructure.
 8. ANSI/TIA-607-B – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications.
- B. National Electrical Manufacturers Association (NEMA) for relevant equipment standards.
- C. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM)
- D. Underwriters' Laboratories (UL).
- E. National Fire Protection Association (NFPA)
1. NFPA 70 - National Electrical Code.
- F. National Electrical Contractors Association (NECA/BICSI)

26 05 23-1

Control and Instrumentation Cable

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. NECA/BICSI 607, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings and related bulletins.
- G. Where reference is made to one of the above standards, the revision in effect at the time of the bid shall apply.

1.4 SYSTEM DESCRIPTION:

- A. Copper cabling assemblies connecting various outlets and devices located at individual work areas using the following types of cables:
 1. Ethernet cables
 2. Multi-paired Shielded twisted cables
 3. Multi-paired Unshielded twisted cables
 4. Multiconductor cables
- B. Low voltage cabling systems: Includes cables, jacks, splice panels, connecting blocks, patch cords, connectors, jumpers, and necessary support systems, such as cable managers and faceplates.
 1. Furnish and install all materials necessary for complete and working cabling systems.
- C. Coordination:
 1. The CONTRACTOR shall coordinate the work within the Tele-Data Rooms with the OWNER or its designated Tele-Data contractor concerning access and terminations at rack mounted equipment.
- D. Performance Requirements:
 1. Surge Withstand Capability: per ANSI/IEEE C62.41 without damage.
 2. The equipment and components shall operate continuously at its rated current under the following environmental conditions without damage or degradation of operating characteristics or life:
 - a. Operating Ambient Temperature: 40 degrees C (104 degrees F) maximum ambient temperature.
 - b. Storage Temperature: -40 to 65 degrees C (-40 to 149 degrees F).
 - c. Relative Humidity: 0 to 95%, non-condensing.
 - d. Altitude: Operating to 3300 feet, de-rate for higher elevations.

PART 2 - PRODUCTS

2.1 CABLES

- A. Single Shielded Pair Cable:
 1. Tinned copper, nineteen strand, PVC insulated conductors, No. 16 AWG minimum, twisted with aluminum-polyester shield, stranded tinned 16 AWG copper drain wire and PVC black or gray outer jacket. Wire conductor colors shall be black (-neg) and red (+pos). 600 V Tray Cable (TC) rated.
 2. Product and Manufacturer: Provide one of the following:
 - a. Belden Inc
 - b. The Okonite Company
 - c. Dekoron Wire and Cable
 - d. Alpha Wire
 - e. General Cable by Prysmian Group

26 05 23-2

Control and Instrumentation Cable

Washwater Equalizer Tank Replacement Project

- f. Or engineer approved equal

2.2 TERMINATIONS:

- A. Provide ferule compression fittings or UL listed fork type copper compression terminals with nylon insulation for termination of cable at all terminal blocks.

2.3 CABLE/WIRE MARKERS:

- A. Provide only heat shrinkage type cable/wire identification, which shall be type-written.
- B. Wire number shall include the conduit number and be a consecutive number based on the number of wires in a conduit, starting with number 1; example C18J – 1, where as C18J is the conduit number and 1 is the first wire. If ten wires are in a conduit, the numbering would be C18J-1 through C18J-10. No two wires are to have the same number.
- C. Product and Manufacturer: Provide one of the following:
1. PSPT-187 for a single conductor – Brady Corporation
 2. PSPT-500-1W for a twisted pair shielded cable – Brady Corporation
 3. Or engineer approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Separation Requirements:
1. Instrumentation Cables shall not be installed within the same conduits, raceways or cable trays with power wiring or 120V control wiring.
 2. Underground duct bank conduits containing control and instrumentation cable shall be installed a minimum of 12 inches from raceways containing power wiring greater than 120V.
 3. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
 4. Telephone Cables are to be routed separately from other cables.
 5. Intercom and Paging System Cables are to be routed separately from other cables.
 6. Fire Detection or Protection System Cables are to be routed separately from other cables.
- B. General Requirements for Cabling:
1. Comply with TIA/EIA-568-B.1.
 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 7. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. Provide following minimum separation distances between low voltage copper cables and power wiring of 480 V or less:
1. Open or Nonmetal Communications Pathways:
 - a. Electric motors, fluorescent light fixtures, and unshielded power lines carrying up to 3 kVA: 12 inches.
 - b. Electrical equipment and unshielded power lines carrying more than 5 kVA: 36 inches.
 - c. Large electrical motors or transformers: 48 inches.
 2. Grounded Metal Conduit Communications Pathways:
 - a. Electrical equipment and unshielded power lines carrying up to 2 kVA: 2-1/2 inches.
 - b. Electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA: 6 inches.
 - c. Electrical equipment and unshielded power lines carrying more than 5 kVA: 12 inches.
 - d. Power lines enclosed in grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA: 3 inches.
 - e. Power lines enclosed in grounded metal conduit (or equivalent shielding) carrying more than 5 kVA: 6 inches.
 3. Security System Cables are to be routed separately from other cables unless noted on the drawings.
 4. Additional separation requirements:
 - a. Class 1 Control circuits (limited to 120 V, see NEC Section 725 Parts I & II for Class 1 Circuits) are to be routed separately from other cables. (Lights and starter circuits)
 - b. Class 2 Control circuits (limited current and less than 50 V, see NEC Section 725 Parts I & III for Class 2 Circuits) are to be routed separately from other cables. (Analog signal, digital communications, Discrete Inputs and Outputs)
 - c. Class 3 Control circuits (limited current and less than 120 V, see NEC Section 725 Parts I & III for Class 3 Circuits) are to be routed separately from other cables. (Discrete Inputs to and Outputs from OPTO 22 modules to or from contacts and interposing relay coils.)
- D. Install communications horizontal cabling in accordance with manufacturer's instructions, ANSI/TIA/EIA-568-C.0, ANSI/TIA/EIA-568-C.1, ANSI/TIA/EIA-569-B, BICSI TDM, and NFPA 70.
- E. Open-Cable Installation:

26 05 23-4

Control and Instrumentation Cable

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- F. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (305 mm) in diameter below each feed point.
- G. Do not fill greater than TIA/EIA-569-B and the NEC maximum fill for particular raceway type.
- H. Each voice jack and each data jack shall be connected to a dedicated 4-pair Unshielded Twisted Pair (UTP) Category 6 cable.
- I. Provide work area outlets (WAO) at locations shown on the Drawings and at the following locations:
1. Install a minimum of two WAO's containing voice and data access in each typical office area, located on opposite walls to offer flexibility for change.
 2. Install a minimum of two WAO's at the Fire Alarm Control Panel (FACP) location in the electrical or mechanical room.
 3. Install a minimum of one WAO at each HVAC control panel.
 4. Install a minimum of one WAO at each elevator control panel.
 5. Install a minimum of one WAO at the security system control panel.
 6. Provide a 120VAC duplex power receptacle within three feet of each WAO location.
 7. WAO's located in hose or wash-down areas shall be installed above the anticipated damp area, and shall include a UL listed, NEMA rated water resistant cover.
- J. Install all cables complete with proper identification and terminations at both ends. Cable outer installation shall be dressed at the end of the cables with heat shrink tubing prior to terminations. Utilizing electrical tape is not allowed for dressing.
- K. Ground shield of shielded cables at one end only and as recommended by instrument manufacturer. When multiple shielded cables are terminated on a designated analog terminal strip an insulated green with yellow strip wire is used to jumper between the shield terminals and at the end of the terminal strip terminate the shields to the isolated DC ground bar mounted in the panel.
- L. Terminate stranded conductors with pre-insulated crimp type spade or barrel compression fitting terminals properly sized to fit fastening device and wire size.
- M. VoIP and data cabling shall be terminated on separate patch panels in the telephone room. Patch panels shall be mounted on a wall-mounted bracket, in a free-standing welded steel equipment rack, or in an enclosed data cabinet as shown on the Drawings.
- N. Dress and terminate cables in accordance with ANSI/TIA/EIA-568-C.0, ANSI/TIA/EIA-C.1, BICSI TDM, and manufacturer's instructions.

26 05 23-5

Control and Instrumentation Cable

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Terminate 4-pair cables on jack and patch panels using T568-B or T568-A wiring scheme.
 2. Pair Untwist at Termination: Do not exceed 12 mm (1/2 inch).
 3. Bend Radius of Horizontal Cables: Not less than 4 times cable OD.
 4. Maintain cable jacket to within 25 mm (1 inch) of termination point.
 5. Neatly bundle cables and dress to their respective panels or blocks.
- O. Install and terminate vendor furnished cable in accordance with vendor equipment requirements.
- P. Terminate shielded cable foil shields and drain wires to maintain shield continuity and shielding effectiveness from the cable to the connector. The connector manufacturer's installation instructions should be followed for shielded cable termination
- Q. Coordinate the installation and termination of the telephone cables with the OWNER, Information Technology Department.
- R. Install in conformance with the National Electrical Code.
- S. Identification:
1. Each cable and conductor shall be identified in each pull box and manhole with identification markers, which shall include the conduit number and/or cable number. The markers shall be self-laminating vinyl on white background and shall be printed using a Brady "XC Plus" printer or equal.

3.2 TESTING

- A. Test all cables in accordance with this specification section, ANSI/TIA/EIA-568-C.0, ANSI/TIA/EIA-568-C.1, and ANSI/TIA/EIA-568-C.2 standards, and manufacturer's instructions.
- B. Test cables and termination hardware 100 percent for defects in installation and verify cabling system performance under installed conditions in accordance with ANSI/TIA/EIA-568-C.0.
1. Verify all pairs of each installed cable before system acceptance.
 2. Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed
- C. Connect shielded instrumentation cables to a calibrated 4 to 20 mADC signal transmitter and receiver. Test at 4, 12 and 20 milliamp transmitter settings.
1. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens, and performance as specified.
 - a. Additional testing is required to verify Category performance.
 - b. Test horizontal cabling using manufacturers approved certification tester (Fluke or Agilent) for Category 6a, Category 6, and Category 5e performance compliance in accordance with ANSI/TIA/EIA-568-C.2.
 - c. Category 6a shall conform to ANSI/TIA/EIA-568-C-2 for augmented Category 6 to 500 MHz.
 2. Follow ANSI/TIA/EIA-568-C.2.
 3. Basic Tests Required:
 - a. Wire map.

26 05 23-6

Control and Instrumentation Cable

Washwater Equalizer Tank Replacement Project

- b. Length (feet).
 - c. Insertion loss (dB), formerly attenuation.
 - d. NEXT (Near end crosstalk) (dB).
 - e. Return loss (dB).
 - f. ELFEXT (dB).
 - g. Propagation delay (ns).
 - h. Delay skew (ns).
 - i. PSNEXT (Power sum near-end crosstalk loss) (dB).
 - j. PSELFEXT (Power sum equal level far-end crosstalk loss) (dB).
4. Category 6: auto test to 250 MHz.
5. Provide test results in approved certification testers original software format on CD, with the following minimum information per cable:
- a. Circuit ID.
 - b. Information from specified basic tests required.
 - c. Test Result: "Pass" or "Fail".
 - d. Date and time of test.
 - e. Project name.
 - f. NVP.
 - g. Software version.
6. No failed test will be accepted. Retest these results and submit after a "Pass" is received.
7. Submit software copy of test results, in original tester software format, to the OWNER and the ENGINEER.
8. Submit fully functional version of tester software for use by the ENGINEER in reviewing test results.
9. Report in writing to the ENGINEER immediately, along with copy of test results, failed test results that cannot be remedied through re-termination (as in the case of reversed or split pairs).
- D. Telephone cables shall be tested in accordance with and in the presence of the OWNER, Information Technology Department. A written proposed schedule shall be submitted a minimum of seven days prior to the testing of each telephone cable for inspection coordination.

++ END OF SECTION ++

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26 05 23-8

Control and Instrumentation Cable

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install complete grounding for the electrical systems, structures and equipment.
 2. Ground rods, building steel, building structural rebar, concrete structures structural brebar, tank steel and tank structural rebar, duct bank ground wires, and Pump cans and buried piping shall be bonded to the ground grid.
 3. Neutral bonding shall be provided for all transformers, generators and other separately derived systems, and where shown on the drawings.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
1. National Electrical Code (NEC) Article 250, Grounding.
 2. Underwriters Laboratories (UL) Standard No. 467, Electrical Grounding and Bonding Equipment.
 3. ANSI-J-STD-607-A, Commercial Building Grounding [Earthing] and Bonding Requirements for Telecommunications.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Manufacturer's technical information for grounding materials proposed for use, including round wires, rods, test wells, and connectors.
 2. Listing of grounding connector types identifying where they are to be used.
 3. Layouts of each structure ground grid.
 4. Test point construction details.
 5. Ground resistance test procedure.
 6. Results of ground resistance tests at each test point.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Ground Wire: Annealed, bare, stranded copper per ASTM B8 or solid per ASTM B 3. Bonding conductor shall be as indicated in Part 3 of this specification.
1. Product and Manufacturer: Provide one of the following:
 - a. Southwire Company

26 05 26-1

Grounding and Bonding

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- b. Service Wire Company
 - c. Encore Wire Corporation
 - d. Or engineer approved equal
- C. Grounding Connectors:
- 1. Material: Pressure connectors shall be copper alloy castings, designed specifically for the items to be connected, and assembled with Durium or silicone bronze bolts, nuts and washers. Welded connections shall be by exothermic process utilizing molds, cartridges and hardware designed specifically for the connection to be made.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Pressure Connectors:
 - 1) O.Z./Gedney - Emerson
 - 2) Burndy - Hubbell
 - 3) Or engineer approved equal
 - b. Welded Connections:
 - 1) Cadweld - Erico
 - 2) Therm-O-Weld by Continental Industries - Hubbell
 - 3) Or engineer approved equal
- D. Concrete Boxes:
- 1. Material: High density reinforced concrete box with non-settling shoulders positioned to maintain grade and facilitate back filling with steel checker plate screw down cover. Box may be rectangular or round with bell end.
 - 2. Size:
 - a. Inside Locations: 10 x 17 inches, minimum.
 - b. Depth: 12" inches minimum.
 - c. Wall thickness: 1 1/8" minimum.
 - 3. Product and Manufacturer: Provide one of the following:
 - a. Concrete Box:
 - 1) Christy Box- Oldcastle Infrastructure
 - 2) Or engineer approved equal
 - b. Steel Cover:
 - 1) Christy Box Cover labeled "GROUND" - Oldcastle Infrastructure
 - 2) Or engineer approved equal
- E. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, length as required, unless otherwise indicated; with insulators.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

26 05 26-2

Grounding and Bonding

Washwater Equalizer Tank Replacement Project

- C. Ground Bar: Provide a ground bar in the electrical rooms. Connect all equipment to ground bus. Provide 2 jumpers from ground bus to ground ring sized according to the grounding electrode size on the drawings.

3.2 STRUCTURE GROUND SYSTEM

- A. Provide ground grids as shown on the Drawings.
- B. Install a copper ground bus mounted to the wall in the electrical room as shown on the drawings.
- C. Install No. 4/0 AWG bare copper cable around the exterior perimeter of structures, minimum 2 feet, 6 inches below grade, unless otherwise shown on the Drawings.
- D. Install ground rods where shown on the Drawings. Install additional ground rods, if necessary, to attain a resistance to ground of less than five (5) ohms for each ground grid.
- E. For structures with steel columns, install 4/0 AWG ground cable. Install cable from grid to each column around the perimeter of the structure. Connect cable to steel using exothermic welds.
- F. Connect grids to a continuous underground water pipe system, when practical.
- G. Provide concrete ground test wells for measuring the ground resistance of each separately derived power source, including generators, prior to terminating in equipment. Provide 12-inch ground conductor slack loop in each well. Route ground conductor from test well to equipment in PVC conduit.
- H. Weld all buried connections. Test points connections shall utilize pressure connectors.

3.3 EQUIPMENT GROUNDING

- A. Ground all electrical equipment in compliance with the National Electrical Code.
- B. Equipment grounding conductors shall be bare stranded copper cable of adequate size installed in metal conduit where necessary for mechanical protection. Ground conductors, pulled into conduits with non-grounded conductors, shall be insulated. Insulation shall be green.
- C. Panel Grounding:
 - 1. A minimum size of 4/0 AWG bare stranded copper cable shall be installed between the ground grid and the panel enclosure grounding lug. The mounting frame for panels shall be grounded to the ground grid.
 - 2. A minimum size of 6 AWG insulated green stranded copper cable shall be installed between the ground grid and the isolated DC Ground Bus located on the enclosure sub-panel. This ground shall be installed in all panels that provide an isolated DC Ground Bus.
- D. A separate green insulated ground conductor sized per the one line diagrams as shown on DRAWINGS or NEC requirements shall be pulled into conduits and connected utilizing grounding conduit bushings.

26 05 26-3
Grounding and Bonding

Washwater Equalizer Tank Replacement Project

- E. Connect ground cable to piping by welding or brazing. Use copper bonding jumpers on all gasketed joints.
- F. Connect ground cable to equipment by means of lug compressed on cable end. Bolt lug to equipment frame using holes or terminals provided on equipment specifically for grounding. Do not install with hold down bolts. Where grounding provisions are not included, drill suitable holes in locations designated by ENGINEER.
- G. Connect to motors by bolting directly to motor frames, not to sole plates or supporting structures.
- H. Connect to service water piping by means of copper clamps. Use copper bonding jumpers on gasketed joints.
- I. Ground all electrical and mechanical equipment frames to ground. Connect outdoor metallic equipment and tank frames to a ground rod or an adjacent ground ring.
- J. Connect surge protective devices to ground.
- K. Connect magnetic flow meters directly to a ground rod.
- L. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- M. Scrape bolted surfaces clean and coat with a conductive oxide- resistant compound.
- N. Test all system grounding conductors for continuity of connection and electrical equipment. Provide in the final report a statement on equipment that was tested and document any discrepancies noted during the tests.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

26 05 26-4
Grounding and Bonding

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.5 INSTALLATION

- A. Grounding Conductors: CONTRACTOR to determine efficient route along shortest and straightest paths possible, unless otherwise indicated or required by Code.
- B. Bonding Grounding system with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- F. Bonding and Grounding for Fencing: For fencing around substations or electrical gear provide listed bonding connectors on each fence post. Connect to area ground grid with minimum #4/0 SDBC grounding conductors. Provide flexible, listed bonding straps across all hinges on all fence gates. Measure resistance to ground using fall-of-potential method and provide OWNER with certified test results.
- G. Grounding and Bonding for Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

- H. Grounding for Steel Building Structure: Exothermically bond ground grid to building steel at locations shown on the drawings.
- I. Ground Ring: Install a grounding ring around building or steel structures as shown on the drawings.
 - 1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
 - 2. Bury ground ring not less than 24 inches from building foundation.
- J. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
 - 1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.6 GROUND GRID TESTING

- A. The CONTRACTOR shall contract the Testing Firm to provide testing of the grounding electrode system as shown on drawings.
 - 1. Performing the following ground single point test:
 - a. Conduct test at the testing point(s) locations as shown on the drawings using a clamp-on ground tester.
 - b. Visually inspect the installed ground reference electrode or ground rods. Verify that they are intact and accessible. Measure the ground system at these test points with the clamp-on meter. The results shall be recorded and submitted for OWNER approval.
 - c. Provide a Serial Key number for each test point shown on the DRAWINGS. Coordinate with OWNER to determine the Serial Key number. Update the RECORD DRAWINGS with the Serial Key number.
 - d. Install metal ground test point tags identified with a Serial Key number at each test point using stainless steel wire and zinc wire clamps. For any test points within equipment, attach test point tag to exterior of equipment with epoxy.
 - e. Digitally Photograph clamp-on meter in place during test and include with test data sheets. Digital images shall have the Serial Key identified for reference. Digital images of these test points with the clamp-on tester in place are to provide a visual representation of the proper clamp-on testing placement and method and shall be inserted into the ground test sheet document.
- B. Install grounding test tags for each grounding test. Provide the following for each tag. Install tag with epoxy if unable to utilize wire and clamp.
- C. Tests shall be witnessed by the ENGINEER and OWNER.

++ END OF SECTION ++

SECTION 26 05 29

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Furnish all labor, materials, equipment, accessories, and components and install complete seismic restraint and support systems as indicated on the Drawings and as specified.
 - a. All racks, equipment stands, supports, hangers, bracing, and appurtenances shall conform to the latest applicable requirements of the State Building Code except as supplemented or modified by the requirements specified in this Section.
 - b. The electrical subcontractor shall engage the services of an independent structural engineer registered in the State, with specific experience in the design of seismic restraints and supports for electrical supporting systems hereinafter referred to as support engineer. Provide seismic design, materials, and installation.
2. Provide anchorage and support design, including seismic, for boxes weighing 400 pounds or more in accordance with General Electrical Provisions under Division 26.
3. Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
1. NEC 70, National Electrical Code.
 2. Local Codes.

1.3 SUBMITTALS

Shop Drawings: Submit for approval manufacturers technical information for structural components, including slotted support systems and hardware.

PART 2 - PRODUCTS

2.1 HARDWARE

- A. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Steel and Stainless-Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Product and Manufacturer: Provide one of the following:
 - a. Allied Tube & Conduit

26 05 29-1
Hangers and Supports

- b. Cooper B-Line, Inc.; a division of Cooper Industries
 - c. ERICO International Corporation
 - d. GS Metals Corp
 - e. Thomas & Betts Corporation
 - f. Unistrut; Tyco International, Ltd
 - g. Wesanco, Inc.
 - h. Or engineer approved equal
- 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Channel Dimensions: Selected for applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Mounting, Anchoring, and Attachment Components:
- 1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries
 - 2) Empire Tool and Manufacturing Co., Inc
 - 3) Hilti Inc
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc
 - 5) MKT Fastening, LLC
 - 6) Or engineer approved equal
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 3. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Hilti Inc
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc
 - 3) MKT Fastening, LLC
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit
 - 5) Or engineer approved equal
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.
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26 05 29-2

Hangers and Supports

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with section requirements for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 3/8 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.

26 05 29-3
Hangers and Supports

7. Spring tension style clamps are prohibited for use.
 8. To Light Steel: Sheet metal screws.
 9. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified for Cast-in-Place Concrete.
- C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

++ END OF SECTION ++

26 05 29-4
Hangers and Supports

SECTION 26 05 33

OUTLET, PULL, AND JUNCTION BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install outlet, pull, and junction boxes.
 2. Boxes are not shown on the drawings. Provide boxes as required for a complete wiring and device system as required to meet the requirements of the National Electrical Code and the drawings and specifications.
 3. Provide boxes so that no conduit run contains more than three 90 degree bends and in runs over 200 feet in length.
 4. Provide anchorage and support design, including seismic, for boxes weighing 400 pounds or more in accordance with General Electrical Provisions under Division 26.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
1. NEC Article 370, Outlet, Switch and Junction Boxes, and Fittings.
 2. UL Standard No. 50, Electrical Cabinets and Boxes.
 3. UL Standard No. 514, Electrical Outlet Boxes and Fittings.
 4. UL Standard No. 886, Electrical Outlet Boxes and Fittings for Use in Hazardous Locations.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Manufacturers technical information for outlet, pull, and junction boxes proposed for use.

PART 2 - PRODUCTS

2.1 DEVICE AND OUTLET BOXES:

- A. NEMA 1 or NEMA 12 boxes:
1. Zinc-coated pressed sheet steel with knockouts and of size and type suitable for the intended application. Cast boxes shall be hub type and include external mounting lugs.
 2. Covers shall be stainless steel Type 302 alloy.
- B. NEMA 3R or NEMA 4 boxes:
1. Cast gray iron alloy, or cast malleable iron, with zinc electroplate finish with cast covers and stainless steel screws. Cast or malleable iron device boxes shall be Type

26 05 33-1

Outlet, Pull, and Junction Boxes

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- FD. Boxes and fittings shall have cadmium-zinc finish with cast covers and stainless steel screws.
2. Cast aluminum device boxes shall be Type FD. Boxes and fittings shall be copper free aluminum with cast aluminum covers and stainless steel screws.
 3. Covers shall be gasketed weatherproof while-in-use door type and fastened with stainless steel clamps.
 4. Product and Manufacturer: Provide one of the following:
 - a. Appleton - Emerson
 - b. Crouse-Hinds - Eaton
 - c. Steel City - Thomas & Betts
 - d. Hoffman
 - e. Electromate - Rittal
 - f. Or engineer approved equal
- C. NEMA 4X boxes:
1. Boxes shall include a factory applied 40-mil PVC coating.
 2. Covers shall be gasketed weatherproof while-in-use door type plastic or PVC coated.
 3. Product and Manufacturer: Provide one of the following:
 - a. Plasti-Bond Red - Robroy Industries
 - b. Triangle PWC Inc
 - c. Or engineer approved equal

2.2 PULL AND JUNCTION BOXES:

- A. General Material and Construction:
1. Cast gray iron alloy with hot-dip galvanized finish or cast malleable iron bodies and covers.
 2. Neoprene gaskets. Gaskets shall be of an approved type designed for the purpose. Improvised gaskets are not acceptable.
 3. Stainless steel cover screws.
 4. External mounting lugs.
 5. Drilled and tapped conduit holes.
 6. Boxes where conduits enter a building below grade shall have 1/4-inch drain hole.
- B. NEMA 1 or NEMA 12 boxes:
1. Small boxes for junction or pull boxes shall be zinc galvanized pressed steel not less than 14 USS gauge with appropriate blank covers, minimum size 4 11/16-inch square by 2 1/8-inch deep.
 2. Large boxes shall be constructed of hot dip galvanized sheet steel without knockouts. Covers shall be secured with round head brass machine screws. All joints shall be welded and ground smooth.
 3. NEMA 12 terminal boxes shall be sheet steel unless otherwise shown on the Drawings. Boxes shall be painted and have continuously welded seams. Welds shall be ground smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Terminal boxes shall be furnished with latching hinged doors, terminal mounting straps and brackets. Terminal blocks shall be rated not less than 20A, 600V.
 4. Product and Manufacturer: Provide one of the following:
 - a. Appleton - Emerson
 - b. Raco - Hubbell

26 05 33-2

Outlet, Pull, and Junction Boxes

Washwater Equalizer Tank Replacement Project

- c. Steel City – Thomas & Betts
 - d. Hoffman
 - e. Electromate - Rittal
 - f. Wiegmann – Hubbell
 - g. Or engineer approved equal
- C. NEMA 3R or NEMA 4 boxes:
- 1. NEMA 3R and NEMA 4 terminal boxes, junction boxes, pull boxes, etc, shall be sheet Type 316 stainless steel unless otherwise shown on the Drawings. Boxes shall have continuously welded seams and mounting feet. Welds shall be ground smooth. Boxes shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel clamps. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amps, 600 Volt.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Appleton - Emerson
 - b. Crouse-Hinds - Eaton
 - c. Steel City – Thomas & Betts
 - d. Hoffman
 - e. Electromate – Rittal
 - f. Or engineer approved equal
- D. Junction boxes and pullboxes embedded in concrete slabs shall be cast iron. Flush-mounted pullboxes in exterior slabs or pavement and where indicated in interior slabs, provide vehicular traffic-bearing covers.

2.3 NAMEPLATES

- A. Material: Laminated phenolic, engraved to show 1/2-inch high letters, Arial Font, unless stated elsewhere in the CONTRACT DOCUMENTS for a specific piece of equipment. The letters shall be black with white background or match existing.
- B. Border: Minimum 1/8-inch around engraved print with extra length for fastening devices.
- C. Fasteners: Secured with #4-40, round-head, stainless steel, self-tapping screws.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten boxes rigidly and neatly to supporting structures.
- B. For units mounted on masonry or concrete walls, provide suitable 1/2-inch spacers to prevent mounting back of box directly against wall.
- C. Leave no open conduit holes in boxes. Close unused openings with capped bushings.

26 05 33-3

Outlet, Pull, and Junction Boxes

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- D. Label each circuit in boxes and identify in accordance with the drawings and this specification.
- E. Mount boxes so that sufficient access and working space is provided.
- F. Securely fasten boxes to walls or other structural surfaces on which they are mounted. Provide independent stainless steel or FRP supports where no walls or other structural surface exists. Do not locate pull boxes on handrails.
- G. Install pull boxes where shown on the Drawings. In addition, install pull boxes in conduit runs containing more than three 90 degree bends and in runs exceeding 200 feet. For communications, signal, and fiber optic cabling conduit runs install pull boxes in runs containing more than two 90 degree bends and in runs exceeding 100 feet.
- H. Provide removable, flame-retardant, insulating cable supports in all boxes with any dimension exceeding 3 feet.
- I. Field apply PVC touch up to scratched PVC boxes damaged as a result of installation. All touch up work shall be in strict conformance with manufacturer's recommendations and instructions.

++ END OF SECTION ++

26 05 33-4

Outlet, Pull, and Junction Boxes

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 26 05 35

RACEWAYS, FITTINGS, AND SUPPORTS

PART 1 - GENERAL

1.1 1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install conduit and fittings to provide complete, coordinated and grounded raceway systems.
2. Conduit routings for various systems within buildings and other areas may not be shown on the Drawings. Conduit and wiring are indicated on the drawing in one-Line diagrams, wiring block diagrams, panel schedules, wiring diagrams, panelboard schedules, P&IDs, etc. Responsibility to establish single line, riser and interconnection diagrams and any other related information shown on the Drawings, belongs to CONTRACTOR. Provide for the proper installation of all conduits for each system. Submit conduit routing and tagging meeting this this specification and submit to ENGINEER/OWNER for review and approval prior to construction.
3. Furnish all labor, materials, equipment, accessories and components and install a complete seismic restraint and support system for raceway systems as indicated on the Drawings and as specified.

B. Coordination:

1. Coordinate conduit installation and routing with piping, ductwork, lighting fixtures and other systems and equipment and locate so as to avoid interferences.
2. For conduits to be embedded in concrete slabs, confirm adequate slab thickness and coordinate location of conduits with placement of reinforcing steel, water stops and expansion joints.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

1. National Electrical Code (NEC) current adoption.
2. UL Standard No. 6, Rigid Metal Electrical Conduit.
3. UL No 514B Standard for Conduit, Tubing, and Cable Fittings.
4. UL Standard No. 651, Schedule 40 and 80 PVC Conduit.
5. ANSI C80.4, Fittings for Rigid Metal Conduit and Electrical Metal Tubing.
6. NEMA TC2, Electrical Plastic Tubing, Conduit and Fittings.
7. NEMA TC3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
8. NEMA RN 1, Polyvinyl Chloride (PVC) Externally Coated Rigid Metal Conduit and Intermediate Metal Conduit.
9. TIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces.
10. BICSI Customer-Owned Outside Plant Design Manual.

26 05 35-1

Raceways, Fittings, and Supports

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Manufacturer's catalog cuts for the conduit, fittings, supports, conduit identification tags, orange electrical ID tape, and warning ribbon proposed for use. Provide engraved samples of conduit identification tags.
 2. Construction details of conduit racks and other conduit support systems.
 3. Layout drawings showing proposed routing of exposed conduits, conduits embedded in structural concrete and conduits directly buried in earth. Drawings shall show locations of intermediate termination panels (ITP's), pull boxes and penetrations in walls and floor slabs. Drawings of embedded conduits shall include cross-sections showing the thickness of the concrete slabs and the locations of conduits with respect to reinforcing steel and waterstops. Tag conduits per conduit schedule shown on drawings.
 4. Drawing shall be electronically produced to maintain quality and clarity of presentation when re-produced, even when reduced to half size (11 x 17 inches).
 5. Provide manufacturer's proof of certification for PVC coated rigid metal conduit for all installer's supervisors.
- B. Record Drawings: Show the actual routing of exposed and concealed conduit runs on the Record Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS - CONDUIT AND CONDUIT FITTINGS

- A. Steel Conduit and Fittings
1. Rigid metal conduit (GRS), couplings, factory elbows and fittings shall be heavy wall steel tubing with a hot-dipped galvanized finish inside and out after threading and shall comply with ANSI C 80.1 and UL/6.
 2. Intermediate metal conduit (IMC), couplings, factory elbows and fittings shall be medium wall steel tubing with a hot-dipped galvanized finish inside and out after threading and shall comply with UL/1242.
 3. Electrical metallic tubing (EMT), factory elbows and fittings shall be thin wall steel tubing with an electrically galvanized finish after fabrication and comply with ANSI C80.3 and UL/797.
 4. Product and Manufacturer: Provide one of the following:
 - a) Allied Tube & Conduit - Atkore
 - b) Wheatland Tube
 - c) Western Tube - Zekelman Industries
 - d) Or engineer approved equal
 5. Rigid metal and intermediate metal conduit fittings shall be of the threaded type, and shall be steel or malleable iron, with a hot-dipped galvanized finish. Threadless fittings and split couplings are not allowed except in specific applications as approved by the ENGINEER.
 6. Electrical metallic tubing fittings shall be of the rain tight, concrete tight, compression type with malleable iron or pressure cast steel body, steel hex type compression nut and electrically galvanized finish.
 7. Product and Manufacturer: Provide one of the following:
 - a) Appleton -Emerson

26 05 35-2

Raceways, Fittings, and Supports

Washwater Equalizer Tank Replacement Project

- b) O-Z Gedney - Emerson
- c) RACO - Hubbell
- d) Gould/Efcor
- e) Steel City – Thomas & Betts
- f) Or engineer approved equal

B. Rigid Nonmetallic Conduit:

1. PVC Plastic Conduit:

- a. Conduit Material: Schedule 40 PVC plastic, 90 degrees C (194 degrees F) rated, conforming to NEMA TC-2 and UL No. 651.
- b. Fittings: Elbows, bodies, terminations, expansions and fasteners of same material and manufacturer as base conduit. Materials shall conform to NEMA TC-3 and UL No 514B or UL No 651.
- c. Provide cement and primer by same manufacturer as base conduit.
- d. Product and Manufacturer: Provide one of the following:
 - 1) PW Eagle
 - 2) Prime Electrical
 - 3) Cantex
 - 4) Or engineer approved equal
 - 5)

C. Liquid-tight Flexible Metal Conduit, Couplings and Fittings

- 1. Liquid-tight flexible metal conduit shall be square locked, galvanized steel flexible conduit with a moisture proof, flame resistant, polyvinyl chloride jacket, for use with rigid metal conduit systems. Sealtite, Type UA.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Anaconda Metal Hose Div.
 - 2) Anaconda American Brass Co.
 - 3) American Flexible Conduit Co., Inc.
 - 4) Universal Metal Hose Co.
 - 5) Electri-Flex Company
 - 6) Or engineer approved equal
- 2. Liquid-tight conduit fittings shall be hot-dipped mechanically galvanized, positive grounding, screw in type. Provide external bonding lugs on sizes 1 1/4-inch and larger. Box connectors shall have insulated throats.
 - a. Product and Manufacturer: Provide one of the following
 - 1) Thomas & Betts Co.
 - 2) Crouse-Hinds Co.
 - 3) O-Z Gedney - Emerson
 - 4) Or engineer approved equal

2.2 MATERIALS - FITTINGS

A. Bushings:

- 1. Insulated bushings shall be provided for all conduit terminations to boxes, cabinets, other enclosures and raceways not requiring a hub. Insulated bushings shall be Malleable iron body with plastic liner, threaded type with steel clamping screw. Provide with bronze grounding lug, as required. Manufacturer shall be O-Z/Gedney - Emerson, Appleton – Emerson, or equal.
- 2. Conduit sealing bushings shall be O.Z./Gedney - Emerson, Type CSB, or equal.

3. Grounding bushings shall be malleable iron with integral insulated throat rated for 150 degrees C (302 degrees F), with solderless lugs as manufactured by Crouse Hinds - Eaton, Series HGLL; Appleton - Emerson, Series GIB; O.Z./Gedney - Emerson, Type HBLG, or equal.
- B. Conduit hubs:
1. Shall be similar to Myers Electric Products, Inc. or equal.
- C. Flexible couplings:
1. Flexible couplings shall be type ECGJH as manufactured by the Crouse-Hinds - Eaton; Appleton - Emerson; Killark - Hubbell, or equal.
- D. Conduit wall seals:
1. Provide for new concrete walls below grade similar to O.Z./Gedney - Emerson, Type WSK; Linkseal; Spring City Electrical Manufacturing Co., Type WDP, or equal.
 2. Provide for cored holes similar to O.Z./Gedney - Emerson Type CSMC, or equal.
 3. Provide wall and floor seals for sleeved openings similar to O.Z./Gedney - Emerson Type CSMI, or equal.
- E. Explosion proof fittings:
1. Manufactured by the Crouse-Hinds - Eaton; Appleton - Emerson; O.Z./Gedney - Emerson, or equal.
- F. Seal Fittings:
1. Materials and Construction:
 - a. Cast gray iron alloy or cast malleable iron or copper free aluminum bodies with zinc electroplate and lacquer or enamel finish.
 - b. Ample opening with threaded closure for access to conduit hub for making dam.
 - c. In corrosive locations, fittings shall include a factory applied 40-mil PVC coating.
 - d. Sealing fiber for forming the dam within the hub and the sealing compound shall be approved for use with the fittings furnished, and shall be products of the fitting manufacturer.
 2. Product and Manufacturer: Provide one of the following:
 - a. Crouse Hinds - Eaton
 - b. Appleton - Emerson
 - c. Or engineer approved equal

2.3 CONDUIT SUPPORTS, RACKS, AND HANGERS

- A. Trapezes and Supports
1. In areas where NEMA 1 or NEMA 12 boxes are specified to be installed, beams, channels, struts, hangers, bracing, rods, beam clamps, accessories and components shall be galvanized steel.
 2. In areas where NEMA 3R or 4 boxes are specified to be installed, beams, channels, struts, hangers, bracing, rods, beam clamps, accessories and components shall be galvanized steel.
 3. In areas where NEMA 4X boxes are specified to be installed, 316 stainless steel beams, channels, struts, channels, struts with stainless steel hangers, bracing,

26 05 35-4

Raceways, Fittings, and Supports

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

rods, beam clamps, accessories and components shall be used, except where PVC coated RGS conduit is specified.

4. In areas where PVC coated rigid galvanized steel conduit is specified to be installed, PVC coated steel beams, channels, struts, channels, struts with stainless steel hangers, bracing, rods, beam clamps, accessories and components shall be used.
5. Adjustable steel and plastic band hangers, adjustable band hangers, adjustable swivel ring hangers and J-hangers shall not be allowed.
6. All hangers, bracing, rods, beam clamps, accessories and components shall be as manufactured by the Carpenter & Paterson Inc.; Grinnell Corporation; B-Line Systems - Eaton, or equal.
7. Design of supplemental structural steel required for attachment to the building structural support system shall be the full responsibility of the CONTRACTOR's independent structural engineer.

B. Equipment Racks

1. Utilize angles, square tubing, channel, and miscellaneous material as shown on the contract drawings.
2. Equipment support racks shall be constructed from U-channel to support enclosures with overall size less than 3 feet wide by 4 feet high.
3. Equipment support racks shall be constructed from angle and tubing to support enclosures with overall size equal to or greater than 3 feet wide by 4 feet high.

2.4 CONDUIT TAGS:

- A. Tag all conduits at the ends and in all intermediate boxes, chambers, hand holes and other enclosures.
- B. Conduit tags shall be yellow, 1 1/2-inch diameter, round, aluminum tags, laser engraved or standard engraving with the conduit number as shown on the Conduit and Cable Schedule. Punched or stamped lettering is not allowed. Font shall be 1/4-inch Arial or Helvetica. The conduit tags shall be manufactured by Brady, Catalog No. 49900, Or Equal.
- C. Each tag shall be attached with nylon-coated 48-mil stainless steel wire and fasteners, as manufactured by Brady, Catalog No. 38091, and zinc wire clamps, double ferrule design, as manufactured by Brady Catalog No. 38090 to secure the stainless steel wire. Where this method is not practical, fasten to the adjacent masonry by means of expansion bolts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in conformance of NEC, Articles 344, 352 and 358. Cap all conduits, ducts and raceways during construction to protect from debris entering and blocking the circuit installation.
- B. Supports:
 1. Rigidly support conduits by clamps, hangers or strut channels.

26 05 35-5

Raceways, Fittings, and Supports

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2. Support single conduits by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the support surface. Support multiple runs of conduits on trapeze type hangers with Type 316 Stainless Steel horizontal members and Type 316 Stainless Steel threaded hanger rods, Kindorff or equal. Rods shall be not less than 3/8-inch diameter.
 3. PVC coated rigid metal conduit runs, beam clamps, U-bolts, pipe straps, clamp back spacers, clamp hangers and supports shall have a factory applied PVC coating or be stainless steel. Hardware shall be Type 316 Stainless Steel.
 4. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit.
- C. Fastenings: Fasten raceway systems rigidly and neatly to supporting structures by the following methods:
1. To Wood: Type 316 Stainless Steel wood screws.
 2. To Hollow Masonry Units: Type 316 Stainless Steel toggle bolts.
 3. To Brick Masonry: Type 316 Stainless Steel Price expansion bolts, or equal.
 4. To Concrete: Refer to Division 5.
 5. To Steel: Type 316 stainless steel welded threaded studs, beam clamps or bolts with lock-washers or locknuts.
- D. Install flexible conduits at motors, transformers, instruments and equipment which are subject to vibration or require movement for maintenance purposes. Provide necessary reducer where equipment furnished cannot accept 3/4-inch size flexible conduit. Limit flexible conduit length to three feet maximum.
- E. Install seal fittings for hazardous locations as required by National Electrical Code, and whereas shown on the Drawings. Select a fitting for the proper use in respect to the mounting position. Use oversized fittings with reducing bushings when necessary to maintain cable fill requirements of the conduit system.
- F. PVC Coated Rigid Metal Exposed Conduit:
1. Install in strict accordance with manufacturer's recommendations and installation manual. Installers shall be certified by the manufacturer before installation begins.
 2. Install with manufacturer's installation tools and compounds to prevent damage to the PVC coating.
 3. Repair minor damage to interior urethane and exterior PVC coating with manufacturers recommended touch-up compound.
 4. Install parallel or perpendicular to structural members or walls.
 5. Wherever possible, run in groups. Provide conduit racks of suitable width, length and height and arranged to suit field conditions. Provide support at manufacturer's recommended distances, or at every ten feet minimum.
 6. Install on structural members in protected locations.
 7. Locate clear of interferences.
 8. Maintain 6 inches from hot fluid lines and 1/4 inch from walls.
 9. Install vertical runs plumb. Unsecured drop length not to exceed 12 feet.
 10. Provide necessary reducers where equipment furnished cannot accept 3/4-inch conduit.
- G. Conduit Embedded in Structural Concrete:
1. Separation: 2 inches minimum clear between conduits.

2. Minimum Slab Thickness: Confirm that concrete slab thickness is sufficient for embedding conduits.
 - a. For embedding conduit sizes up to 1 1/2 inches, the minimum slab thickness shall be 7 inches plus the outer diameter of the conduit or conduits, where conduits cross.
 - b. For embedding conduits larger than 1 1/2 inches, the minimum slab thickness shall be five times the outer diameter of the conduit where conduits do not cross and six times the outer diameter of the larger conduit where conduits do cross.
 3. Concrete shall have a minimum 28-day compressive strength of 2,000 PSI. Concrete used for ductbanks shall be Type 2 with red color added as specified in Division 3.
 4. Run conduits in center of slab, where applicable.
 5. Run conduits in spacers to maintain recommended minimum, even spacing.
 6. Run conduits above waterstops.
 7. Before concrete is placed, make the necessary location measurements of the conduits to be embedded so that the information is available to prepare Record Drawings.
 8. All conduits entering or exiting concrete shall be PVC coated galvanized rigid metal, for a minimum of 12 inches from the concrete edge.
- H. Underground Conduits that are non-encased: PVC coated rigid metal conduits.
1. Install individual underground conduits a minimum of 24-inches below grade, unless otherwise shown on the Drawings or as required to avoid existing obstructions.
 2. Perform all excavation, bedding, backfilling and surface restoration including pavement replacement, where required.
 3. Install warning ribbon 12 inches below finished grade over all conduits.
 4. Make conduit connections watertight by applying PVC touch-up compound at the sealing sleeve joints.
- I. Empty Conduits:
1. Spare conduits shall be cleaned, swabbed, and mandreled to verify viability for future use.
 2. Install a true tape or mule tape in each empty conduit and cap conduits not terminating in boxes with permanent fittings designed for the purpose. Pulling rope or tape shall be constructed of polyester and factory lubricated. Nylon is not allowed.
 3. Identify each empty conduit with a conduit tag conforming to the requirements of the specifications showing the conduit number shown on the Drawings.
- J. Field Bends: Use manufacturer supplied field bends whenever possible. No indentations. Diameter of conduit shall not vary more than 15 percent at any bend. Maximum total amount of bends shall not exceed 270 degrees.
- K. Length of run between manholes shall be limited to:
1. 300 feet with 270 degree in bends.
 2. 600 feet with 180 degree in bends.
 3. 1000 feet with 90 degree in bends.
- L. Joints:
1. Make joints tight and ground thoroughly.

26 05 35-7

Raceways, Fittings, and Supports

Washwater Equalizer Tank Replacement Project

2. Use standard tapered pipe threads for conduit and fittings.
3. Cut conduit ends square and ream to prevent damage to wire and cable.
4. Use a degreasing spray to thoroughly clean field cut threads, and internal reams to ensure the touch-up compound will adhere to the unprotected metal.
5. Apply urethane touch-up compound to all joints, field cut threads, and internal reams before assembly for corrosion protection and visible identification of proper installation.
6. Use full threaded couplings. Split couplings not permitted.
7. During installation, install with manufacturer's installation tools to prevent damage to PVC coating. Replace conduit with wrench marks.

M. Moisture Protection:

1. Plug or cap conduit ends at time of installation to prevent entrance of moisture or foreign materials.
2. Make underground and embedded conduit connections watertight.
3. Through Wall Seals and Conduit Sealing Bushings: Install for all conduits passing through concrete slabs, floors, walls or concrete block walls.
 - a. For conduits and cables in new construction and passing through exterior subsurface walls and exterior concrete walls, use Type WSK and WSCS through wall seals as manufactured by O-Z/Gedney - Emerson.
 - b. For conduits and cables in new construction and passing through concrete floors and floor slabs, use Type FSK and FSCS floor seals, as manufactured by O-Z/Gedney - Emerson.
 - c. For conduits passing through new exterior block walls or through core-drilled holes in existing exterior subsurface walls, exterior concrete walls, floor slabs and roof slabs, use Type CSMI sealing bushing at the inside of the structure and Type CSMC sealing bushing at the outside of the structure. Sealing bushings shall be as manufactured by O-Z/Gedney - Emerson.
 - d. For conduits passing through existing interior concrete walls or floors and interior block walls, provide CSMC or CSMI type sealing bushings as manufactured by O-Z/Gedney - Emerson.
4. Drainage: Pay particular attention to drainage for conduit runs. Wherever possible, install conduit runs so as to drain to one end and away from buildings. Avoid pockets or depressions in conduit runs. Where conduits enter buildings below grade, seal inside of conduit to form a watertight seal around cables to prevent the entry of water into building.
 - a. Product and Manufacturers:
 - 1) Type DUX - Duct Sealing Compound by O-Z/Gedney - Emerson
 - 2) Type FST Foam Sealant - American Polywater Corp
5. Seal all conduit openings within control and instrumentation panels and distribution equipment with Type DUX - Duct Sealing Compound, as manufactured by O-Z/Gedney - Emerson, to provide a water/bug-tight seal.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Type DUX - Duct Sealing Compound by O-Z/Gedney - Emerson
 - 2) Type FST Foam Sealant - American Polywater Corp

N. Corrosion Protection:

1. Conduit Curb:
 - a. For conduits routed in concrete slabs or floors and stub-ups through the floor, provide a 2-inch high concrete curb, extending 2-inches from the outer surface

- of the conduit penetrating the floor, to prevent corrosion. For floor-mounted equipment, the concrete equipment base shall be in lieu of the concrete curb.
- b. Conduit stub-ups shall be a 90 degree PVC coated rigid metal conduit elbow. PVC coated elbow shall extend slightly above the top of the concrete curb or equipment base. Should the elbow not reach this height, provide PVC coated conduit extension to accommodate requirements. Provide PVC coated coupling/fitting for transition from conduit in slab to elbow.
 - c. For conduits stubbing up and terminating at equipment enclosure mounted on a concrete equipment base, provide RNC stub-up and bell end.
 - d. For conduits stubbing up and extending to boxes, cabinets and other enclosures above the concrete curb in wet and dusty areas provide PVC coated conduit coupling/fittings between the PVC coated elbow and PVC coated rigid metal conduit for transition between the two conduit types.
 - e. For conduits stubbing up and extending to boxes, cabinets and other enclosures above the concrete curb or equipment base in corrosive areas, continue the conduit system with PVC coated rigid metal conduit.
 - f. Conduit into a protected base or equipment enclosure shall be RNC with RNC bell end.
2. Dissimilar Metals: Take every action to prevent the occurrence of electrolytic action between dissimilar metals
- O. Reused Existing Conduits:
1. Pull rag swab through conduits to remove water and to clean conduit prior to installing new cable.
 2. Repeat swabbing until all foreign material is removed.
 3. Pull mandrel through conduit, if necessary, to remove obstructions.
- P. Core drill for individual conduits passing through existing concrete slabs and walls. Obtain authorization from OWNER prior to core drilling. Prior to core drilling, drill sufficient number of small exploratory holes to establish that the area to be core drilled is free of existing embedded conduits. Seal spaces around conduit in accordance the specifications.
- Q. Non-metallic Conduit:
1. Install in accordance with manufacturer's recommendations.
 2. Join sections in accordance with manufacturer's installation procedures for push-fit, bell and spigot type joints, if applicable, or with manufacturer's recommended cement and primer.
 3. During installation provide expansion fittings for expansion and contraction to compensate for temperature variations. Expansion fittings shall be watertight and of the type suitable for direct burial.
 4. Make transition to PVC coated galvanized rigid metal conduit before making turns into enclosures, cabinets, termination boxes, pull boxes, etc.
 5. For expansion/deflection fittings as shown on CONTRACT DRAWINGS.
- R. Wall Penetrations:
1. CONTRACTOR shall ensure conduits that penetrate walls allow for the maintenance of minimum bend radius during the installation of cable.
 2. Submit shop drawings for approval for each wall penetration.

3.2 TESTING

- A. Test conduits by pulling through each conduit a cylindrical mandrel not less than two pipe inside diameters long, having an outside diameter equal to 90 percent of the inside diameter of the conduit.
- B. All conduits greater than 1 1/2 inches in size shall be swabbed and mandrel cleaned. This process shall be 100 percent witness inspected and each conduit inspection shall be identified and documented.

++ END OF SECTION ++

26 05 35-10

Raceways, Fittings, and Supports

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish and install underground duct banks including all labor, materials, equipment and incidentals as shown on the Drawings and specified for a complete system.
- B. Coordinate installation with piping and other underground systems and structures. Provide supports for traversing existing underground facilities. Field verify proposed equipment locations prior to rough-in.
- C. Provide bases for pad mounted electrical equipment per manufacturer's recommendations.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the National Electrical Code.
- B. Materials shall be UL listed where applicable.

1.3 SUBMITTALS

- A. Submit the following:
 - 1. Plans showing the proposed routing of duct banks and the locations of manholes, handholes and indicate burial depth and duct bank construction at each location.
 - 2. Profiles of duct banks showing crossings with piping and other underground systems.
 - 3. Typical cross sections.
 - 4. Concrete pad and vault information:
 - a. Detailed drawings
 - b. Structural calculations
 - c. Catalog information:
 - 1) Manholes, hand holes, and vaults
 - 2) Vault accessories
- B. Record Drawings: Include the actual routing of underground duct runs on Record Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Duct: Schedule 40 PVC conduit and fittings.

26 05 43-1

Underground Ducts and Raceways

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- B. Provide red color oxide to concrete and warning tape over all duct banks for easy identification during subsequent excavation. The red oxide is to be added in the concrete truck prior to the concrete being placed. Red oxide concrete shall include the entire duct bank, top and bottom unless under a slab.
- C. Exposed: PVC Coated Galvanized Rigid Metal Conduit: PVC coated rigid metal conduit and fittings.
- D. Backfill: Select electrical duct bank backfill material not to exceed 90 RHO thermal resistance while dry and in accordance with the specifications.
- E. Reinforcement: In accordance with the material specifications.
- F. Concrete: In accordance with the material specifications.
- G. Padmounted transformer pads and Vaults in accordance with utility company Standard. Utility transformer Pads and vaults must be pre-approved by the utility company.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install outdoor equipment pads such that the electrical terminals are 3 feet above finished grade minimum.
- B. Ducts containing 1 phase wiring greater than 600V (1 phase per duct) shall be non-metal only with fiberglass elbows and risers into pad-mounted equipment or shall match utility company requirements.
- C. Separation of Duct Banks systems:
 - 1. The following systems shall be routed in separate duct banks:
 - a. Control and signal 48 V and less.
 - b. Power and control 120 V.
 - c. Power greater than 120V and less than 1000 V.
 - d. Power 1000 V and greater.
 - 2. The following systems shall be routed in separate hand holes and manholes:
 - a. Control and signal 48 V and less and power and control 120 V.
 - b. Power greater than 120 V and less than 1000 V.
 - c. Power 1000 V and greater.
 - d. Manholes shall be sized as shown on the contract drawings.
- D. All bends (vertical and horizontal) of 45 degrees or more require PVC coated rigid metal conduit.
- E. Excavation and backfilling required for duct bank installation.
- F. All duct bank installations and penetrations through foundation walls shall be watertight and in accordance with the specifications.
- G. Top of duct banks shall be as follows:

26 05 43-2

Underground Ducts and Raceways

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. 1000V and below - minimum of 36 inches below grade, unless otherwise approved by the ENGINEER.
 2. Greater than 1000V – 48 inches below grade.
 3. Duct banks may vary for short distances to avoid underground interferences as approved by the ENGINEER.
- H. Assemble duct banks using non-magnetic saddles, spacers and separators. Position the separators to provide 3 inches minimum concrete separation between the outer surfaces of the ducts. Side forms are only required to prevent excessive widening of the duct bank where over excavation has occurred.
- I. Provide a 3-inch minimum concrete covering on sides, top and bottom of concrete envelopes around conduits. Concrete covering size shall be as shown on the Drawings.
- J. Firmly fix ducts in place during placing of concrete. Carefully place and vibrate the concrete to ensure filling of all spaces between ducts.
- K. Conduits entering floor mounted equipment, such as, switchgear compartments, motor control centers, transformers shall terminate with PVC coated rigid metal conduit factory 90° elbows, RNC risers and bell ends.
- L. Reinforce all duct banks.
1. Unless otherwise shown on the Drawings, reinforce with No. 4 longitudinal steel bars placed at each corner and along each face at a maximum parallel spacing of 18 inches on centers, and No. 3 tie-bars transversely placed at 18 inches maximum longitudinal intervals. Overlap of No. 3 tie-bars shall be a minimum of 4-inches.
 2. Maintain a maximum clearance of 1 inch from bars to the edge of the concrete encasement.
 3. Install dowel reinforcement rebar where duct bank meets other concrete structures.
- M. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material or other materials which can damage or contribute to corrosion of ducts or cables or prevent adequate compaction of fill.
- N. Slope duct runs for drainage toward manholes and away from buildings with a slope of approximately 3 inches per 100 feet.
- O. Install a bare stranded copper duct bank ground cable (4/0 or as shown on drawings) in each duct bank envelope. Make ground electrically continuous throughout the entire duct bank system. Connect ground cable to building and station ground grid or to equipment ground buses. In addition, connect ground cable to steel conduit extensions of the underground duct system. Provide ground clamp and bonding of each steel conduit extension, where necessary to maintain continuity of the ground system. Terminate ground cable at last manhole or handhole for outlying structures.
- P. After completion of the duct bank or utilizing existing ducts and prior to pulling cable, pull a mandrel, not less than 12 inches long and with a cross section approximately 1/4 inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to make certain that no particles of earth, sand or gravel have been left in the duct.
- Q. Pulling Rope/Tape

26 05 43-3

Underground Ducts and Raceways

Washwater Equalizer Tank Replacement Project

1. Pulling rope or tape shall be constructed of polyester and factory lubricated. Nylon is not allowed.
- R. Plug and seal empty spare ducts entering buildings and structures. Install pulling tape in all empty spare ducts. Seal watertight all ducts in use entering buildings and structures in accordance with the specifications.

++ END OF SECTION ++

SECTION 26 05 45

MANHOLES AND HANDHOLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
 - 1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install manholes and handholes.
- B. Coordination:
 - 1. Coordinate manhole and handhole installation with piping, sheeting and other underground systems and structures and locate clear of interferences.
- C. Minimum interior dimensions shall be as shown below unless indicated otherwise on the drawings:
 - 1. Lighting and fiber optic cable handholes – 18"W x 24"L x 18"D
 - 2. Control and signal handholes – 48"W x 48"L x 48"D
 - 3. 600 volts and below power handholes (12-4"C max) - 48"W x 48"L x 48"D
 - 4. 600 volts and below power manholes - 72"W x 72"L x 72"D
 - 5. 1000 volts and above power manholes - 72"W x 96"L x 72"D

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
 - 1. National Electrical Code (NEC) current adoption.
 - 2. Materials shall be UL listed where applicable.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Manufacturer's technical information for manholes, handholes and accessories proposed for use.
 - 2. Drawings showing interior and exterior dimensions and details of openings, jointing, inserts and reinforcing.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Material and Construction:
 - 1. Precast or cast-in-place type of reinforced concrete. Composite manholes and covers for handholes smaller the 4 feet in any dimension may be acceptable if approved by the owner. Composite manhole shall be single-piece, factory integrated, light weight, and corrosion resistant.
 - 2. Minimum interior dimensions as shown on the Drawings.
 - 3. Duct entrances sized and located to suit duct banks.

26 05 45-1

Manholes and Handholes

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

4. Handholes and Manholes must have a bottom.
- B. Accessories:
 1. Frames and Covers:
 - a. Material: Cast iron conforming to ASTM A 48, Class 30A.
 - b. Covers: Watertight, sealed type marked "ELECTRICAL" in raised 2-inch letters. Identify covers as shown on the Drawings.
 - 1) Manhole covers to be 36 inches minimum.
 - c. Frame shall be grouted on the manhole or handhole.
 - d. Product and Manufacturer: Provide one of the following:
 - 1) Neenah Foundry Company
 - 2) Campbell Foundry Company
 - 3) Or engineer approved equal
 2. Pulling Irons:
 - a. Material: Galvanized steel.
 - b. Cast in the wall opposite to the centerline of each incoming duct bank and 12 inches below centerline of bottom line of ducts.
 - c. Product and Manufacturer: Provide one of the following:
 - 1) 8119 by Chance Utility - Hubbell
 - 2) Inwesco Inc
 - 3) Or engineer approved equal
 3. Cable Racks:
 - a. Material: Galvanized steel.
 - b. Cable racks shall adequately support cables with space allowed for future cables.
 - c. Each rack shall be a vertical assembly of 24-inch cable racks extending from within 6-inches of the manhole roof slab to within 6 inches of the manhole floor.
 - d. Product and Manufacturer: Provide one of the following:
 - 1) J-5125 - MacLean Power Systems
 - 2) C203-1125 by Chance Utility - Hubbell
 - 3) Or engineer approved equal
 4. Cable Hooks:
 - a. Material: Galvanized steel.
 - b. Length: 7-1/2-inch minimum.
 - c. Product and Manufacturer: Provide one of the following:
 - 1) J-5132A - MacLean Power Systems
 - 2) C203-1132 by Chance Utility - Hubbell
 - 3) Or engineer approved equal
 5. Insulators:
 - a. Material: Porcelain.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) J-5122 - MacLean Power Systems
 - 2) C203-1120 by Chance Utility - Hubbell
 - 3) Or engineer approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install manholes and handholes where shown on the Drawings. Verify final locations in field. Responsibility belongs to CONTRACTOR for all excavation and backfilling required for installation.

26 05 45-2
Manholes and Handholes

- B. Complete installation of manholes and handholes so that structures are watertight. Apply foam sealant to all openings and penetrations. Seal all conduit openings to provide a water/bug-tight seal.
 - 1. Product and Manufacturers:
 - a. DUX - Duct Sealing Compound – O-Z/Gedney - Emerson
 - b. Type FST Foam Sealant – American Polywater Corp
 - c. Or engineer approved equal
- C. Cable Supports in Manholes:
 - 1. Attach cable racks with 3-inch by 3/8-inch diameter "tamp-in" studs mounted in 1-inch holes drilled into walls of manholes in the absence of inserts. Apply PVC coating to all racks.
 - 2. Provide cable hooks to support each cable on each rack along the cable run within the manholes. Apply PVC coating to all hooks.
 - 3. Individually support each cable at each hook on porcelain insulators. Provide sufficient slack for each cable.
 - 4. Securely tie each cable in place at each insulator block to prevent excessive movement of insulators, cables, or fireproof tape. Tie cables with non-metallic 3/4-inch strapping tape as manufactured by 3M or tie down with nylon straps.
- D. Grounding: Install a 3/4-inch by 10-foot copper-clad ground rod for each manhole. Bond all exposed metal manhole accessories and the concrete reinforcing rods with No. 4 AWG minimum bare copper wire and connect to the ground rod and to the duct bank ground cable.
- E. Sump: Provide a 12-inch by 12-inch by 6-inch sump in manhole floor.
- F. Provide grading rings for manholes when required to adjust cover to proper grade. Grading ring shall be minimum of 12 inches in height, constructed on the roof slab or cone section on which the manhole frame and cover shall be placed. The height of the grading ring shall be such as is necessary to bring the frame to the proper grade.
- G. Metal Pullbox: only where explicitly shown on the drawings install NEMA 4X stainless steel wall mounted pullbox inside manholes/handholes where analog signal cables are mixed with power cables. Route conduits for analog cables directly into and out of metal pullbox so that no analog cables are exposed.

++ END OF SECTION ++

26 05 45-3
Manholes and Handholes

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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26 05 45-4
Manholes and Handholes

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide identification nameplates and labels in accordance with this Section and the drawings for the following:
 - 1. Identification for raceway and metal-clad cable.
 - 2. Identification for conductors and communication and control cable.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
 - 1. Power Circuits: Black letters on an orange field.
 - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Conduits and cables shall be identified as indicated on the drawings.

26 05 53-1
Electrical identification

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Marker tags: heat shrink wire tags, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core with red polyethylene film on top and with clear polyethylene film on the bottom.
 - 4. Printed legend shall indicate type of underground line and "CAUTION BURIED ELECTRIC LINE BELOW".
- B. Product and Manufacturer: Provide one of the following:
 - 1. Identoline, "Buried Underground Tape" – Brady Coporation
 - 2. Thomas & Betts
 - 3. Or engineer approved equal

2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive 2-sided adhesive tape, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Letters shall be 3/4 inch. Font shall be capitalized block characters. White letters on black.
- D. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- E. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- F. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES "

2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

26 05 53-2
Electrical identification

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- B. Letters shall be 3/4 inch. Font shall be capitalized block characters. White letters on black.
- C. Punched or drilled for mechanical fasteners.
- D. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a black. Minimum letter height shall be 3/4 inch. Font shall be capitalized block characters.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb minimum.
 - 3. Temperature Range: In accordance with the specifications.
 - 4. Color: Black, except where used for color-coding.
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Raceways and Duct Banks More Than 600 V Concealed within Buildings: 4-inch-wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:
 - 1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to raceways concealed within wall.
 - 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- B. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.
- C. Power-Circuit Conductor Identification: For primary and secondary conductors No.1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

26 05 53-3
Electrical identification

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway. Install warning ribbon approximately 12 inches below finished grade and centered on direct buried cables, electrical ductbanks and conduits without ductbank encasement.
- F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
 - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- G. Instruction Signs:
 - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1 1/2-inch high label; where 2 lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label 4 inches high.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.

26 05 53-4

Electrical identification

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- c. Electrical switchgear and switchboards.
- d. Transformers.
- e. Electrical substations.
- f. Emergency system boxes and enclosures.
- g. Motor-control centers.
- h. Disconnect switches.
- i. Enclosed circuit breakers.
- j. Motor starters.
- k. Push-button stations.
- l. Power transfer equipment.
- m. Contactors.
- n. Remote-controlled switches, dimmer modules, and control devices.
- o. Battery inverter units.
- p. Battery racks.
- q. Power-generating units.
- r. Voice and data cable terminal equipment.
- s. Monitoring and control equipment.
- t. Uninterruptible power supply equipment.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Colors for 208/120 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 2. Colors for 480/277 V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.

26 05 53-5
Electrical identification

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.3 EQUIPMENT IDENTIFICATION

- A. Provide identification of each electrical item, in addition to the manufacturer's nameplates, to identify the item's function, and the equipment or system which it serves or controls.
- B. Identify equipment by means of nameplates. Re-label existing equipment whose designation has been changed.
- C. Identify pull and terminal boxes with nameplates. Identify each box by a unique number. Numbering system shall reflect the actual designations used in the field and as documented on wiring diagrams.
- D. Process/Mechanical/Electrical equipment located outdoors shall be labeled by the manufacturer: "For Outdoor Use".
- E. Equipment Voltage Labels:
 1. Voltage labels shall be installed on all equipment that has voltage in the equipment.
 2. Where applicable, install voltage label below the Arc Flash Warning label.
 3. If the equipment has access to the backs or side of the gear, apply voltage labels on all access panels.
 4. Provide standard 3 1/2-inch by 5-inch, Black/Red on White rectangular labels to match Figure 3.1.A below.
 5. Apply a "Danger High Voltage" label to all medium equipment greater than 600 V.
 6. Product and Manufacture: Provide the following:
 - a. BRADY
 - 1) DANGER 120 VOLTS, Part # 86784
 - 2) DANGER 208 VOLTS, Part # 86782
 - 3) DANGER 240 VOLTS, Part # 86785
 - 4) DANGER 480 VOLTS, Part # 86783
 - 5) DANGER HIGH VOLTAGE INSIDE, Part # 86861
 - b. Or Equal

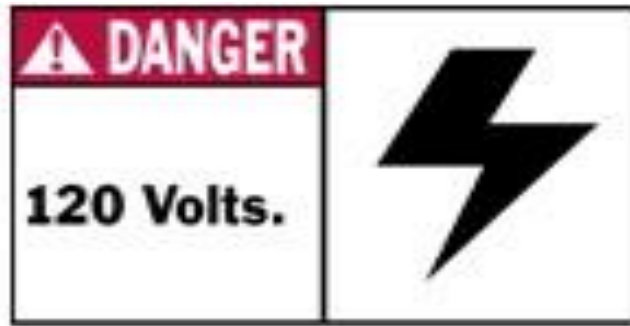


Figure 3-1. A

F. Service Entrance Sections:

1. Install a Danger Electrical Hazard & Voltage placard on the front side of all Service Entrance Sections.
 - a. Placard to be Black/Red on White on aluminum and size to be 7-inch by 10inch to match Figure 3.2.B below.
 - b. Install 1 3/4-inch x 3 1/2-inch, type printed, high performance polyester appropriate voltage level labels on the placard. Hand written is not allowed
2. If the Service Entrance Section has access to the backs or side of the gear, apply voltage labels per Paragraph 2.2.C above and Arc Flash Potential Warning labels per Paragraph 2.2.B.2 on all access panels at each main breaker.
3. Product and Manufacture: Provide the following:
 - a. BRADY
 - 1) DANGER _____ VOLTS, Part # 43141
 - b. Or Equal

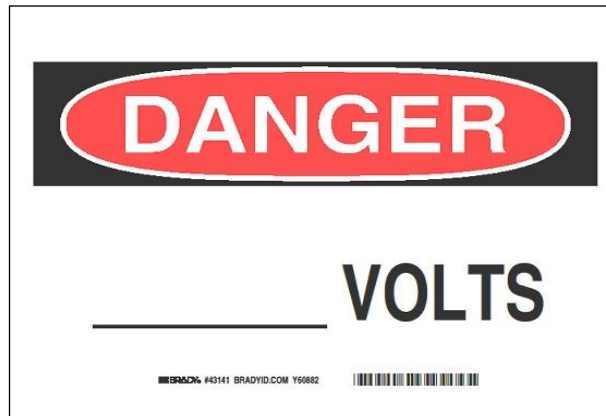


Figure 3-2. B

G. Utility Sections:

1. When the Utility Sections has access to the back, apply a standard 3 1/2-inch by 5-inch, Black/Red on White rectangular "Danger" label stating to match Figure 3.3.C below and Arc Flash Potential Warning labels.
2. Product and Manufacture: Provide the following:
 - a. BRADY
 - b. Or Equal

26 05 53-7
Electrical identification

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents



Figure 3-3. C

H. Additional Sources of Power:

1. When more than one source of power is located inside the equipment apply standard 3 1/3-inch by 5-inch, Black/Red on White rectangular "Danger" label stating to match Figure 3.4.D below.
2. Product and Manufacture: Provide the following:
 - a. BRADY
 - b. Or Equal



Figure 3-4. D

I. Generator Power Sources:

1. There are to be no Arc Flash Potential Labels printed or applied pertaining to any system that has generation power as an alternate source. For these sites apply at the automatic transfer switch a standard 3 1/2-inch by 5-inch, Black on Orange "WARNING" label stating to match Figure 3.5.E below
2. Product and Manufacture: Provide the following:
 - a. BRADY
 - b. Or Equal

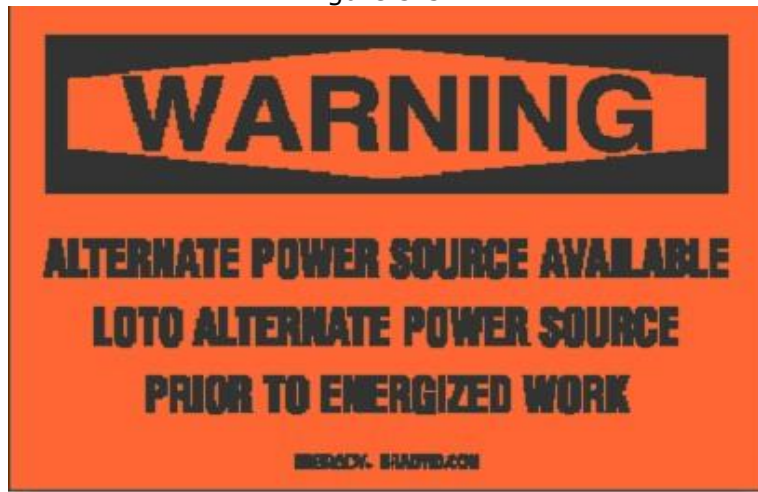
26 05 53-8
Electrical identification

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

Figure 3-5. E



++ END OF SECTION ++

26 05 53-9
Electrical identification

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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26 05 53-10
Electrical identification

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 26 18 03

WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install receptacles.
 2. Provide all interconnecting conduit and branch circuit wiring for all devices where shown on the drawings in accordance with the NEC.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
1. National Electrical Code (NEC) current adoption.
 2. UL Standard No. 1010, Electrical Receptacle - Plug Combinations for Use in Hazardous Locations.
 3. UL Standard No. 20, General Use Snap Switches.
 4. UL Standard No. 894, Switches for Use in Hazardous Locations.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Manufacturer's technical information for devices proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Switches for Non-Hazardous Locations: Wall switches shall be heavy duty, specification grade, toggle action, flush mounting quiet type. All switches shall conform to the latest revision of Federal Specification WS 896. Wall switches shall be suitable for the area classification indicated and shall be of the following types:
1. Single pole AC toggle switch, quiet type, 120/277 VAC, 20 amperes, Ivory, specification grade.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Cooper - Eaton
 - 2) Pass & Seymour - Legrand
 - 3) Hubbell
 - 4) Arrow-Hart - Eaton
 - 5) Or engineer approved equal
 2. Single pole, 3-way AC toggle switch, quiet type, 120/277 VAC, 20 amperes, Ivory, specification grade.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Cooper - Eaton
 - 2) Pass & Seymour - Legrand

26 18 03-1
Wiring Devices

- 3) Hubbell
- 4) Arrow-Hart – Eaton
- 5) Or engineer approved equal
3. Two pole AC toggle switch, quiet type, 120/277 VAC, 20 amperes, Ivory, specification grade.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Cooper - Eaton
 - 2) Pass & Seymour - Legrand
 - 3) Hubbell
 - 4) Arrow-Hart – Eaton
 - 5) Or engineer approved equal
- B. Device Covers:
 1. Plates for indoor flush mounted devices shall be of the required number of gangs for the application involved and shall be as follows:
 - a. Finished areas: Smooth, high impact nylon of the same manufacturer and color as the device. Final color shall be as selected by the OWNER.
 - b. Where permitted: flush mounted devices in cement block construction shall be Type 302 high nickel (18-8) stainless steel of the same manufacturer as the devices.
 2. Device plates for switches mounted outdoors or indicated as weatherproof shall be gasketed, cast aluminum with provisions for padlocking switches "On" and "Off."
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Crouse Hinds - Eaton DS185
 - 2) Appleton - Emerson FSK1VS
 - 3) Pass & Seymour - Legrand
 - 4) Or engineer approved equal.
 3. Weatherproof, gasketed cover for GFI receptacle mounted in a FS/FD box.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Cooper Crouse-Hinds - Eaton
 - 2) RACO - Hubbell
 - 3) Pass & Seymour - Legrand
 - 4) Or engineer approved equal.
 4. Weatherproof non-metallic 'While-In-Use' cover, UV & corrosion resistant polycarbonate back & cover, deep cover, gasketed, horizontal or vertical mounting as required, single or double gang as required, lockable hasp.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Thomas & Betts (Red Dot)
 - 2) Cooper Wiring Devices (Arrow Hart)
 - 3) Carlon
 - 4) Or engineer approved equal
 5. Weatherproof metallic 'While-In-Use' cover, UV & powder die-cast metal construction, minimum 3-1/2 in deep cover, gasketed, horizontal or vertical mounting as required, single or double gang as required, lockable hasp.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Thomas & Betts (Red Dot)
 - 2) TayMac
 - 3) Orbit Electric
 - 4) Or engineer approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices at locations as shown on the Drawings in outlet or device boxes in non-hazardous locations.
- B. Install flush in finished areas with stud frame and gypsum board construction and where shown as concealed on the drawings. Surface mount in damp and wet locations.
- C. Install devices in PVC coated galvanized rigid steel conduit systems in hazardous locations.
- D. Install receptacles with ground pole in the down position.
- E. Mount wall switches and dimmer controls 4 feet, 6 inches above finished floor unless otherwise noted.
- F. Mount motion sensors as required according to manufacturer's recommendations for adequate coverage.
- G. Receptacles located outdoor or in wet locations shall have a weatherproof while-in-use cover.
- H. Mount receptacles 18inches above finished floor in finished areas and in indoor area specified to contain NEMA 1 and NEMA 12 enclosures. Mount receptacles 4 feet-6 inches above finished floor in process, wet, outdoor, corrosive, or hazardous locations, unless otherwise noted.
- I. Where individual ground fault interrupter type receptacles are shown on the Drawings connected to the same circuit, the CONTRACTOR shall provide all ground fault interrupter type receptacles. Use of one ground fault interrupter type receptacle to protect downstream conventional receptacles is unacceptable.
- J. Identify each conductor with the circuit number and the lighting panel number.
- K. Identify each receptacle with a permanent self adhesive label. Approximate size 3/8 x 1 1/4 inches. The label shall include the panel name and circuit number.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) PTL-45-422 Brady Corporation
 - 2) Or Equal

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26 18 03-3
Wiring Devices

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26 18 03-4
Wiring Devices

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 26 41 13

LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to design, furnish, and install a complete lightning protection system for the structures indicated on the drawings. The system shall be UL labeled and shall be designed and installed in compliance with provisions of UL-96A and NFPA-780.
2. Employ the services of a licensed lightning protection systems engineering company to design and install the lightning protection system and prepare detailed installation drawings and material specifications.
3. The lightning protection system shall be checked by a UL field inspector upon completion of the installation. Assume full responsibility for the correctness of the installation and shall make any and all corrections and additions deemed necessary by the UL inspector. Pay for all costs of the UL inspection and any subsequent re-inspections as required

B. Coordination:

1. System arrangement, not shown on the Drawings, shall be arranged in accordance with the class of structure to be protected. Coordinate arrangement and connections with roof system proposed for use and roof mounted equipment.

1.2 QUALITY ASSURANCE

A. Quality Control:

1. All materials for this system shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems. All materials shall comply in weight, size, and composition for the class of structure to be protected.
2. The system shall be installed under the direct supervision of a certified master installer.

B. Requirements of Certification:

1. Provide master installer certified forms for the following:
 - a. Form LP1-175A, Jobsite Witness of Grounding Connections.
 - b. Form LP1-175B, Post-Installation Inspection.
 - c. UL Master Label C.

C. Reference Standards: Comply with applicable provisions and recommendations for the following, except where otherwise shown or specified:

1. LP1-174, Lightning Protection Institute Installation Code.
2. NFPA-780, Lightning Protection Code.
3. UL Standard No. 96A, Master Label Provisions.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Manufacturers technical information for materials proposed for use.
 - 2. Complete scaled drawings identifying the system arrangement and equipment connections for each building or pole. Drawings shall include equipment connection details and downlead details.
 - 3. Submit certificates for LP1 Code Compliance together with UL Master Label C certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials:
 - 1. General: System materials shall be copper and high copper-content bronze castings. All fittings, except cable holders, shall be heavy-duty type made from bronze castings. All terminal rods, bolts, screws, and related type hardware shall be copper clad steel or brass to prevent galvanic corrosion.
 - 2. Components: The system shall consist of all necessary equipment as required to provide a complete and coordinated system. All cable and all air terminals used shall bear the UL Label. The components shall consist of, but not limited to, the following:
 - a. Cables.
 - b. Air terminals.
 - c. Mounting bases.
 - d. Fittings.
 - e. Couplings.
 - f. Connectors.
 - g. Fasteners.
 - h. Conduit.
 - i. Pitch pads and weatherproof seals.
 - 3. Product and Manufacturer: Provide one of the following:
 - a. Thompson Lightning Protection Inc
 - b. AC Lightning Protection
 - c. Heary Bros
 - d. Or engineer approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Conceal system conductors wherever practical. Main downleads and roof risers shall be concealed within the building walls or columns.

- B. Run leads in 1-inch PVC plastic conduit. Terminate upper end above floor ceiling, utilize through-roof connectors for cable roof penetrations. Conduit terminations at lower end to be 6-inch above finished ground level, to pinpoint locations during future inspections.
- C. Bond all metallic objects and systems at roof level. Primary bonds shall utilize appropriate fittings and full size conductor. Primary bond all roof exhaust fans, HVAC units, ductwork, piping, ladders, skylights, stacks, vents, etc.
- D. Primary bond all downleads to steel column or major framing member at every downlead position with full-size conductor.
- E. Secondary bond, with secondary cable and fittings, metal bodies of inductance located within six feet of a conductor or object with primary bond.
- F. Connect to structure ground grid system using exothermic welds.

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26 41 13-4

Lightning Protection for Structures

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 26 51 03

LIGHTING SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
 - 1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install lighting fixtures and controls.
 - 2. Provide all conduit and wiring for a complete lighting system as shown on the drawings.
 - 3. Provide anchorage and support design, including seismic, for lighting fixtures in accordance with General Electrical Provisions under Division 26.
- B. Coordination:
 - 1. Coordinate location of fixtures with piping, ductwork, openings and other systems and equipment and locate clear of interferences.
 - 2. Coordinate fixtures to be mounted in hung ceilings with the ceiling suspension system proposed for use.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
 - 1. Illuminating Engineer's Society.
 - 2. National Electrical Code (NEC) current adoption.
 - 3. UL Standard No. 57, Electric Lighting Fixtures.
 - 4. UL Standard No. 844, Electric Lighting Fixtures for Use in Hazardous Locations.
 - 5. UL Standard No. 917, Clock-Operated Switches.
 - 6. UL Standard No. 1570, Fluorescent Lighting Fixtures.
 - 7. UL Standard #1571, Incandescent Lighting Fixtures.
 - 8. UL Standard #1572, High Intensity Discharge Lighting Fixtures.
 - 9. Local lighting Ordinance if applicable.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Manufacturer's catalog cuts and technical information for lighting fixtures proposed for use.
 - 2. Fixture construction details.
 - 3. ETL photometric and isocandle curves for each fixture proposed.
 - 4. Verification that recessed fixtures which are to be mounted in hung ceilings are compatible with the ceiling suspension system proposed for use.
 - 5. Manufacturer's technical information for lighting controls proposed for use.
 - 6. Wiring diagrams.

26 51 03-1
Lighting System

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Type: Lighting fixtures are noted in the Fixture Schedule on the Drawings. Fixtures to be complete with supports, ballasts, lamps and incidentals, as required.
- B. Luminaire types shall be furnished as required by the "Lighting Fixture Schedule" on the Drawings. The catalog numbers are given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be acceptable upon approval by the Engineer and shall comply with the following requirements:
 - 1. LED Lighting Fixtures shall have a temperature range of 3000 to 5000 deg K. The fixture lumen depreciation shall be less than 30% at the end of life of the fixture. The manufacturer shall provide a 5 year warranty on the fixture. LED fixtures shall be fully enclosed with a minimum IP rating of 44. The total harmonic distortion shall be less than 15%. The power supply must be equipped with an in-line fuse. The LED lamp shall be field replaceable as an assembly with no soldering required.
 - 2. Exit Sign: UL listed. Provide with automatic power failure device with integral self-testing module and fully automatic high/low trickle charger in a self-contained power pack. Battery shall be sealed electrolyte type, shall operate unattended, and require no maintenance, including no additional water, for a period of not less than 5 years. LED exit sign shall have emergency run time of 1-1/2 hours (minimum). The light emitting diodes shall have rated lamp life of 70,000 hours (minimum).
- C. LED Lamps:
 - 1. Total lumens from independent lab test based on IES LM-79-08 with life expectancy rating to be a minimum of 50,000 hours (tested per LM-79-08).
 - 2. Lumen depreciation shall be less than 30% at end of life. The lamp life shall have been independently tested according to IES-LM-80-08 with the intended fixture assembly.
 - 3. Fixtures shall have a maximum total harmonic distortion less than 10% unless approved by the engineer.
- D. All lamps shall be of one manufacturer and shall be as manufactured by Osram Sylvania; General Electric; Philips or approved equal.
- E. Fixtures located in an area which is identified as a hazardous location shall be approved as a complete assembly for the hazardous location classification as shown on the Drawings, shall be clearly marked to indicate maximum wattage of lamps for which they are approved, and shall be protected against physical damage by suitable guards.
- F. Poles shall be as indicated on the lighting fixture schedule on the drawings. Provide tilt-able poles as indicated. Orient pole so that they will tilt to allow ready access for maintenance. Mount poles to concrete base as shown on the drawings. Ground all site poles to a ground rod adjacent to the pole.

- G. Hardware: All necessary hangers, supports, conduit adaptors, reducers, hooks, brackets and other hardware required for safe fixture mounting shall be furnished. Hardware shall have a protective, non-corrosive finish.
- H. Photocell:
 - 1. Cadmium sulphide hermetically sealed cell, fully temperature compensated, with time delay of at least 15 seconds to prevent false switching.
 - 2. Built-in fail safe light level selector, adjustable within limits of 2 to 50 foot candles and factory set at 25 foot candles.
 - 3. Product and Manufacturer: Provide one of the following:
 - a. Tork
 - b. Schneider Square D
 - c. Or engineer approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Fixture mounting heights and locations as shown on the Drawings are approximate and are subject to revision in the field, where necessary to clear conflicts and obstructions.
- B. Suspended Fixtures: Pendant mount using 1/2-inch conduit stems. Ground to outlet box. Attach mounting to building structure with expansion anchors. Fixtures shall not be dependent on the outlet box cover screws for support. Do not support from suspended ceilings.
- C. Surface Mounted Fixtures: Attach to appropriate outlet box.
- D. Boxes and Fixtures:
 - 1. For units mounted against masonry or concrete walls, provide suitable 1/2-inch spacers to prevent mounting back of box directly against wall.
 - 2. Bolt units rigidly to building with expansion anchors, toggle bolts, hangers or Unistrut.
 - 3. No boxes shall be installed with open conduit holes.
 - 4. Cable each circuit and identify with tag.
- E. Mounting Heights: Mounting heights or elevations are to bottom of the fixture or to centerline of device.
- F. Mount equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.
- G. Mount photocell as shown on the Drawings and adjust footcandle setting for proper dusk and dawn photocontrol. Provide wiring in conduit from the photocell to controls.
- H. Securely fasten equipment to walls or other surfaces on which they are mounted.

+ + END OF SECTION + +

26 51 03-3
Lighting System

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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26 51 03-4
Lighting System

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 31 05 03

EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section includes: All excavating, backfilling, filling, grading, subgrade preparation and disposing of earth materials as required. It also includes all temporary means needed to prevent discharge of sediment to watercourses from dewatering systems or erosion.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
1. ASTM C33, Standard Specification for Aggregate Material.
 2. ASTM D422, Method for Particle-Size Analysis of Soils.
 3. ASTM D423, Liquid Limit of Soils.
 4. ASTM D427, Shrinkage Factors of Soils.
 5. ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil.
 6. ASTM D1556, Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 7. ASTM D2922, Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 8. ASTM D2166, unconfined compressive strength of soils.
- B. Occupational Safety and Health Administration (OSHA)
1. Title 29, Code of Federal Regulations, Part 1926

1.3 SYSTEM DESCRIPTION

- A. Permits and Regulations:
1. Perform excavation Work in compliance with applicable requirements of governing authorities having jurisdiction.
 2. Obtain all necessary permits for Work in roads, rights-of-way, railroads, etc. Also, obtain permits as required by local, state and federal agencies for discharging water from excavations, for erosion control, and for prevention of air and water pollution.

1.4 SUBMITTALS

- A. Test Reports - Borrow, Backfill, and Grading: Testing laboratory shall submit copies of the following reports directly to ENGINEER:
1. Tests on borrow material.
 2. Tests on footing subgrade.
 3. Field density tests.
 4. Optimum moisture - maximum density curve for each soil used for backfill.
 5. Reports of observations for conformance of borrow material to the Project Geotechnical Report.

31 05 03-1
Earthwork

6. Quality Control Plan: Names and phone numbers of independent testing companies that will be used to perform soil and asphalt concrete testing, qualifications, and proposed procedures for performing tests and providing test results to ENGINEER.
- B. Submit to the ENGINEER samples of all materials, including select backfill, general backfill, bedding, crushed stone, sand and topsoil. Submit samples of the proposed material at least seven days in advance of its anticipated use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General:
 1. All material will be tested by the laboratory and approved by the ENGINEER.
 2. No material shall be placed without the approval of the ENGINEER.
- B. Marking Tape:
 1. Plastic:
 - a. Inert polyethylene, impervious to known alkalis, acids, chemical reagents, and solvents likely to be encountered in soil.
 - b. Thickness: Minimum 4 mils.
 - c. Width: 12 inches.
 - d. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.
 - e. Manufacturers and Products:
 - 1) Reef Industries; Terra Tape.
 - 2) Allen; Markline.
 - 3) Or equal.
 2. Metallic:
 - a. Solid aluminum foil, visible on unprinted side, encased in a protective high visibility, inert polyethylene plastic jacket.
 - b. Foil Thickness: Minimum 5.5 mils.
 - c. Width: 12 inches.
 - d. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.
 - e. Joining Clips: Tin or nickel-coated, furnished by tape manufacturer.
 - f. Manufacturers and Products:
 - 1) Reef Industries; Terra "D".
 - 2) Allen; Detectatape.
 - 3) Or equal.
 3. Marking tape shall be marked with the following statements:
 - a. Potable Water Pipeline: "CAUTION – WATER PIPELINE BURIED BELOW."
 - b. Recycled Water Pipeline: "CAUTION – RECYCLED WATER PIPELINE BURIED BELOW."
 - c. Sanitary Sewer (or Drain) Pipeline: "CAUTION – SANITARY SEWER PIPELINE BURIED BELOW."
 - d. For Existing Utilities Within Trench Limits: "CAUTION – BURIED PIPELINE/CONDUIT" or as specified by utility owner.
 4. Color:
 - a. Water Pipeline: Blue, as specified in ANSI Z53.1 Safety Color Code.

31 05 03-2
Earthwork

Washwater Equalizer Tank Replacement Project

- b. Recycled Water Pipeline: Blue, as specified in ANSI Z53.1 Safety Color Code.
 - c. Sanitary Sewer Pipeline: Green, as specified in ANSI Z53.1 Safety Color Code.
 - d. Natural Gas Pipeline: Yellow, as specified in ANSI Z53.1 Safety Color Code.
 - e. Others Disturbed: Color, as specified for specific utility in ANSI Z53.1 Safety Color Code.
- C. Pipe Locating Wire:
 - 1. Refer to PID specification 1016 Locator Wire.
 - 2. No. 12 AWG solids, soft drawn copper wire with Type UF insulation laid on top of the pipe.
 - 3. Provide at least 6-mil PVC electrical tape insulation around wire where adjacent to metal pipe, valves, and in all valve boxes.
- D. Filter Fabric:
 - 1. Filter fabric shall be Mirafi, Type 140N; Dupont, Type PAR, Style 3401, or equal and shall conform to the following requirements:
 - 2. Minimum grab strength of 120 lbs per ASTM D4632.
 - 3. Apparent open size (AOS) to be equal to or greater than the U.S. Standard Sieve No. 100 (0.210 mm) per ASTM D4751.
 - 4. Percent open area not to exceed about 25 percent. The percent open area is defined as the ratio of the sum of 20 or more individual open areas (times 100) to the sum of the corresponding 20 or more individual total areas.
 - 5. Permittivity shall not be less than 1.7 sec-1.
- E. Fill Material:
 - 1. Classification:
 - a. Fill adjacent to structures to a distance measured horizontally from the structure that is equal to the depth from the finished grade is classified as Select Fill.
 - b. Outside these limits, the fill is classified as Common Fill, unless otherwise specified.
 - 2. Common Fill:
 - a. Common Fill materials shall consist of soils obtained from on-site excavations or off-site sources that are uniformly mixed, contain no organic material, and have been passed through a 3-inch screen.
 - b. The maximum expansion of off-site materials shall be 1.5% as performed on a sample remolded to approximately 9% of the maximum dry density as determined in accordance with ASTM D 698 at 2% below optimum moisture content under a 100 psf surcharge pressure.
 - c. If on-site material is unsuitable as determined by the ENGINEER, imported fill shall be used.
 - 3. Select Fill:
 - a. Select fill or backfill is material selected by the ENGINEER from the excavation.
 - b. Select material shall be free of organic or other unsuitable materials and shall not contain rocks, or unbroken masses of soil larger than 4 inches in greatest dimension.
- F. Aggregate Base:
 - 1. Class 2, $\frac{3}{4}$ inch maximum conforming to Section 26 of the Caltrans Standard Specifications.
- G. Granular Bedding:

31 05 03-3
Earthwork

Washwater Equalizer Tank Replacement Project

1. Well-graded sand and gravel materials.
 2. Unfrozen, friable, and no clay balls, roots, or other organic material.
 3. Clean or gravelly sand with less than 5% passing No. 200 sieve, as determined in accordance with ASTM D1140, or gravel or crushed rock within maximum particle size and other requirements as follows unless otherwise specified.
 4. 3/4-inch maximum particle size, except 1/4 inch for stainless steel pipe, copper pipe, tubing, and plastic pipe under 3-inch diameter.
 5. Conduit and Direct-Buried Cable:
 - a. Sand, clean or clean to silty, less than 12% passing No. 200 sieve.
 - b. Individual Particles: Free of sharp edges.
 - c. Maximum Size Particle: Pass a No. 4 sieve.
 - d. If more than 5% passes No. 200 sieve, the fraction that passes No. 40 sieve shall be non-plastic as determined in accordance with ASTM D4318.
- H. Sand:
1. Natural or manufactured granular material, containing no organic material.
 2. Sand will be non-plastic, when tested in accordance with ASTM D 4318, 100% passing a 1/2 inch screen and no more than 20% passing a No. 200 screen.
- I. Fine Stone:
1. Crushed stone will be crushed rock or gravel conforming to the requirements of ASTM C33, Size #6 (3/4" to 3/8").
- J. Crushed Stone:
1. Crushed stone will be crushed rock or gravel conforming to the requirements of ASTM C33, Size #57 (1" to #4).
- K. Gravel Surfacing
1. Gravel Surfacing will be crushed rock, angular, and well-graded.
 2. Maximum size of 3/4 inch, at least 50% passing the No 4. screen, between 10 and 30% passing the No. 10 screen and no more than 15% passing the No. 40 screen.
 3. Color to be selected by OWNER.
- L. Rock Slope Protection
1. Conform with CalTrans Section 4-72
 2. Backing No. 1
 3. 1/4 ton rock
 4. Place in accordance with Caltrans Method B (not restrictive to the placement of individual rocks).
- M. Controlled Low Strength Material (CLSM):
1. Select and proportion ingredients to obtain compressive strength between 50 and 150 psi at 7 days in accordance with ASTM D4832. Sufficient cement shall be added to meet the strength and material requirements given below and as required to provide sufficient strength for compacting overlying trench backfill. Provide certified mix design and test results in accordance with submittal requirements.
 2. Materials:
 - a. Cement: ASTM C150, Type I or II, two sacks minimum per cubic yard.
 - b. Aggregate: ASTM C33, maximum Size 7. The amount of material passing a No. 200 sieve shall not exceed 12%. The above No. 200 sieve material shall be well

31 05 03-4
Earthwork

- graded so as to avoid segregation. The minus #200 sieve fraction shall be nonplastic.
- c. Fly Ash (if used): ASTM C618, Class C or F.
 - d. Water: Clean, potable, containing less than 500 ppm of chlorides.
3. Mix Design:
- a. The CONTRACTOR and its suppliers shall determine the materials and proportions used to meet the requirements of these Specifications. Make daily checks of the aggregate gradation and adjust the mix design as required. Modify the CLSM mix as necessary to meet the flowability, pumpability, and set time requirements for each individual pour.
 - b. At least 30 days before placing CLSM, submit to the ENGINEER a mix design for each CLSM to be used. The mix design shall include trial lab and field data, with pairs of 6-inch by 12-inch cylinder breaks performed at 7, 14, and 28 days. Molds shall be plastic or waxed cardboard. The mix design shall be performed by an independent laboratory under the direction of an engineer licensed in California.
 - c. No CLSM shall be placed until the ENGINEER has approved the mix design. The ENGINEER's approval of the mix design shall be understood to indicate conditional acceptance. Final acceptance will be based on tests conducted on field samples and conformance with these Specifications.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspection:
- 1. Provide ENGINEER with sufficient notice and with means to examine the areas and conditions under which excavating, filling, and grading are to be performed.
 - 2. ENGINEER will notify CONTRACTOR if conditions are found that may be detrimental to the proper and timely completion of the Work.
 - 3. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. "Pot-holing":
- 1. Excavate and backfill, in advance of the construction, test pits to determine conditions or location of the existing utilities and structures.
 - 2. Define the location of each existing facility involved within the area of his excavation for Work under this Contract.
 - 3. Exercise care during such location work to avoid damaging and/or disrupting the affected facility.
 - 4. CONTRACTOR is responsible for repairing, at his expense, damage to any structure, piping, or utility caused by his Work.
- C. Temporary Fencing:
- 1. Furnish and install a temporary fence surrounding excavations and work area, including the stockpile and storage areas.
 - 2. Provide fence openings only at vehicular, equipment and worker access points.

31 05 03-5
Earthwork

3.2 EROSION CONTROL

- A. General: Implement the construction procedures outlined herein to assure minimum damage to the environment during construction. Take all additional measures required to conform to the requirements of applicable codes and regulations.
 - 1. Whenever possible, locate and construct access and temporary roads to avoid environmental damage. Make provisions to regulate drainage, avoid erosion and minimize damage to vegetation.
 - 2. Where areas must be cleared for storage of materials or temporary structures, provisions will be made for regulating drainage and controlling erosion, subject to the ENGINEER'S approval.
 - 3. Remove only those shrubs and grasses that must be removed for construction. Protect the remainder to preserve their erosion-control value.
- B. Control Measures: Apply measures to control erosion and to minimize the siltation of the existing waterways, and natural ponding areas. Such measures include, but are not limited to, the use of berms, baled straw silt barriers, gravel or crushed stone, mulch, slope drains and other methods.
 - 1. Install erosion and sediment control practices where shown and according to applicable standards, codes and specifications. The practices will be maintained in effective working condition during construction and until the drainage area has been permanently stabilized.
 - 2. Temporary measures will be coordinated with the construction of permanent drainage facilities and other Work to the extent practicable to assure economical, effective, and continuous erosion and siltation control.
 - 3. CONTRACTOR will provide special care in areas with steep slopes. Disturbance of vegetation will be kept to a minimum to maintain stability.
 - 4. After stabilization, remove all straw bale dikes, debris, etc., from the site.
- C. Dust Control:
 - 1. Prevent blowing and movement of dust from exposed soil surfaces and access roads to reduce on- and off-site damage and health hazards.
 - 2. Control may be achieved by irrigation in which the site is sprinkled with water until the surface is moist.
 - 3. Repeat the process as needed.
- D. Failure to Comply: In the event CONTRACTOR repeatedly fails to satisfactorily control erosion and siltation, the OWNER reserves the right to employ outside assistance or to use its own forces to provide the corrective measures indicated. The cost of such work, plus engineering costs, will be deducted from monies due CONTRACTOR.

3.3 DEWATERING

- A. General:
 - 1. Continuously control all water during the course of construction, including surface water and ground water, to prevent any damage to any excavation or to the construction activities occurring within those excavations.
 - 2. Maintain all dewatering systems full time (24-hours/day) during the entire time the excavation is open. Do not shut down dewatering systems at night, on weekends or on holidays, or any other time the excavation is open.

31 05 03-6
Earthwork

3. Each excavation will be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein is inspected by the ENGINEER and backfill operations have been completed.
 4. Provide adequate alarm, monitoring and back-up systems for all dewatering systems to maintain control of all water during all times any excavation is open.
- B. Surface Water:
1. Provide and maintain adequate drainage and dewatering system to prevent surface water from entering excavations and to remove and dispose of all rainwater entering excavations, trenches, or other parts of the Work.
 2. Keep the different working areas on the site free of surface water at all times. Special care will be taken to eliminate depressions that could serve as mosquito pools.
 3. The diversion and removal of surface water will be performed in a manner that will prevent the accumulation of water behind temporary structures or at any other locations within the construction area where it may be detrimental.
- C. Ground Water:
1. Provide, operate and maintain dewatering system to permit excavation and subsequent construction activities in a dry, safe environment.
 2. System shall be of sufficient size and capacity to maintain groundwater level a minimum of 2 feet below the lowest point of excavation.
 3. Contractor shall make an assessment of the potential for dewatering induced settlement of surrounding soils and structures. Contractor shall provide all necessary equipment and facilities, including re-injection wells, cutoff walls, infiltration trenches, etc, to prevent damage to adjacent structures.
- D. Disposal of water:
1. Disposal of discharge water shall conform to any and all applicable permit requirements.

3.4 EXCAVATION SUPPORT SYSTEMS

- A. Trench Support
1. Provide, install and maintain trench shields for all trench excavations for which trench shields are required (at a minimum, as required by OSHA).
 2. Follow all OSHA guidelines and other applicable laws and ordinances.
 3. Elevation of Bottom:
 - a. Excavation of earth material below the bottom of a shield will not exceed the limits established by ordinances, codes, laws and regulations.
 - b. When using a shield for pipe installation, the bottom of the shield will not extend below the mid-diameter of installed pipe at any time.
 - c. When using a shield for the installation of structures, the bottom of the shield shall not extend below the top of the bedding for the structures.
 4. Moving Shield: When a shield is removed or moved ahead, extreme care will be taken to prevent the movement of pipe or structures or the disturbance of the bedding for pipe or structures. Pipe or structures that are disturbed are to be removed and reinstalled as specified.
- B. Below Grade Structure Excavation Support

31 05 03-7
Earthwork

1. Provide, install and maintain excavation support systems for all structural excavations where excavation support is required (at a minimum, as required by OSHA).
 2. Follow all OSHA guidelines and other applicable laws and ordinances.
 3. Prepare excavation support plan addressing the following topics:
 - a. Details of shoring, bracing, sloping or other provisions for worker protection from the hazards of caving ground
 - b. Design assumptions and calculations
 - c. Methods and sequencing of installing excavation support
 - d. Proposed locations of stockpiled excavated materials
 - e. Minimum lateral distance from the crest of slopes for vehicles, equipment and materials
 - f. Location of vertical and horizontal monitoring points on structures and recommended frequency of monitoring for excavation support system stability and performance
 4. Design of excavation support systems and excavation support plan shall be prepared by a civil or structural engineer registered in the state in which the system is installed.
 - a. Excavation support system shall consist of h-pile and lagging, sheet piles, or other reliable method of excavation support.
 - b. The use of below-ground tiebacks is allowed, however, Contractor is responsible for locating and avoiding potential conflicts with existing utilities in the area in which the tie-backs are installed. All tiebacks shall be further than 3 feet from any conflicting utility. Tiebacks shall not use existing structures for support.
- C. Removal of Excavation Support
1. Completely remove all excavation support unless ENGINEER specifically allows requested excavation support to remain in place after backfill.
 2. Remove all excavation support in a manner that will maintain support as excavation is backfilled and will not leave voids in the backfill.

3.5 EXCAVATION

A. General:

1. Material removed: Excavations include earth, sand, clay, gravel, hardpan, boulders, rock, pavements, rubbish and all other materials within the excavation limits.
2. Excavations for structures and pipelines will be open excavations. Provide excavation protection system(s) required by ordinances, codes, law and regulations to prevent injury to workmen and to prevent damage to new and existing structures or pipelines. Unless shown or specified otherwise, protection system(s) will be utilized under the following conditions.
 - a. Excavation Less Than 5 feet deep: Excavations in stable rock or in soil conditions where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations will be sloped and benched, shielded, or shored and braced.
 - b. Excavations More Than 5 feet deep: Excavations in stable rock where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations will be sloped and benched, shielded or shored and braced.
 - c. Excavation protection system(s) will be installed and maintained in accordance with the excavation plan submitted.

31 05 03-8
Earthwork

B. Structural Excavation:

1. The elevation of the bottom of footings shown is approximate only. ENGINEER may order such changes in dimensions, and elevations as may be required to secure a satisfactory footing.
2. Hand-trim all structure excavations to permit the placing of full widths and lengths of footings on horizontal beds. Rounded and undercut edges will not be permitted.
3. Excavations shall allow for aggregate base, forms, working space, installation of shoring or bracing or the safe sloping of banks.

C. Pipe Trench Excavation:

1. No more than 100 feet of trench may be opened in advance of pipe laying.
2. Minimize trench width to the greatest extent practical, but conform to the following:
3. Sufficient to provide room for installing, jointing and inspecting piping, but in no case wider at top of pipe than pipe barrel outside diameter plus 3 feet.
4. Enlargements at pipe joints may be made, if required, and approved by ENGINEER.
5. Sufficient for shoring and bracing, or shielding and dewatering.
6. Sufficient to allow thorough compaction of backfill adjacent to bottom half of pipe.
7. Depth of trench will be as shown. If required and approved by ENGINEER, depths may be revised.

D. Subgrades:

1. Subgrades for roadways, structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; free from mud, muck, and other soft or unsuitable materials; and remain firm and intact under all construction operations.
2. Subgrades that are otherwise solid, but which become soft or mucky on top due to construction operations, shall be reinforced with select fill.
3. The finished elevation of stabilized subgrades shall not be above subgrade elevations shown.

E. Material Storage: Stockpile satisfactory excavated materials in approved areas, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations.
2. Dispose of excess soil material and waste materials as specified hereinafter.

F. Unauthorized Excavation:

1. All excavation outside the lines and grades shown, and which is not approved by ENGINEER, together with the removal and disposal of the associated material is at the CONTRACTOR'S expense.
2. Unauthorized excavations shall be filled and compacted with select fill by the CONTRACTOR at his expense.

3.6 PLACEMENT OF FILL AND BACKFILL

A. General:

1. Backfill excavations as promptly as Work permits, but not until completion of the following:
 - a. Acceptance by the ENGINEER of construction below finish grade.
 - b. Inspection, testing, approval, and recording of locations of underground piping and ductwork.
 - c. Removal of concrete formwork.

31 05 03-9
Earthwork

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
 - e. Removal of trash and debris.
 2. Remove and replace with approved fill material, as specified, fill containing organic materials or other unacceptable material.
 3. Compact all fill and backfill as specified in Subsection 3.7.
- B. Structural Backfill:
1. Select fill shall be placed as structural backfill where shown on the Drawings or indicated herein.
 2. Constraints:
 - a. Backfill water-holding basins or structures only after satisfactory leakage tests have been conducted as specified in Sections Concrete and Precast Concrete.
 - b. No backfill or fill material shall be placed when free water is standing on the surface of the area.
 - c. No compaction of fill will be permitted with free water on any portion of the fill to be compacted.
 - d. No fill shall be placed or compacted in a frozen condition or on top of frozen material.
 - e. Any fill containing organic materials or other unacceptable material previously described shall be removed and replaced with approved fill material prior to compaction.
 3. Levels of backfill against concrete walls are not to differ by more than 2 feet on either side of walls, unless walls are adequately braced or all floor framing is in place up to and including grade level slabs.
 4. Wherever a pipe passes through a structure backfill, the structure backfill shall be placed and compacted to an elevation 12 inches above the top of the pipe before the trench is excavated.
- C. Backfill in Pipe Trenches:
1. Pipeline trenches may be backfilled prior to pressure testing, but no structure shall be constructed over any pipeline until it has been tested.
 2. Unless otherwise shown, place all pipe on a minimum 6 inches thick layer of Sand. The bedding shall extend 12 inches above the top of the pipe.
 3. Install bedding as follows:
 - a. Spread bedding and grade to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints.
 - b. After each pipe section is placed, deposit and compact sufficient bedding material under and around each side of the pipe to hold the pipe in proper position and to maintain alignment during subsequent pipe jointing and bedding operations.
 - c. Bedding material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement. Then place and compact the bedding material to an elevation 12 inches above the top of pipe.
 4. Above the level of bedding, place Select or Common Fill, as specified elsewhere in these specifications.
 5. Controlled Low Strength Material (CLSM):
 - a. When CLSM pipe zone material is indicated, the pipe may be supported above the trench floor on pea gravel bags or sandbag supports. The CONTRACTOR shall demonstrate to the ENGINEER, 7 days prior to full pipeline backfill installation, placement of CLSM as described below. This demonstration shall occur on the

31 05 03-10
Earthwork

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

first 300 feet of trench, The CLSM pipe zone material shall be installed as indicated.

- 1) Bedding and Embedment: Place and compact CLSM pipe zone material using the following techniques:
 - a) Following placement and anchoring of the pipe, remove all loose soil from trench walls and floor. Remove any unstable soil at the top of the trench which might fall into the trench during placement of the CLSM.
 - b) Deliver the CLSM to the trench in ready mix trucks or traveling pug mill and utilize pumps or chutes to place the CLSM in the trench. Direct CLSM to one side of the pipe, taking care not to displace the pipe at any time. Continue placing CLSM on one side of the pipe until CLSM has gone under the pipe and up the other side to a depth of 6 inches above the pipe bottom. Use at least two handheld vibrators to continuously liquefy and move CLSM into all voids. Adjust water in mixture to maintain fluid consistency but maintain strength requirements. Continue placing CLSM on both sides of the pipe continuously using two vibrators for every 30 feet of pipe run.
 - c) Maintain stability of pipe and conduit throughout CLSM placement and curing. CLSM will likely require placement in lifts to prevent pipe flotation. No movement of the pipe caused by flotation will be allowed. If any movement occurs, the CLSM material shall be removed and/or repaired in full conformance with these Contract Documents at no additional cost to the OWNER. Remove all sloughed material or other debris from top of previously placed CLSM.
 - d) CLSM shall be allowed to cure a minimum of 4 hours prior to placing each lift as well as trench zone material. A smaller cure period will be allowed if it can be demonstrated to the ENGINEER that it will support the individual lift or trench zone material. The CLSM shall be sufficiently strong to support trench backfill material and the compaction effort required to achieve the specified compaction.

D. Marking Tape:

1. Continuously install marking tape along centerline of all buried piping, on top of last lift of pipe zone material unless otherwise shown. Coordinate with piping installation drawings. Install in accordance with manufacturer's recommendations.
 - a. Metallic Marking Tape: Install with nonmetallic piping and waterlines. Join ends with clips provided by the manufacturer.
 - b. Plastic Marking Tape: Install with metallic piping.

E. Pipe-Locating Wire:

1. Pipe-locating wire shall be provided for the entire length of all nonmetallic pipelines and shall be continuous around restrained joint sections.
2. Install pipe locating wire by strapping to the top of the pipe with PVC tape, polyethylene-backed tape, or tie locks. Test pipe locating wire with pipe locator equipment prior to final acceptance.
3. Stub the pipe-locating wire up inside each valve box or flush-mounted Type C corrosion monitoring stations. Sufficient excess length shall be provided at terminal connections to allow continuation of the pipe-locating wire to the terminal connection.
4. Wire splices shall be made with compression fittings or soldering; wrapped with Tac-Tape, Aqua-Seal, or equal, and wrapped with electrical tape. Prevent bare copper

31 05 03-11
Earthwork

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

wire from contacting metallic appurtenances including, but not limited to, pipe, buried valves, or fittings.

- F. Resume backfilling operations using the techniques described above to complete the pipe zone backfill. ENGINEER will approve the pipe zone backfill prior to initiating the trench zone backfill.
- G. Embankments:
 - 1. To the maximum extent available, use excess earth obtained from structure and trench excavations for construction of embankments. Obtain additional material from borrow pits, if such pits are shown, otherwise obtain additional material from offsite sources as necessary.
 - 2. Strip, scarify, level and roll the subgrade so that surface materials of the subgrade will be compact and well bonded with the first layer of the embankment.
 - 3. Wherever a pipe is to pass through a fill or embankment, place and compact the fill or embankment material to an elevation 12 inches above the top of the pipe before the trench is excavated.
- H. Crushed Stone:
 - 1. Place where shown on the Drawings, to the limits shown.
 - 2. Place in hand-tamped lifts, not to exceed 6 inches.
- I. Replacement of Unacceptable Excavated Materials: In cases where over-excavation for the replacement of unacceptable soil materials is required, backfill the excavation to the required subgrade with select backfill material and thoroughly compacted.

3.7 COMPACTION

- A. General:
 - 1. Compaction by inundation with water will not be permitted.
 - 2. Provide equipment capable of discing, aerating, and mixing the soil to ensure reasonable uniformity of moisture content throughout the material and to reduce the moisture content by air drying, if necessary.
 - 3. Perform compaction with equipment suitable for the type of fill material being placed. Select equipment that is capable of providing the minimum density required by these Specifications. Use hand-operated compacting equipment within a distance of 3 feet from the wall of any completed below grade structure. Between 3 feet and 12 feet adjacent to below grade structures, compaction may be completed with lightweight compaction equipment weighing less than 15,000 pounds. Beyond 12 feet adjacent to below grade structures, there are no equipment weight restrictions. Provide equipment that is capable of compacting in restricted areas next to structures and around piping.
- B. Compaction Density Requirements: The degree of compaction required for several types of fill is listed below. Moistened or aerated material as necessary to provide the moisture content specified, or if not specified, that will facilitate obtaining the specified compaction.

MATERIAL	Required Minimum Density	Maximum Uncompacted Lift*
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31 05 03-12
Earthwork

Washwater Equalizer Tank Replacement Project

	(ASTM D 1557)	
Common Fill/Prepared Subgrade:	90%	8 inches
Select Fill/Trench Backfill above pipe:		
More than 2 feet below final grade	90%	8 inches
Less than 2 feet below final grade	95%	8 inches
Aggregate Base:	95%	8 inches
Granular Bedding	90%	6 inches
Sand	90%	6 inches
Gravel Surfacing	95%	6 inches

*Where large areas of backfill allow for use of large, heavy equipment, ENGINEER may, at their option, allow uncompacted lifts up to 12 inches.

C. Moisture Content: All fill and backfill shall be prepared and thoroughly mixed to achieve optimum moisture content, $\pm 3\%$, with the following exception: On site clayey soils optimum to $+3\%$.

D. Testing: Testing will be as specified under Paragraph 3.10, "Field Quality Control".

3.8 GRADING

A. General:

1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
2. Smooth subgrade surfaces within specified tolerances, and compact with uniform levels or slopes between points where elevations are shown or between such points and existing grades.

B. Adjacent to Structures: Grade areas adjacent to structures to drain away from structures (including masonry fences) and to prevent ponding.

C. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 1 inch above or below the required subgrade elevation.

D. Pavements: Shape surface of areas under pavement to line, and grade and cross-section with finish surface not more than $\frac{1}{2}$ inch above or below the required subgrade elevation.

E. Under Building Slabs: Grade smooth and even, free of voids, compacted as specified and to required elevation. Provide final grades within a tolerance of $\frac{1}{2}$ inch when tested with a 10-foot straightedge.

F. Special Areas: In turfed areas or areas covered with gravel, stone, wood chips, or other special cover, grade to within not more than 1 inch above or below the required subgrade elevations.

G. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

31 05 03-13
Earthwork

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

Area	Required Minimum Density (ASTM D 1557)
Beneath Treatment Structures and Buildings	95%
Beneath Pavement	90%
Landscaped and other areas	85%

3.9 PAVEMENT BASE COURSE

- A. Shoulders:
 1. Place shoulders along edges of base course to prevent lateral movement.
 2. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each base course layer.
 3. Compact and roll at least a 12-inch width of shoulder simultaneously with compacting and rolling of each layer of base course.
- B. Placing:
 1. Place base course material on prepared subgrade in layers of uniform thickness conforming to indicated cross-section and thickness.
 2. Maintain optimum moisture content for compacting base material during placement operations.

3.10 FIELD QUALITY CONTROL:

- A. General: Testing by a testing laboratory of materials, testing for moisture content during placement and compaction of fill materials, and of compaction requirements for compliance with technical requirements of the Specifications.
- B. The CONTRACTOR shall retain one or more independent testing agencies to perform all quality control testing required for all materials except portland cement concrete. The required testing is for soil, aggregates, imported gravel, aggregate base, asphalt concrete, and CLSM. Each independent testing agency shall perform the testing under the supervision of an engineer registered in California. Technicians performing the testing shall be certified to operate the equipment and have at least 1 full year of experience in the type of tests being performed.
- C. A Quality Control Plan shall be submitted by the CONTRACTOR to the ENGINEER at least 30 days before field testing is required. It shall include the names, addresses, and phone number of the companies, the major personnel that will be involved, and resumes of the individuals that will be supervising and performing the tests. Copies of certificates held by the companies and the testing personnel shall be included.
- D. CONTRACTOR's independent testing agency shall perform all field and laboratory testing as described in these Specifications. Test shall include specific gravity, sand equivalent, durability, abrasion resistance, soundness, gradation, compaction curves, lab and field moisture contents, compressive strength, and field density. Other tests shall be performed by the CONTRACTOR's independent testing agency as may be required to meet the Specifications. Mix design testing for portland cement concrete, CLSM, and asphalt concrete shall also be performed by the CONTRACTOR. Field testing for portland cement concrete will be performed by the ENGINEER.

31 05 03-14
Earthwork

Washwater Equalizer Tank Replacement Project

- E. CONTRACTOR shall schedule all lab testing so that materials arriving at the site have been approved by the ENGINEER for use on the Project.
- F. All lab tests shall be performed on Samples obtained from the source of actual material that will be used on the Project. No test results more than 90 days old shall be submitted for review.
- G. The location of field density tests shall be determined by the ENGINEER.
- H. Frequency of tests: Frequency will be not less than as follows:
 - 1. For trenches:
 - a. In open fields: 2 locations every 1,000 linear feet, for each layer
 - b. Along dirt, gravel, or paved roads or off traveled right-of-way: 2 locations every 500 linear feet, for each layer
 - c. Crossing roads: 2 locations along each crossing, for each layer
 - 2. For structural backfill: 1 every 50 cubic yards.
 - 3. In embankment or fill: 1 every 200 cubic yards.
 - 4. Base material: 1 every 50 cubic yards.
 - 5. Footing Subgrade: 1 every 50 linear feet, for each layer.
 - 6. Paved Areas and Building Slab Subgrade: 1 every 500 square feet, but in no case less than 3 tests, for each layer.
- I. The ENGINEER may modify the frequency or spacing of tests to provide for testing at specific structures or locations where the ENGINEER deems additional testing is required. The CONTRACTOR shall perform such additional testing up to 10% above the frequency and total number of tests specified at no additional cost to the OWNER.
- J. Verbal and hand-written test results shall be provided to the ENGINEER and CONTRACTOR immediately following the field testing. Written test data sheets shall be provided to the ENGINEER not more than 12 hours following completion of the field test. Typed lab test results shall be provided to the ENGINEER not more than 7 calendar days following completion of the tests; however, the results must be reviewed and approved by the ENGINEER prior to placing the material in the trenches or incorporating it in the Work.
- A. Any location where a failing test occurs shall be recompacted and retested until a passing test is obtained. Specified testing values are minimums and no tests shall be accepted below the specified minimums. No material shall be placed over the failing test area until the failing material is recompacted and a passing test is obtained, and the area is approved by the ENGINEER. The limits of the failing test shall be assumed to be halfway between the failing location and the nearest passing location. Additional tests may be taken to determine the limits of unsatisfactory compaction.
- B. At the first of each month, the CONTRACTOR shall provide to the ENGINEER a typed summary of all tests performed for the previous month including test location by station, depth below finished grade, material tested, wet density, moisture content, dry density, maximum density curve used, and percent relative compaction. Lab test results shall also be included in the monthly report with clear description of material tested, intended use on the Project, and a statement of compliance or noncompliance with the Project Specifications.

31 05 03-15
Earthwork

Washwater Equalizer Tank Replacement Project

- C. Any material which does not meet the Specifications shall be removed from the site and replaced with material in compliance.
- D. Material which has been softened or modified prior to placing the overlying lift shall be removed down to material which is in compliance.

3.11 DISPOSAL OF EXCAVATED MATERIALS

- A. Material removed from the excavations that does not conform to the requirements for fill or is in excess of that required for backfill shall be hauled away from the Work site and disposed of by CONTRACTOR in compliance with ordinances, codes, laws and regulations at no additional cost to the OWNER.
- B. A site is not available to dispose of excess material.

++ END OF SECTION ++

31 05 03-16
Earthwork

SECTION 31 11 03

SITE PREPARATION

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.
- B. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.
- C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 0.5 inch caliper to a depth of 6 inches below subgrade.
- D. Stripping: Removal of topsoil remaining after applicable scalping is completed.
- E. Project Limits: Areas, as shown or specified, within which Work is to be performed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Clear, grub, and strip areas actually needed for waste disposal, borrow, or site improvements within limits shown or specified.
- B. Do not injure or deface vegetation that is not designated for removal.

3.2 LIMITS

- A. As follows, but not to extend beyond Project limits.
 - 1. Excavation 5 feet beyond top of cut slopes.
 - 2. Trench Excavation: 4 feet from trench centerline, regardless of actual trench width.
 - 3. Waste Disposal:
 - a. Clearing: 5 feet beyond perimeter.
 - b. Scalping and Stripping: Not required.
 - c. Grubbing: Around perimeter as necessary for neat finished appearance.
 - 4. Structures: 5 feet outside of new structures.
 - 5. Roadways: Clearing , grubbing and stripping 50 feet from centerline.
 - 6. Overhead Utilities:
 - a. Clearing and Grubbing: Entire width of easements and rights-of-way.
 - b. Scalping and Stripping: Wherever grading is required.
 - 7. Other Areas: As shown.

31 11 03-1
Site Preparation

- B. Remove rubbish, trash, and junk from entire area within Project limits.

3.3 CLEARING

- A. Clear areas within limits shown or specified.
- B. Fell trees so that they fall away from facilities and vegetation not designated for removal.
- C. Cut stumps not designated for grubbing flush with ground surface.
- D. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

3.4 GRUBBING

- A. Grub areas within limits shown or specified.

3.5 STRIPPING

- A. Do not remove topsoil until after scalping is completed.
- B. Strip areas within limits to minimum depths shown or specified. Do not remove subsoil with topsoil.

3.6 DISPOSAL

- A. Clearing and Grubbing Debris: Dispose of debris offsite.
- B. Strippings:
 - 1. Dispose of strippings that are unsuitable for topsoil or that exceed quantity required for topsoil offsite or approved by ENGINEER.
 - 2. Stockpile topsoil in sufficient quantity to meet Project needs. Dispose of excess strippings as specified for clearing and grubbing.

++ END OF SECTION ++

SECTION 31 23 17

ROCK AND BOULDER EXCAVATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish all labor, materials, equipment and incidentals required and excavate and dispose of rock and boulders as shown on the Drawings and as specified herein.
- B. **Blasting will not be permitted on this project.**

1.2 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33, Standard Specification for Aggregate Material.
 - 2. ASTM D422, Method for Particle-Size Analysis of Soils.
 - 3. ASTM D423, Liquid Limit of Soils.
 - 4. ASTM D427, Shrinkage Factors of Soils.
 - 5. ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil.
 - 6. ASTM D1556, Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 7. ASTM D2922, Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 8. ASTM D2166, unconfined compressive strength of soils.
- B. Occupational Safety and Health Administration (OSHA)
 - 1. Title 29, Code of Federal Regulations, Part 1926
- C. International Organization for Standardization (ISO)
 - 1. 6165, Earth moving machinery
- D. United States Department of Agriculture, National Engineering Handbook (NEH)

1.3 DEFINITIONS

- A. Rock: Rock is defined as limestone, sandstone, granite or similar rocks in solid beds or masses in original or stratified position which can be removed only by continuous drilling, blasting or the use of pneumatic tools.
- B. Boulders: Rock fragments that are 1 cubic yard in volume or larger.
- C. Rippability: The ability to rip or excavate rock is determined by the type of excavator capable of removing it without blasting (i.e. hydraulic excavator; equipped with a short-tip-radius rock bucket; rated at not less than 250-flywheel hp with bucket curling force of not less than 25,000 lbf and stick-crowd force of not less than 18,700 lbf; measured according to International Organization for Standardization (ISO) 6165).

- D. Material: Material which can be loosened with a pick, frozen materials, soft laminated shale and hardpan, which for convenience or economy is loosened by drilling, blasting, wedging or the use of pneumatic tools, removal of concrete pavement and retaining walls shall not be classified as rock excavation.
- E. Blasting: Blasting is the controlled use of explosives and other similar methods to excavate, breakdown or remove rock.
- F. Rock Excavation: The removal of solid rock or rock fragments greater than 1 cubic yard in volume which cannot be removed by conventional mechanical excavation equipment or which requires continuous, systematic drilling and blasting, chemical expanders or other special procedures.

1.4 SYSTEM DESCRIPTION

- A. General:
 - 1. The CONTRACTOR shall be aware of the subsurface rock characteristics mentioned in the Geotechnical Report.
 - 2. Nonconventional excavation methods will likely be needed to construct this project.
 - 3. Naturally Occurring Asbestos (NOA) was not encountered in testing during the Geotechnical study but was encountered at a nearby site on the property. No action needs to be taken regarding NOA at this time but during construction, if fibrous serpentinite is observed, then it is recommended that the Contractor retain an industrial hygienist to help reduce the risks of handling and placement of NOA-bearing earth materials.
 - 4. Blasting is prohibited on the project.
- B. Measurement of Rock Quantity:
 - 1. The method of measurement of the rock quantity is by standard cross-section method:
 - a. Measured in its natural state before disturbance.
 - b. Unit of measurement shall be in bank cubic yard (BCY).
 - c. Take cross-sections at regular intervals typically at every 5 feet within the excavation area and calculate its cross-section end areas.
 - d. In a pipeline trench, calculate the length of the rock obstruction multiply by the cross-section at every 5 feet intervals.
 - 2. When the rock is in the bottom of a trench the CONTRACTOR shall drill through overburden to determine the top of rock for rock quantity calculations.
 - 3. Whenever the ENGINEER finds that subsurface conditions are substantially different from what is shown on the Contract Drawings or could be inferred by from the borings, the ENGINEER and the OWNER shall immediately investigate the work site to verify the rock quantity.
- C. Permits and Regulations:
 - 1. Perform excavation Work in compliance with applicable requirements of governing authorities having jurisdiction.
 - 2. Obtain all necessary permits for Work in roads, rights-of-way, railroads, etc. Also, obtain permits as required by local, state and federal agencies for discharging water from excavations, for erosion control, and for prevention of air and water pollution.

1.5 SUBMITTALS

- A. Submit the proposed methods of excavation for the various portions of the work. Submittals shall be for information only. Remain responsible for means, methods and techniques, as well as all safety considerations.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Trench Support:
1. Provide, install and maintain trench shields for all trench excavations for which trench shields are required (at a minimum, as required by OSHA).
 2. Follow all OSHA guidelines and other applicable laws and ordinances.
 3. Elevation of Bottom:
 - a. Excavation of earth material below the bottom of a shield will not exceed the limits established by ordinances, codes, laws and regulations.
 - b. When using a shield for pipe installation, the bottom of the shield will not extend below the mid-diameter of installed pipe at any time.
 - c. When using a shield for the installation of structures, the bottom of the shield shall not extend below the top of the bedding for the structures.
 4. Moving Shield: When a shield is removed or moved ahead, extreme care will be taken to prevent the movement of pipe or structures or the disturbance of the bedding for pipe or structures. Pipe or structures that are disturbed are to be removed and reinstalled as specified.
 5. Conform additional excavation support system requirements as per Section 31 05 03, Earthwork.
- B. Pipe Trench Excavation:
1. No more than 100 feet of trench may be opened in advance of pipe laying.
 2. Minimize trench width to the greatest extent practical, but conform to the following:
 - a. Sufficient to provide room for installing, jointing and inspecting piping, but in no case wider at top of pipe than pipe barrel outside diameter plus 6 feet.
 - b. Sufficient for shoring and bracing, or shielding, rock excavation and dewatering.
 - c. Sufficient to allow thorough compaction of backfill adjacent to bottom half of pipe.
 3. Depth of trench will be as shown. If required and approved by ENGINEER, depths may be revised.
- C. Rock and Boulder Excavation:
1. Rock excavation may be performed by relatively unconventional methods of excavation such as the use of hoe-rams, jack hammering, expansive chemical splitting, chiseling, single shank, rock saw or other similar process.
 2. The spacing of the drill holes shall not exceed the depth of the cut at the point of drilling.
 3. Drill hole locations shall be indicated to the ENGINEER by the CONTRACTOR at minimum 72 hours in advance of the drilling.

4. Boulders and rock fragments 1 cu yd or larger in volume may be reduced in size by rock excavation methods to simplify its removal.

3.2 EQUIPMENT FOR ROCK EXCAVATION

- A. ENGINEER conducted seismic refraction analysis near the alignment indicating seismic velocity as high as 9,400 fps.
- B. Refer to Volume 3 – Geotechnical Report for more information regarding the type of equipment required to excavate the rock.
- C. The unconventional methods for rock and boulder excavation shall be a combination of hoe-rams, jack hammering, expansive chemical splitting, chiseling, single shank, rock saw or other similar process.
- D. Heavy ripping equipment may be rear-mounted, heavy duty, single-tooth, with a ripping attachment.

3.3 PLACEMENT OF FILL AND BACKFILL

- A. General:
 1. Backfill of rock and boulder excavation trenches and surrounding areas shall conform to the Contract Specifications Section 31 05 03, Earthwork.
 2. Remove and replace with approved fill material, as specified, in the Contract Specifications Section 31 05 03, Earthwork.
 3. Compact all fill and backfill as specified in the Contract Specifications Section 31 05 03, Earthwork.
 4. Suitable material from the rock and boulder excavation may be used as fill material if it conforms to the $\frac{3}{4}$ inch crushed stone specs Section 31 05 03, Earthwork.

3.4 DISPOSAL OF ROCK AND BOULDERS

- A. Fragmented rock up to 12 inches in length in any direction may be used as riprap or slope stabilization, provided that such materials meet the requirements for riprap and slope stabilization specified in the Contract Specification Section 31 37 03, Rip Rap.
- B. Rock and boulders may be crushed and screened for reuse in the work, provided that the resultant materials meet the requirements for gravel, crushed stone, or structural fill as specified in the Contract Specification Section 31 05 03, Earthwork.
- C. Unused rock and boulders shall be removed and disposed of off-site.

++ END OF SECTION ++

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings: Detailed information and specifications for materials, finishes, and dimensions.
- B. Samples: Approximately 6 inches square, or 6 inches long of posts, rails, braces, fabric, wire, ties, and fittings.
- C. Quality Control Submittals:
 - 1. Manufacturer's recommended installation instructions.
 - 2. Evidence of Supplier and installer qualifications.

1.2 SCHEDULING AND SEQUENCING

- A. Complete necessary site preparation and grading before installing chain link fence and gates.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Match style, finish, and color of each fence component with that of other fence components.

2.2 CHAIN LINK FENCE FABRIC

- A. Galvanized fabric conforming to ASTM F668, Class 1 or 29.

2.3 POSTS

- A. General:
 - 1. Strength and Stiffness Requirements: ASTM F669, Heavy Industrial Fence, except as modified in this section.
 - 2. Steel Pipe: ASTM F1083.
 - 3. Roll-Formed Steel Shapes: Roll-formed from ASTM A570, Grade 45, steel.
 - 4. Protective Coatings:
 - a. Zinc Coating: ASTM F1234, Type A external and internal coating.
- B. Line Posts:
 - 1. Steel Pipe:
 - a. Outside Diameter: 2.375-inch.
 - b. Weight: 3.65 pounds per foot.
 - 2. Roll-Formed Steel C Shape:

32 31 13-1
Chain Link Fences and Gates

- a. Outside Dimensions: 2.25-inch by 1.625-inch.
 - b. Weight: 2.70 pounds per foot.
- 3. Steel H-Section:
 - a. Outside Dimensions: 2.25-inch by 1.70-inch.
 - b. Weight: 3.26 pounds per foot.
- C. End, Corner, Angle, and Pull Posts:
 - 1. Steel Pipe:
 - a. Outside Diameter: 2.875-inch.
 - b. Weight: 5.79 pounds per foot.
- D. Posts for Removable Fence Panels: As specified for end, corner, angle, and pull posts.
- E. Posts for Swing Gates:
 - 1. Material: ASTM F1043 Group IA ASTM F1083 schedule 40 pipe.
 - 2. Gate Post Size per ASTM F900:

For gate fabric height up to and including 6 feet	
Gate Leaf Width	Post Outside Diameter
Up to 4 feet	2.375-inch
Over 4 feet to 10 feet	2.875-inch
Over 10 feet to 18 feet	4.0-inch
For gate fabric height over 6 feet to 12 feet	
Up to 6 feet	2.875-inch
Over 6 feet to 12 feet	4.0-inch
Over 12 feet to 18 feet	6.625-inch
Over 18 feet to 24 feet	8.625-inch

- a. Roll-formed steel shapes may be substituted for steel pipe posts for gate leaf widths up to 6 feet and fabric heights up to 8 feet.
 - 1) Outside Dimensions: 3.5-inch by 3.5-inch.
 - 2) Weight: 4.85 pounds per foot.

2.4 TOP RAILS AND BRACE RAILS

- A. Galvanized steel pipe or roll-formed steel C shapes.
- B. Protective Coatings: As specified for posts.
- C. Strength and Stiffness Requirements: ASTM F669, Top Rail, Heavy or Light Industrial Fence.
- D. Steel Pipe:
 - 1. ASTM F1083.
 - 2. Outside Diameter: 1.66-inch.
 - 3. Weight: 2.27 pounds per foot.
- E. Roll-Formed Steel C Shapes:
 - 1. Roll formed from ASTM A570, Grade 45.
 - 2. Outside Dimensions: 1.625-inch by 1.25-inch.
 - 3. Weight: 1.40 pounds per foot.

2.5 FENCE FITTINGS

- A. General: In conformance with ASTM F626, except as modified by this article.
- B. Post and Line Caps: Designed to accommodate passage of top rail through cap, where top rail required.
- C. Tension and Brace Bands: No exceptions to ASTM F626.
- D. Tension Bars:
 - 1. One-piece.
 - 2. Equal in length to full height of fabric.
- E. Truss Rod Assembly: 3/8-inch diameter.
- F. Barb Arms: 45-degree arms for supporting three strands of barbed wire.

2.6 TENSION WIRE

- A. Zinc-coated steel marcelled tension wire conforming to ASTM A824, Type II, Class 2.

2.7 GATES

- A. General:
 - 1. Gate Operation: Opened and closed easily by one person.
 - 2. Welded Steel Joints: Paint with zinc-based paint.
 - 3. Chain Link Fabric: Attached securely to gate frame at intervals not exceeding 15 inches.
- B. Swing Gates: ASTM F900.
 - 1. Hinges:
 - a. Furnished with large bearing surfaces for clamping in position.
 - b. Designed to swing either 180 degrees outward, 180 degrees inward, or 90 degrees in or out, as shown, and not twist or turn under action of gate.
 - 2. Latches: Plunger bar arranged to engage stop, except single gates of openings less than 10 feet wide may each have forked latch.
 - 3. Gate Stops: Mushroom type or flush plate with anchors, suitable for setting in concrete.
 - 4. Locking Device and Padlock Eyes: Integral part of latch, requiring one padlock for locking both gate leaves of double gates.
 - 5. Hold-Open Keepers: Designed to automatically engage gate leaf and hold it in open position until manually released.
- C. Fabric Salvage: Knuckled.
- D. Appurtenances and Framework: As specified.

2.8 CONCRETE

- A. Provide as specified in Section 03 30 03, Cast-in-Place Concrete.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install chain link fences and gates in accordance with ASTM F567, except as modified in this section, and in accordance with fence manufacturer's recommendations, as approved by ENGINEER. Erect fencing in straight lines between angle points.
- B. Provide all necessary hardware for a complete fence and gate installation.

3.2 PREPARATION

- A. Establish locations of fence lines, gates, and terminal posts.

3.3 POST SETTING

- A. Driven posts are not acceptable.
- B. Post Hole Depth:
 - 1. Minimum 3 feet below finished grade.
 - 2. 2 inches deeper than post embedment depth below finish grade.
- C. Backfill post holes with concrete to 2 inches above finished grade.
- D. Before concrete sets, crown and finish top of concrete to readily shed water.

3.4 BRACING

- A. Brace gate and corner posts diagonally to adjacent line posts to ensure stability.

3.5 TOP RAILS

- A. Install top rail sleeves with springs at 105 feet maximum spacing to permit expansion in rail.

3.6 CHAIN LINK FABRIC

- A. Do not install fabric until concrete has cured minimum 7 days.
- B. Install fabric with twisted and barbed selvage at top.

3.7 GATES

- A. Hang gates and adjust hardware so gates operate satisfactorily from open or closed position.
- B. Set gate stops in concrete to engage center drop rod or plunger bar.

3.8 ELECTRICAL GROUNDING

- A. Ground fences in accordance with applicable requirements of IEEE C2, National Electrical Safety Code.

3.9 FIELD QUALITY CONTROL

- A. Gate Tests: Prior to acceptance of installed gates and gate operator systems, demonstrate proper operation of gates under each possible open and close condition specified.

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32 31 13-6

Chain Link Fences and Gates

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 32 92 03

HYDROSEEDING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This specification includes hydroseeding areas indicated and maintaining seeded areas until acceptance of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Furnish from the project site, Topsoil shall be reasonably free from subsoil, refuse, heavy or stiff clay, stones larger than one inch in size and other deleterious substances. Break all lumps and clods before the soil is spread.
- B. Erosion control slurry: A hydromulch type consisting of the following ingredients per acre:

Water	3,000 gal.
Fertilizer	320 lbs.
Seed	50 lbs.
Fiber	1,500 lbs.
Stabilizer	100 lbs.

- C. Commercial fertilizers: Conform to the requirements of the California Food and Agricultural Codes uniform in composition with the guaranteed chemical analysis of 16-20-0. Soluble potash shall be a form that will rapidly dispense in the slurry; Sentinel by Albright and Towne; or equal.
- D. Seed:
1. 50 lb/ac 'Regreen' sterile wheat (Triticum X Elymus 'Regreen'). 95% minimum purity, and minimum germination of 85%
- E. Fiber mulch: Green colored, fibrous, wood cellulose mulch containing no growth or germination inhibiting factors. Mulch shall, after addition and agitation in slurry tanks with fertilizer, seed, water, and other approved additives, uniformly suspend fibers to form a homogeneous slurry; and when hydraulically sprayed on the ground, the material will form a blotter-like ground cover impregnated uniformly with seed. After application, mulch shall allow the absorption of moisture and allow the rainfall to percolate to underlying soil.
1. Cellulose: Certified to indicate laboratory and field testing has been accomplished and that it meets all foregoing requirements. Weight specifications from suppliers and for application shall be the air dry weight of the fiber material.

32 92 03-1
Hydroseeding

2. Absolute air dry weight is based on the normal standards of the Technical Association of the Pulp and Paper Industry for wood cellulose and is considered equivalent to 10 percent moisture. Each package of the cellulose fiber shall be marked by the manufacturer to show the air dry weight content.
- F. Stabilizing agent: A mixture of 100 percent organic, water soluble alginic acids derived from cold-water keips.

PART 3 - EXECUTION

3.1 PREPARATION AND APPLICATION

- A. Restore all areas damaged by erosion, construction activities, or other causes before beginning hydroseeding activities. Restoration shall include filling depressions and gullies, establishing level grades and slopes, and compacting soils to prevent wind erosion. Only native fill shall be used for restoration.
- B. Place and spread native fill a minimum depth of three inches over the areas shown to be hydroseeded, except that sloped areas greater than 1 horizontal to 2 vertical shall not receive this native fill.
- C. The equipment for application of erosion control slurry shall have a minimum tank capacity of 500 gallons, a built-in agitation system of sufficient operating capacity to produce an homogeneous slurry, and a discharge system with a set of spray nozzles which will deliver slurry to the areas to be seeded in a continuous and uniform rate, without misses, waste or erosion. Slurry distribution lines shall be large enough to prevent stoppage and the equipment shall be capable of being propelled.
- D. Prepare slurry at the Project site. Fill the tank with water to the quarter mark and agitate well before adding seed and fertilizer. Agitate slurry during mixing period to assure fast, homogeneous mixing, but seed shall not be added more than twenty minutes before spraying. Continue agitation at one-half optimum rpm until all material is dispersed.
- E. Using the green color of the mulch as a guide, apply slurry in sweeping motions in an arched stream so as to fall like rain. Allow materials to build on each other until a good coat is achieved and slurry is spread at the required rate per acre. In areas difficult to reach, apply in a more controlled manner.
- F. Should slurry cover any object not to be covered, wash with clear water immediately. Apply slurry as soon as practicable on cut slopes; apply to filled and graded areas as directed by the ENGINEER. Slurry shall not be applied during rain or high wind conditions.

3.2 TIMING

- A. Time for hydroseeding shall be scheduled so that seed will be planted in time for the first germination-causing rain. Unless approved by ENGINEER, planting shall be not earlier than October 15 nor later than October 31.

32 92 03-2
Hydroseeding

3.3 MAINTENANCE

- A. Maintenance shall include repair of erosion, replacement of mulch, and incidental work necessary.
- B. CONTRACTOR to hydroseed and then maintain and water it until confirmed that it germinates with two-week, four-week, six-week and eight week germination field checks by owner representative with contract representative present. CONTRACTOR required to maintain hydroseeding through the confirmation of documented germination.

++ END OF SECTION ++

32 92 03-3
Hydroseeding

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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32 92 03-4
Hydroseeding

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 40 05 06

PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Manufacturer's data on materials, construction, end connections, ratings, overall lengths, etc.

PART 2 - PRODUCTS

2.1 FLEXIBLE COUPLINGS (FC)

- A. Features:
 - 1. Description: Sleeve-type flexible couplings.
 - 2. Pressure and Service: Same as connected piping.
 - 3. Sleeve and Follower material: Ductile iron or steel.
 - 4. Coating and Lining: End and center rings shall be epoxy lined and coated, minimum 16 mils thickness. For potable water service, lining shall be NSF-61 certified.
 - 5. Gasket: EPDM
 - 6. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated. Buried couplings shall have Type 316 stainless steel bolts and nuts.
- B. Manufacturers and Products:
 - 1. Romac;
 - a. Style 501 (2-inch through 24-inch)
 - b. Style 400 (12-inch through 96-inch)
 - 2. Dresser Piping Specialties; Style 38
 - 3. Smith-Blair, Inc.; Style 411.
 - 4. Or Equal.

2.2 RESTRAINED MECHANICAL JOINT GLANDS (RMJ)

- A. Features:
 - 1. Pressure Rating:
 - a. Minimum Working Pressure Rating: Not less than 150 psi.
 - b. Safety Factor: Not less than two times working pressure and shall be supported by manufacturer's proof testing.
 - 2. RMJ gland shall be designed for use with standard mechanical joint pipe. Pipe restraint products designed for use with push-on joints will not be acceptable.
 - 3. Thrust Restraint:
 - a. Provide hardened steel wedges that bear against and engage outer pipe surface, and allow articulation of pipe joint after assembly while wedges remain in their original setting position on pipe surface.
 - b. Products employing set screws that bear directly on pipe will not be acceptable.

40 05 06-1
Piping Specialties

- B. Manufacturers and Products:
 - 1. Ductile Iron Pipe Only
 - a. EBAA Iron Sales Co.; Megalug.
 - b. Romac Industries Inc.: RomaGrip
 - c. Or Equal.

2.3 MODULAR MECHANICAL SEALS

- A. Features:
 - 1. Type: Interconnecting synthetic rubber links shaped and sized to continuously fill annular space between pipe and sleeve, blockout, or core-drilled opening in concrete slabs or walls.
 - 2. Links: EPDM
 - 3. Bolts and nuts: Type 316 stainless steel
 - 4. Pressure plates: composite
 - 5. Temperature range: -40 to 250 degrees Fahrenheit
 - 6. Pressure rating: guaranteed by the manufacturer to provide a water-tight seal with a differential hydrostatic head of 40-feet of water
- B. Manufacturers and Products:
 - 1. PSI-Thunderline; Link-seal, Type S-316
 - 2. Or equal

2.4 SERVICE SADDLES

- A. Double-Strap Iron:
 - 1. Features:
 - a. Description: Double strap iron.
 - b. Pressure Rating: Capable of withstanding 150 psi internal pressure without leakage or over stressing.
 - c. Run Diameter: Compatible with outside diameter of pipe on which saddle is installed.
 - d. Taps: Iron pipe threads.
 - e. Materials:
 - 1) Body: Malleable or ductile iron.
 - 2) Straps: Galvanized steel.
 - 3) Hex Nuts and Washers: Steel.
 - 4) Seal: Rubber.
 - 2. Manufacturers and Products:
 - a. Smith-Blair; Series 313 or 366.
 - b. Dresser; Style 91.
 - c. Or Equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General
 - 1. Follow all manufacturer's directions

40 05 06-2
Piping Specialties

- B. Thrust Restraint for Unrestrained Couplings:
1. Provide thrust restraint for the following coupling types, as shown on the Drawings.
 - a. Flexible couplings
 - b. Flanged coupling adapters
 - c.
 2. If no thrust restraint is shown on the Drawings, but pipe schedule indicates a test pressure greater than zero, notify ENGINEER to request appropriate thrust restraint detail.
- C. Flexible Couplings
1. Follow all manufacturer's directions
 2. No more than 1-inch gap between pipe ends
 3. Center flexible coupling in joint
 4. Tighten bolts in an alternating pattern to provide even tension around the coupling
 5. Tighten bolts to specified torque
 6. In buried installations, wrap coupling with plastic fastened to pipe to protect bolts and coupling from backfill material
- D. Restrained Mechanical Joint Glands
1. Follow all manufacturer's directions
 2. Tighten mechanical joint gland bolts before tightening restraint lugs
 3. Tighten restraint lugs until torque head breaks off
 4. In buried installations, wrap joint with plastic fastened to pipe to protect bolts and coupling from backfill material

++ END OF SECTION ++

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40 05 06-4
Piping Specialties

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 40 05 07
PIPING SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Details of each pipe support type used.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All pipe supports shall be type 304 or 316 stainless steel.

2.2 SUPPORT SYSTEMS:

- A. Channel-type support systems
 - 1. Unistrut
 - 2. B-Line
 - 3. Or Equal.
- B. Hanger- and Clevis-type support systems
 - 1. B-line
 - 2. Anvil
 - 3. Or Equal
- C. Stanchion-type support systems
 - 1. B-Line
 - 2. Anvil
 - 3. Or Equal
- D. Adjustable Pipe Saddle Support
 - 1. B-Line, Figure B-3092
 - 2. Or Equal
- E. Flange Mounted Pipe Support
 - 1. B-Line B-3094
 - 2. Or Equal
- F. Wall Bracket (4-inch to 6-inch pipe)
 - 1. B-Line Figure B-3068 Light Duty Angle Bracket
 - 2. Or Equal
- G. Wall Bracket (8-inch to 12-inch pipe)
 - 1. B-Line Figure B-3066 Medium Duty Angle Bracket
 - 2. Or Equal

40 05 07-1
Piping Support Systems

- H. Wall Bracket (14-inch to 24-inch pipe)
1. B-Line Figure B-3067 Heavy Duty Angle Bracket
 2. Or Equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. In addition to the pipe supports specifically called for on the Drawings, CONTRACTOR shall provide pipe supports as required to fully support all piping systems.
- B. CONTRACTOR shall design, supply and install pipe support system using manufacturer's standard available pipe support hardware.
- C. Pipe supports shall, at a minimum, be installed at the following locations:
1. On both sides of each valve, piece of equipment or other appurtenance, such that allowance is made for removal of the valve, piece of equipment, or other appurtenance while leaving the pipe system fully supported. Support piping connections to equipment by pipe support and not by the equipment.
 2. Along straight runs of pipe, the maximum distance between supports shall be as listed below:

Pipe Diameter	Maximum Distance Between Supports	Minimum Hanger Rod Diameter (if Hanger Rods are used)
2" and smaller	6-feet	1/2"
2-1/2" to 6"	8-feet	3/4"
8" to 12"	10-feet	2 @ 3/4"
14" to 18"	10-feet	2 @ 1"
Over 18"	Custom Design	

3. Directly supporting valves 8-inch in diameter and larger.
 4. At least two supports on each side of flexible couplings or flanged coupling adapters to provide that no load is applied to the flexible coupling.
 5. On the pipe within two pipe diameters of each side of elbows and each branch of tees and crosses.
 6. Where piping passes through walls, such that no load is transferred to the wall.
- D. Install support systems in accordance with MSS SP 69, Pipe Hangers and Supports-Selection and Application and MSS SP 89, Pipe Hangers and Supports-Fabrication and Installation, unless shown otherwise.
1. Support no pipe from the pipe above it.
 2. Do not install pipe supports and hangers in equipment access areas or bridge crane runs.
- E. Bracing and lateral support:
1. Provide lateral sway bracing on 10-foot maximum centers
 - a. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing.
 2. Install lateral supports for seismic loads at all changes in direction.

- F. Thermal expansion and thrust restraint
 - 1. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
- G. Support types:
 - 1. Horizontal Suspended Piping:
 - a. Single Pipes: Adjustable swivel-ring, splint-ring or clevis hangers.
 - b. Grouped Pipes: Trapeze hanger systems.
 - c. For insulated piping, furnish galvanized steel protection shields, welding insulation saddles, or precut sections of rigid insulation (with vapor barrier) at all hanger locations.
 - 2. Horizontal Piping Supported From Walls:
 - a. Single Pipes: Wall brackets or wall clips attached to wall with anchors. Clips attached to wall-mounted framing also acceptable.
 - b. Stacked Piping:
 - 1) Wall-mounted framing system and clips acceptable for piping smaller than 3-inch minimal diameter.
 - 2) Piping clamps that resist axial movement of pipe through support not acceptable.
 - c. Insulated piping shall have the insulation removed in the vicinity of wall brackets and piping clips to allow only direct pipe wall contact with the support system.
 - 3. Horizontal Piping Supported From Floors:
 - a. Stanchion Type:
 - 1) Pedestal type; adjustable with stanchion, saddle, and anchoring flange.
 - 2) Use yoked saddles for piping whose centerline elevation is 18 inches or greater above the floor and for all exterior installations.
 - 3) Provide neoprene waffle isolation pad under anchoring flanges, adjacent to equipment or where otherwise required to provide vibration isolation.
 - b. Floor-Mounted Channel Supports:
 - 1) Use for piping smaller than 3-inch nominal diameter running along floors and in trenches at piping elevations lower than can be accommodated using pedestal pipe supports.
 - 2) Attach channel framing to floors with anchor bolts.
 - 3) Attach pipe to channel with clips or pipe clamps.
 - c. Concrete Cradles:
 - 1) Use for piping larger than 3-inch along floor and in trenches at piping elevations lower than can be accommodated using stanchion type.
 - 4. Vertical Pipe:
 - a. Support with wall brackets and base elbow or riser clamps on floor penetrations.
 - b. Insulated piping shall have the insulation removed in the vicinity of wall brackets and riser clamps, to allow only direct wall contact with the support system.
- H. Standard Attachments:
 - 1. To Concrete Ceilings: Concrete inserts.
 - 2. To Steel Beams: I-beam clamp or welded attachments.
 - 3. To Wooden Beams: Lag screws and angle clips to members not less than 2-1/2 inches thick.
 - 4. To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.
 - 5. Existing Walls and Ceilings: Install as specified for new construction, unless shown otherwise.

6. Repair mounting surfaces to original condition after attachments are made.
- I. Isolation:
 1. Install elastomeric inserts designed to isolate piping from pipe supports where copper pipe is run in stainless steel supports, or where other dissimilar metals are in contact with pipe supports.
- J. Materials:
 1. Channel-type, hanger-type and trapeze-type support systems and pipe racks constructed of channel systems:
 - a. Provide non-metallic support systems in all chemical storage and feed areas or as otherwise noted on the Drawings. Provide type 316 stainless steel fasteners.
 - b. Provide type 304 stainless steel support systems and fasteners in all other areas.
 2. Stanchion-type support systems
 - a. Provide steel and ductile iron stanchion components
 - b. Coat stanchions after assembly per specification Section 09 91 03, Painting.

++ END OF SECTION ++

SECTION 40 05 10

PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Product data sheets for each piping system.
 - a. Include information on pipe, fittings and joint systems.
 - 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 - 3. Complete descriptions and data for all coatings and linings.
 - 4. Tests and inspection data for pipe and coatings/linings.
 - 5. Qualifications for welders and/or technicians performing joining processes that requires specialized equipment to perform the work or as specifically identified herein.
- B. Operation and Maintenance Data as specified in Submittal Procedures section of these specifications.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. In accordance with manufacturer's directions.

PART 2 - PRODUCTS

2.1 PIPING SYSTEM DATA SHEETS

- A. Piping system data sheets (PSDS) have been attached to this Specification and are incorporated herein by reference. Provide piping systems in accordance with piping system data sheets.

2.2 THRUST RESTRAINT

- A. Provide rigid or restrained joints and fittings for all piping systems specified with a test pressure in the Pipe Schedule.
- B. Unless otherwise specified in the Pipe Schedule or shown on the Drawings, thrust blocks shall not be used.

PART 3 - EXECUTION

3.1 PIPE SCHEDULE

- A. A Pipe Schedule is included in the Specifications and is incorporated herein by reference. Install piping systems in accordance with Pipe Schedule.

40 05 10-1
Pipe and Fittings

- B. For pipe which is shown on the Drawings, but not referenced in the Pipe Schedule, CONTRACTOR to provide pipe material and fittings which are appropriate for the intended service and acceptable to the ENGINEER.

3.2 PREPARATION

- A. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.
- B. Repair any coatings or linings which were damaged during shipping and handling using manufacturer-approved coating and lining repair materials in accordance with manufacturer's instructions.

3.3 INSTALLATION

- A. General:
 - 1. Join pipe and fittings in accordance with manufacturer's instructions, unless otherwise shown or specified.
- B. Joint Assembly:
 - 1. Flanged Joints (FLG):
 - a. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.
 - b. Follow a bolt tightening pattern which produces uniform bearing pressure.
 - c. Do not over-tighten bolts. Follow manufacturer's recommendation for bolt torque.
 - d. Provide gasket at every flanged joint.
 - e. Provide insulating flange kit where indicated on Drawings and required in this Specification.
 - 2. Threaded and Coupled Joints (THR):
 - a. Conform to ANSI B1.20.1.
 - b. Produce sufficient thread length to ensure full engagement when screwed home in fittings.
 - c. Ream pipe ends and clean chips and burrs after threading.
 - d. Make connections with not more than three threads exposed.
 - e. Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.
 - f. PVC Threaded Joints:
 - 1) Provide Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.
 - 2) Use strap wrench for tightening threaded plastic joints. Do not overtighten fittings.
 - g. HDPE Threaded Joints:
 - 1) Joining HDPE pipe with threaded connections is not allowed unless specifically approved by the ENGINEER
 - h. Provide dielectric union or insulating coupling where indicated on Drawings and required in this Specification.
 - 3. Grooved-End Joints (GRV):
 - a. Type: Rigid, except where joints are used to correct misalignment, to provide flexibility, and where shown otherwise, in which case provide flexible type.
 - b. Grooved end joints are not allowed for plastic pipes unless approved by the ENGINEER.

4. Soldered Joints (SLD):
 - a. Before soldering, remove stems and washers from solder joint valves.
 - b. Use only solder specified for particular service.
 - c. Cut pipe ends square and remove fins and burrs.
 - d. Protect adjacent surfaces from damage during soldering.
 - 1) Protect from high temperatures due to flame
 - 2) Protect from damage due to dripping flux or solder
 - e. After thoroughly cleaning pipe and fitting of oil and grease using solvent and emery cloth, apply noncorrosive flux to the male end only.
 - f. Solder Joint
 - g. Wipe excess solder from exterior of joint before hardened.
 5. Solvent Welded Joints (SLV):
 - a. Use only solvent cement which is rated for use in the service intended. Check compatibility of solvent cement with service, especially in pipelines which carry chemicals.
 - b. Observe all manufacturer's requirements for environmental conditions for use of solvent cement.
 - c. Cut pipe ends square and remove fins and burrs.
 - d. Apply appropriate primer.
 - e. Apply solvent cement and assemble joint.
 - 1) Hold in place long enough for solvent cement to set-up and hold joint, as assembled, until solvent cement has cured.
 - f. Wipe excess solvent cement from exterior of joint before hardened.
 6. Proprietary Restrained Mechanical Joints (PRJ):
 - a. PRJ piping shall be furnished with factory-fabricated retainer weldment on spigot end.
 - b. If PRJ piping is field cut, the pipe joint shall be restrained using Restrained Mechanical Joint (RMJ) Glands. Field welding of retainer weldment will not be allowed.
 7. Insulating Flanges, Couplings, and Dielectric Unions:
 - a. Applications: Provide insulating flange, coupling or di-electric union for all joints at the following locations:
 - 1) Dissimilar metal piping connections.
 - 2) Cathodically protected piping penetration to buildings.
 - 3) Submerged to unsubmerged metallic piping connections.
 - 4) Where required for electrically insulated connection.
 - b. Installation:
 - 1) Insulating joints connecting immersed piping to non-immersed piping shall be installed above maximum water surface elevation.
 - 2) Align and install insulating joints according to manufacturer's recommendations to avoid damaging insulating materials.
- C. Exposed Piping Installation:
1. Piping Runs:
 - a. Parallel to building or column lines and perpendicular to floor, unless shown otherwise.
 - b. Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.
 2. Supports: As specified in Piping Support Systems section of these specifications.

3. Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other work.
4. Provide unions or flanges at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.
5. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection;
6. Install piping to allow for contraction and expansion without stressing pipe, joints, or connected equipment.
7. Piping clearance, unless otherwise shown:
 - a. Over Walkway and Stairs: Minimum of 7 feet 6 inches, measured from walking surface or stair tread to lowest extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
 - b. Between Equipment or Equipment Piping and Adjacent Piping: Minimum 3 feet 0 inch, measured from equipment extremity and extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
 - c. From Adjacent Work: Minimum 1 inch from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
 - d. Do not route piping in front of or to interfere with access ways, ladders, stairs, platforms, walkways, openings, doors, or windows.
 - e. Headroom in front of openings, doors, and windows shall not be less than the top of the opening.
 - f. Do not install piping containing liquids or liquid vapors in transformer vaults or electrical equipment rooms.
 - g. Do not route piping over, around, in front of, in back of, or below electrical equipment including controls, panels, switches, terminals, boxes, or other similar electrical work.

D. Buried Pipe Installation:

1. Pipe Placement:
 - a. Keep trench dry until pipe laying and joining are completed.
 - b. Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.
 - c. Prevent foreign material from entering pipe during placement.
 - 1) Close and block open end of last laid pipe section when placement operations are not in progress and at close of day's work.
 - d. Lay pipe upgrade with bell ends pointing in direction of laying.
 - e. Deflect pipe at joints for pipelines laid on a curve using unsymmetrical closure of spigot into bell. Utilize a maximum of 75 percent of manufacturer's recommended allowable joint deflection.
 - 1) If joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment, provide:
 - a) Shorter pipe lengths.
 - b) Fittings/bends.
 - f. Secure pipe which has been placed from movement or damage while placing the next section of pipe.
 - g. Prevent uplift and floating of pipe prior to backfilling.

E. Cleaning:

40 05 10-4
Pipe and Fittings

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Following assembly and testing, and prior to disinfection and final acceptance, flush pipelines with water at 2.5 fps minimum flushing velocity until foreign matter is removed. At a minimum, flush for a period of time which will flush the entire pipeline volume three times.
 - a. If impractical to flush large diameter pipe at 2.5 fps, clean in-place from inside by brushing and sweeping, then flush line at lower velocity. If lower velocity is used, flush the entire pipeline volume five times.
2. Provide temporary means of removing flushing water from pipeline during flushing.
3. Provide means for removal/screening of debris from the flushing water, disposal of debris and disposal of flushing water.

3.4 TESTING

- A. Pressure test piping in accordance with the Pipe Schedule, Testing of Pressure Piping Systems section of these specifications.

3.5 SUPPLEMENTS

- A. The following supplements are attached to this Specification section and incorporated herein by reference:
 1. 40 05 19 – Piping System Data Sheet - Ductile Iron Process Pipe (DIP)
 2. 40 05 24.02 – Piping System Data Sheet - Galvanized Steel Pipe (GSP)
 3. 40 05 24.03 – Piping System Data Sheet - Welded Steel Pipe (WSP)
 4. 40 05 31.01 – Piping System Data Sheet - Solvent Welded PVC Pipe (PVC1)
 5. 40 05 33.01 – Piping System Data Sheet - HDPE Drainage Pipe (HDPE1)

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40 05 10-6
Pipe and Fittings

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 40 05 10.01

PIPE SCHEDULE

1.1 DESCRIPTION

A. General:

1. This schedule is provided for the convenience of the CONTRACTOR. Some flow streams may be shown on the drawings, but not listed here.

B. Flow Stream IDs:

1. BRW – Backwash Residual Water
2. D – Drain
3. OF – Overflow
4. 2W – Utility Water (non-potable)

C. Pipe Materials:

1. Ductile Iron Process Pipe (DIP)
2. Galvanized Steel Pipe (GSP)
3. Welded Steel Pipe (WSP)
4. HDPE Drainage Pipe (HDPE1)
5. Solvent Welded Polyvinyl Chloride Pipe (PVC1)

D. Joint Types:

1. FLG – Flanged
2. GRV – Grooved End
3. PO – Push On
4. RMJ – Restrained Mechanical Joint
5. THR – Threaded
6. WLD – Butt Welded

E. Lining Systems:

1. CE – Ceramic Epoxy
2. CM – Cement Mortar
3. FE – Fusion Bonded Epoxy

F. Coating Systems:

1. System numbers as described in Section 09 91 03, Painting.
2. CM – Cement Mortar
3. FBE – Fusion Epoxy

40 05 10.01-1
Pipe Schedule

1.2 PIPE SCHEDULE

Contractor shall install piping systems in accordance with the following pipe schedule:

SERVICE	DESCRIPTION	EXPOSURE	SIZE RANGE	MATERIAL	JOINT TYPE	TEST PRESSURE	LINING	COATING SYSTEM/ COLOR	NOTES
BRW	Backwash Residual Water	Buried	All	DIP	RMJ	50 psi	CM	Asphaltic	
		Exposed	All	DIP	FLG, GRV	50 psi	CM	No. 300/Grey	
D	Drain	Buried	4"	HDPE1	PO	None	None	None	
		All	> 4"	DIP	FLG, RMJ	50 psi	CM	No. 300/Grey	1
OF	Overflow	Exposed	All	WSP	FLG	None	CM	No. 300/Grey	
		Immersed	All	WSP	FLG, WLD	None	CM	No. 302/Grey	
2W	Utility Water (non-potable)	Exposed	2"	GSP	THR	100 psi	None	None	2, 3
		Buried	2"	PVC1	SLV	100 psi	None	None	

1. 6" D piping between new retaining wall and Tank 2 shall be DIP.
2. Where GSP is installed below grade, wrap fully with pipe tape to protect from contact with soil.
3. Provide INS-02 for exposed piping

++ END OF SECTION ++

40 05 10.01-2
Pipe Schedule

Washwater Equalizer Tank Replacement Project

SECTION 40 05 19

PIPING SYSTEM DATA SHEET – DUCTILE IRON PIPE (DIP)

ITEM	DESCRIPTION
Pipe	Buried Piping: Pressure class as indicated in the pipe schedule. If not indicated: - All pipe 12" diameter and smaller shall be pressure class 350. - All pipe 14" through 20" shall be pressure class 250. - All pipe larger than 20" shall be pressure class 200. Flanged Piping: Special Thickness Class 53 Pressure class shall be per AWWA C150/A21.50 and AWWA C151/A21.51 All buried pipes designed to carry recycled water shall be distinctively wrapped in purple tape.
Lining	Cement-Mortar: AWWA C104/A21.4, standard (single) thickness.
Coating	Unless otherwise specified in the Pipe Schedule, piping shall be coated as follows: Buried Piping: - AWWA C151/A21.51: Minimum 1-mil asphaltic coating. - AWWA C105/A21.5: Polyethylene encasement, 4-mil high-density cross laminated or 8-mil linear-low density, color as required by local/state regulations. Exposed/Immersed Piping: - Primer Coating: Where shop primer is applied to protect pipe during shipping, storage and handling, primer shall be compatible with pipe coating requirements of Section 09 91 03, Painting.
Fittings	Lined and coated same as pipe. Push-On (PO): AWWA C110/A21.10 (3"-48", 250 psi min working pressure) or C153/A21.53 (54"-64", 150 psi working pressure) ductile iron. American Cast Iron Pipe Co., Fastite Joint; U.S. Pipe and Foundry, Tyton Joint. Mechanical Joint (MJ): AWWA C153/A21.53 ductile iron, 250 psi minimum working pressure 3"- 48", 150 psi working pressure over 48". Follower glands shall be ductile iron. Restrained Mechanical Joint (RMJ): Standard MJ Fittings with RMJ Gland conforming to requirements of Section 40 05 06, Piping Specialties. Grooved End (GRV): AWWA C606 with C110/A21.10 center-to-end dimensions and wall thickness, ductile iron, 250 psi minimum working pressure. Victaulic. Flange (FLG): AWWA C110/A21.10 (3"-48", 250 psi min working

40 05 19-1

Piping System Data Sheet – Ductile Iron Pipe (DIP)

Washwater Equalizer Tank Replacement Project

ITEM	DESCRIPTION
	pressure) or C153/A21.53 (54"-64", 150 psi working pressure) ductile iron, faced and drilled, 125-pound flat face. Gray cast iron will not be allowed.
Joints	Push-On (PO): 250 psi minimum working pressure, AWWA C110/A21.10, C111/A21.11, C153/A21.53. American Cast Iron Pipe Co., Fastite Joint; U.S. Pipe and Foundry, Tyton Joint. Mechanical Joint (MJ): 250 psi minimum working pressure. Proprietary Restrained (PRJ): 150 psi minimum working pressure. Clow Corp., Super-Lock; American Cast Iron Pipe Co., Flex-Ring or Lok-Ring; U.S. Pipe, TR Flex. Grooved End (GRV): Rigid type radius cut conforming to AWWA C606, 250 psi minimum working pressure. Victaulic. Flange (FLG): 125-pound flat face, ductile iron, threaded conforming to AWWA C115/A21.15. Gray cast iron will not be allowed. Branch connections 3 inches and smaller, shall be made with service saddles as specified in Section 40 05 06, Piping Specialties.
Bolting	T-Bolts and other specialty bolts: Manufacturer's standard. Hex Bolts: ASTM A307, Grade B carbon steel hex head bolts Nuts: ASTM A563, Grade A carbon steel hex head nuts.
Gaskets	Push-On, Mechanical, and Proprietary Restrained Joints: Red Rubber (SBR) conforming to ANSI/AWWA C111/A21.11. Grooved End Joints: Halogenated butyl conforming to ASTM D2000 and AWWA C606. Flanged, Water and Sewage Service: 1/8 inch-thick, red rubber (SBR), hardness 80 (Shore A), rated to 200 degrees F, conforming to ANSI B16.21, AWWA C207, and ASTM D1330, Grades 1 and 2. Full face for 125-pound flat-faced flanges, flat-ring type for 250-pound raised-face flanges. Blind flanges shall be gasketed covering the entire inside face with the gasket cemented to the blind flange. Gasket pressure rating to equal or exceed the system hydrostatic test pressure.
Joint Lubricant	Manufacturer's standard.

++ END OF SECTION ++

40 05 19-2

Piping System Data Sheet – Ductile Iron Pipe (DIP)

Washwater Equalizer Tank Replacement Project

SECTION 40 05 24.02**PIPING SYSTEM DATA SHEET – GALVANIZED STEEL PIPE (GSP)**

ITEM	SIZE	DESCRIPTION
Pipe	2 inch & smaller 2-1/2 thru 6 inch 8 thru 12 inch 14 inch	Galvanized carbon steel, ASTM A106, Grade B seamless or ASTM A53 Rev A, Grade B seamless or ERW. Schedule 80. Schedule 40. Schedule 30. Standard weight.
Joints	3 inch & smaller 4 inch & larger	Threaded or flanged at valves and equipment, or grooved end meeting the requirements of AWWA C606. Flanged at valves and equipment, or grooved end meeting the requirements of AWWA C606.
Fittings		Threaded: 150- or 300-pound malleable iron, ASTM A197 or ASTM A47, dimensions in accordance with ANSI B16.3. Grooved End: Malleable iron ASTM A47 or ductile iron ASTM A536, 250 psi working pressure, grooved ends to accept couplings without field preparation. Victaulic or equal.
Branch Connections	2 inch & smaller 2-1/2 inch & larger	Tee or reducing tee in conformance with Fittings, above, galvanized 2,000-pound WOG threadolet or welding boss; galvanize after welding. Branch Same Size as Run: Grooved end tee in accordance with Fittings, above. Branch One or More Sizes Smaller Than Run: Grooved end reducing tee in accordance with Fittings, above.
Flanges		Galvanized forged carbon steel, ASTM A105/A105M, ANSI B16.5 Class 150 or Class 300, threaded, 1/16-inch raised face. Grooved end adapter flange, malleable iron ASTM A47 or ductile iron ASTM A536. Victaulic or equal.
Unions		Threaded malleable iron, ASTM A197 or A47, 300-pound WOG, brass to iron seat, meeting the requirements of ANSI B16.3.
Couplings		Grooved End: Rigid joint malleable iron, ASTM A47 or ductile iron, ASTM A536, 250 psi working pressure. Victaulic or equal.
Plugs		Forged carbon steel, ASTM A181/A181M Rev A, Grade II, round head, threaded, galvanized.
Bolting		Grooved End Couplings: Carbon steel, ASTM A183

40 05 24.02-1

Piping System Data Sheet – Galvanized Steel Pipe (GSP)

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098March 2024
Bid Documents

ITEM	SIZE	DESCRIPTION
		bolts and nuts, 110,000 psi minimum tensile strength. Flanges: Carbon steel ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts.
Gaskets	All Flanges Grooved end Couplings	Flanged, Water and Sewage Service: 1/8-inch thick, red rubber (SBR), hardness 80 (Shore A), rated to 200 degrees F., conforming to ANSI B16.21, AWWA C207, and ASTM D1330, Grades 1 and 2. Blind flanges shall be gasketed covering the entire inside face with the gasket cemented to the blind flange. EPDM or chlorinated butyl per ASTM D2000 for water and air to 230 degrees F, dimensions conforming to AWWA C606.
Thread Lubricant	2 inch & smaller	Teflon tape or joint compound that is insoluble in water.

++ END OF SECTION ++

40 05 24.02-2

Piping System Data Sheet – Galvanized Steel Pipe (GSP)

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098March 2024
Bid Documents

SECTION 40 05 24.03**PIPING SYSTEM DATA SHEET – WELDED STEEL PIPE (WSP)**

ITEM	DESCRIPTION
Pipe	Carbon steel ASTM A283/A283M Rev A Grade C or ASTM A285/A285M Grade C, sheet or coil, fabricated in accordance with AWWA C200, straight or spiral seam, thickness designed for 66 percent of minimum yield stress at hydrostatic test pressure, minimum thickness 1/4-inch, sizes are to be nominal outside diameters conforming to ASME B36.10M.
Linings/Coatings	Lining: Cement-Mortar: AWWA C205. Coating: Per Section 40 05 10.01, Pipe Schedule and Section 09 91 03, Painting Factory Applied Lining and Coating: When noted in Pipe Schedule, Fusion Bonded Epoxy per AWWA C-213, 16 mil thickness. 3M Scotchkote 206N, or equal.
Joints	Full penetration butt-welded, flanged, rolled grooved end where shown and/or required.
Joint Restraint Harnesses	AWWA M11 steel harness restraint ring welded to pipe to allow tie rods to span across unrestrained piping components. ASTM A36 or A283 Grade C steel. 3/16 inch (on diameter) clearance between the specified pipe O.D. up through 24 inch piping, and 1/4 inch clearance for pipes larger than 24 inches. Field coat with pipe after installation.
Fittings	All fittings 6" and smaller shall be forged. Buried fittings 8" to 24" may be fabricated or forged. Buried fittings larger than 24" shall be fabricated. Exposed fittings 24" and smaller shall be forged. Exposed fittings 30" to 48" may be fabricated or forged. All fittings larger than 48" shall be fabricated. Fabricated: Carbon steel fabricated from pipe in accordance with AWWA C208; elbows to have a 22.5-degree maximum miter section angle and a radius of 2.5 times the diameter, unless shown otherwise; wyes, tees, crosses, and outlets to be reinforced in accordance with AWWA M-11. Fitting wall thickness shall be equal to or greater than adjoining pipe. Forged: Butt-welding fittings, ASTM A234/A234M, Grade WPB meeting the requirements of ANSI B16.9. Fitting wall thickness to match adjoining pipe. Elbows to be short radius unless noted otherwise on Drawings

40 05 24.03-1

Piping System Data Sheet – Welded Steel Pipe (WSP)

Washwater Equalizer Tank Replacement Project

ITEM	DESCRIPTION
Flanges	Flat-faced, pressure class to exceed test pressure. Raised-face flanges only allowed when mating to equipment with raised-face flanges. Raised-face flanges are not allowed to mate with flat-faced flanges. AWWA C207 ring or hub, Class D minimum. Or ANSI B16.5 slip-on or weld neck, Class 150 minimum.
Bolting	Carbon steel ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts. Bolts for rolled grooved ends shall be manufacturer's standard.
Gaskets	Corrosive acid and alkali free non-metallic conforming to AWWA C207 and ASME B16.21, as follows: • Class D (to 175 psi), 4"-24": Rubber, Full Faced, 1/8" thick • Class D (to 175 psi), 26"-144": Rubber, Ring, 1/8" thick • Class E (to 175 psi), 4"-24": Rubber, Ring, 1/16" thick • Class E (to 275 psi), 4"-24": Nonasbestos, Ring, 1/16" thick • Class E (to 275 psi), 26"-144": Nonasbestos, Ring, 1/8" thick • Class F (to 300 psi), 4"-24": Nonasbestos, Ring, 1/16" thick • Class F (to 300 psi), 26"-48": Nonasbestos, Ring, 1/8" thick Provide full-face gaskets for flat-face flanges; flat ring gaskets for raised-face flanges. Gaskets for rolled grooved ends shall be as recommended by manufacturer for sewage service.

++ END OF SECTION ++

SECTION 40 05 31.01**PIPING SYSTEM DATA SHEET – SOLVENT WELDED POLYVINYL CHLORIDE PIPE (PVC1)**

ITEM	DESCRIPTION
Pipe	Schedule 80 Polyvinyl Chloride (PVC), unless indicated otherwise. Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Pipe shall be manufactured with 1% titanium dioxide for ultraviolet protection.
Fittings	Schedule to match pipe above, ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type. Fittings shall be manufactured with 1% titanium dioxide for ultraviolet protection.
Joints	Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.
Flanges	One piece, molded hub type PVC flat face flange in accordance with Fittings above, 125-pound ANSI B16.1 drilling
Bolting	Hex Bolts: ASTM A193 B8, Type 304 stainless steel Nuts: ASTM A194 Grade 8, Type 304 stainless steel
Gaskets	Flat-Face Mating Flange: Full-faced 1/8-inch thick EPDM rubber.
Solvent Cement	As recommended by the pipe and fitting manufacturer conforming to ASTM D2564, except solvent weld cement for PVC pipe joints in sodium hypochlorite service shall be free of silica filler and shall be certified by the manufacturer to be suitable for that service. Certification shall be submitted.
Thread Sealant	Teflon Tape.

++ END OF SECTION ++

40 05 31.01-1

Piping System Data Sheet – Solvent Welded PVC Pipe (PVC1)

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098March 2024
Bid Documents

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Piping System Data Sheet – Solvent Welded PVC Pipe (PVC1)

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 40 05 33.01**PIPING SYSTEM DATA SHEET – HIGH DENSITY POLYETHYLENE DRAINAGE PIPE (HDPE1)**

ITEM	DESCRIPTION
Pipe	High Density Polyethylene Pipe, smooth inside, corrugated outside intended for storm drainage application. Meeting the requirements of AASHTO M-252/M-294, Type S. Meets H-20 loading requirements with 1-foot of soil cover. Provide solid pipe unless specifically called out "slotted" in the Pipe Schedule. ADS N-12 WT IB or equal. Slotted pipe to conform to AASHTO Class II standards.
Fittings	Use PVC thermo-molded sanitary fittings which are constructed to specifically work with the HDPE pipe system. Lab test certified to 10.8 psi, minimum, meeting the requirements of ASTM D3212. Elbows shall be radiused, not segmented/beveled. Do not use fabricated HDPE fittings. ADS Series 35 or equal.
Joints	Water-tight joints, integral bell/spigot ends with an integral reinforcing collar on the bell. Provide gasket on the spigot end. Lab test certified to 10.8 psi, minimum, meeting the requirements of ASTM D3212. Provide transition couplings and adapters as required to couple with other piping systems.
Couplings	HDPE bell x bell couplers. Water tight. Same manufacturer as pipe.
Gaskets	Rubber gasket meeting the requirements of ASTM F-477

++ END OF SECTION ++

40 05 33.01-1

Piping System Data Sheet – HDPE Drainage Pipe (HDPE1)

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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40 05 33.01-2

Piping System Data Sheet – HDPE Drainage Pipe (HDPE1)

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 40 05 51

VALVES

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Product data sheets for make and model.
 - 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 - 3. Certificate of Compliance for: Butterfly valves; full compliance with AWWA C504.
- B. Tests and inspection data.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. In accordance with manufacturer's directions.

1.3 TRADE NAME ABBREVIATIONS

- A. FKM: Fluorocarbon (FPM or Viton®)
- B. PTFE: Polytetrafluoroethylene (Teflon®)

PART 2 - PRODUCTS

2.1 GENERAL

- A. All valves shall be the same size as the pipe in which they are installed, unless specifically noted otherwise on the Drawings.
- B. All valves shall include all appurtenant parts (operators, chainwheels, handwheels, valve stems, floor stands, gear boxes, operating nut, etc.) for a complete operating valve.
 - 1. Valve shall be, as much as practical, fully factory assembled.
- C. All valves shall open by turning counter-clockwise. Maximum force required for operation shall be 80 lbs.
- D. Where Lead-Free Bronze or Brass is specified, materials shall be in compliance with California Health & Safety Code Section 116875. Not more than a weighted average of 0.25 percent of the wetted surface of the valve shall be lead. Valve shall be provided with a "hang tag" or other marking that easily identifies the valve as Lead-Free.
- E. Coatings and Linings:
 - 1. Provide factory-applied coatings as described herein.
 - 2. Where liquid epoxy coatings are specified, coatings shall conform to AWWA C550.

40 05 51-1
Valves

3. Field coat the exterior of all valve bodies with the same coating as is required for the adjacent pipe unless otherwise specified.
- F. Nuts, Bolts and Washers
1. Hex Bolts: ASTM A320/A320M, Type 304 stainless steel, Grade B8, Class 2
 2. Nuts: ASTM F594, Type 304 stainless steel, Grade B8, Class 2
 3. Washers: Type 304 stainless steel

2.2 BALL VALVES

- A. **BAV-01:** Bronze Ball Valve (3" and Smaller)
1. Where BAV-01 is called out on the drawings and the service is potable water (at any point in the treatment process) then the valve shall be lead-free as specified in BAV-02.
 2. Service: Water, air
 3. Features:
 - a. Two-piece end entry type
 - b. Bronze body and end piece
 - c. Hard chrome-plated bronze or brass ball
 - d. RTFE seats and packing
 - e. Blowout-proof stem
 - f. Zinc-coated steel hand lever operator with vinyl grip
 - g. Rated 600-pound WOG, 150-pound SWP.
 4. Manufacturers and Products:
 - a. Threaded:
 - 1) Milwaukee; BA100
 - 2) Nibco; T-585-70
 - 3) Or Equal
 - b. Soldered:
 - 1) Milwaukee; BA150
 - 2) Nibco; S-585-70
 - 3) Or Equal

2.3 BUTTERFLY VALVES

- A. **BFV-01:** AWWA Butterfly Valve (3" through 144")
1. Service: Water
 2. Features:
 - a. Flanged or mechanical joint end, short body type
 - 1) End type as shown on the Drawings
 - b. AWWA C504, Class 150B or 250B, as required by test pressure in Pipe Schedule
 - c. Features:
 - 1) Body:
 - a) Cast iron
 - 2) Disc:
 - a) Cast or ductile iron disc
 - b) On valves 24-inch and larger, provide non-hollow discs
 - 3) Shaft:
 - a) Type 304 stainless steel shaft
 - b) Self-adjusting V-type or O-ring shaft seals

- 4) Seat:
 - a) Valves 3- to 20- inch:
 - 1. Buna-N or NBR rubber seat bonded or molded in body only
 - 2. Elastomer seats which are bonded or vulcanized to the body shall have adhesive integrity of bond between seat and body assured by testing, with minimum 75-pound pull in accordance with ASTM D429, Method B
 - b) Valves 24-inch and larger:
 - 1. Buna-N or NBR rubber seat retained within a dovetail groove in the valve body and mechanically locked in place by use of an epoxy filler
 - 2. Valve to be adjustable from either side
 - 3. Valves using seat fasteners or retaining rings are not allowed.
 - c) Provide stainless steel seating surface
 - 5) Coatings and Linings:
 - a) Liquid epoxy, 12 mil minimum, for valve interior and exterior
 - b) For potable water applications, epoxy lining shall be NSF 61 approved
 - d. Valve shall be suitable for throttling operations and infrequent operation after periods of inactivity.
 - e. Valve shall be bubble-tight with rated pressure applied from either side.
 - f. Smooth flow stream on valve body interior
 - 1) No travel stops for disc on interior of body
 - 2) Isolate metal-to-metal thrust bearing surfaces from flow stream.
 - 3. Manufacturers and Products:
 - a. DeZurik Water Controls; Model BAW
 - b. Henry Pratt Company:
 - 1) 3" through 20"; Model 2FII
 - 2) 24" through 144"; Model Triton XR-70
 - c. Or Equal
- B. **BFV-04:** Resilient Seated Butterfly Valve (2" through 24")
- 1. Service:
 - a. Potable Water, Recycled Water, HVAC
 - 2. Features:
 - a. General purpose resilient seated butterfly valve.
 - b. Temperature Rating: -20 to 400 degrees F.
 - c. Pressure Rating:
 - 1) 2" to 12": 175 psi.
 - 2) 14" to 24": 150 psi.
 - d. Shutoff pressure rating: Bidirectional bubble-tight.
 - e. Full lug style, designed to fit between ANSI Class 150, suitable for dead-end service in either direction, unless noted as wafer on Drawings or in Valve Schedule.
 - f. Flange Drilling (Lugged Style only): ASME B16.5 Class 150.
 - g. Valve seat shall be retained in the valve body and replaceable without removing disc or stem.
 - h. Materials:
 - 1) Body: Cast iron, ductile iron or carbon steel.
 - 2) Disc: Nylon 11 coated ductile iron
 - 3) Shaft/Stem: Stainless steel or Monel K500.
 - 4) Seat: Buna-N

- i. Coatings and Linings:
 - 1) Liquid epoxy, 12 mil minimum, for valve interior and exterior.
- 3. Manufacturers and Products:
 - a. Bray: Series 30/31
 - b. Or Equal

2.4 GATE VALVES

- A. **GAV-01:** Gate Valve (3" and Smaller)
 - 1. Where GAV-01 is called out on the drawings and the service is potable water (at any point in the treatment process) then the valve shall be lead-free as specified in GAV-02
 - 2. Service: Water
 - 3. Features:
 - a. All-bronze
 - b. Screwed bonnet
 - c. Single solid wedge gate
 - d. Non-rising stem
 - e. Rated 125-pound SWP, 200-pound WOG
 - 4. Manufacturers and Products:
 - a. Threaded:
 - 1) Stockham; B103, threaded end
 - 2) Crane; 438, threaded end
 - 3) Or Equal
 - b. Soldered:
 - 1) Stockham; B104, soldered end
 - 2) Crane; 1324, soldered end
 - 3) Or Equal

2.5 HOSE VALVES

- A. **HSV-01:** Angle-Pattern Hose Valve (3/4")
 - 1. Service: Water
 - 2. Features:
 - a. 3/4-inch NPT female inlet
 - b. 3/4-inch NPSH male bent nose outlet
 - c. Heavy rough brass body rated 125 psi
 - d. Lead-Free Brass & Bronze Materials in compliance with California Health & Safety Code Section 116875. Not more than a weighted average of 0.25 percent of the wetted surface of the valve shall be lead. Valve shall be provided with a "hang tag" or other marking that easily identifies the valve as Lead-Free.
 - e. Lockshield bonnet and removable handle
 - f. Replaceable cartridge containing all wearing parts, including seat
 - g. Atmospheric vacuum breaker conforming to ASSE Standard 1011 and IAPMO code
 - 3. Manufacturers and Products:
 - a. Acorn; Model 8126-LF
 - b. Or Equal

2.6 MISCELLANEOUS VALVES

A. **MDV-01:** Mud Valve (4" through 24")

1. Service: Water
2. Features:
 - a. Cast iron body with bronze stem, stem nut, disc ring and seat ring
 - b. Stainless steel bolts and nuts
 - c. Flanged end for mounting on a flat surface.
 - d. Non-rising stem ending in 2-inch square operating nut. Length as indicated on Drawings.
 - e. Provide adjustable stem guides as required for the installation in accordance with Manufacturer's recommendations.
3. Manufacturers and Products:
 - a. Clow, Model F-3075
 - b. M&H Style 140
 - c. Waterman Industries, Model MV-11
 - d. Or Equal

2.7 OPERATORS

A. General:

1. Operator force not to exceed 40 pounds under any operating condition, including initial breakaway. Gear reduction operator when force exceeds 40 pounds.
2. Operator self-locking type or equipped with self-locking device.
3. Provide position indicator on all valves.
4. Worm and gear operators one-piece design worm-gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operators threaded steel reach rods with internally threaded bronze or ductile iron nut.
5. Valve handles, wheels, etc. to be designed to accommodate a padlock.

B. Manual Operator:

1. Galvanized and painted handwheels.
2. Lever operators allowed on quarter-turn valves 8 inches and smaller.
3. Cranks on gear type operators.
4. For all valves above 5'-0" above adjacent working surface (finished floor or finished grade), provide chain wheel operator with tiebacks
5. For all exposed valves below adjacent working surface (finished floor or walkway), provide extension stem, floor stands, and other accessories to permit operation from 2'-6" above adjacent working surface.
6. For all buried valves 3" and larger, provide stem extension, valve bonnet, valve box and 2" AWWA operating nut such that operating nut is within 12" of adjacent finished grade.
 - a. For small-diameter buried valves, provide cross-shaped handle for operating with forked key.

PART 3 - EXECUTION

3.1 VALVE SCHEDULE

- A. A Valve Schedule has been attached to this Specification and is incorporated herein by reference. Provide valves in accordance with Valve Schedule.
- B. For valves that are not referenced in Valve Schedule, provide the valve type called for on the Drawings.

3.2 PREPARATION

- A. Cleaning:
 - 1. Clean all mating faces of valve (threads, flange faces, etc.) prior to assembly.
 - 2. Remove all debris from valve body prior to assembly.
 - 3. Take extra care to clean mating faces of existing pipe and fittings which may have corrosion, dirt, debris and mineral build-up which should be removed for a proper fit.
- B. Apply joint compound, lubricant, etc. as recommended by valve manufacturer for proper installation prior to installation.
- C. Install valves in accordance with the following schedule and as noted on the Drawings:

3.3 INSTALLATION

- A. Install valves per manufacturer's recommendations.
- B. Install valves so handles operate from fully open to fully closed without encountering obstructions.
- C. Install valves in location and orientation for easy access for routine operation and maintenance. Access should be such that an operator can operate the valve by reaching a handle, chain, etc. at a height between 2'-6" and 5'-0" above adjacent work surface (for buried valves, this is accomplished with a t-handle wrench and the operating nut being within 12" of finished grade).
- D. Install plug valves with the seat side as indicated on the Drawings. If manufacturer's recommendations differ from indicated seat direction on the drawings, or if no seat side is indicated, install plug valves with seat side as recommended by the manufacturer after obtaining approval from the ENGINEER.

3.4 TESTS AND INSPECTION

- A. Valve may be either tested while testing pipelines, or as a separate step.
- B. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.

- C. Inspect air release and vacuum valves as pipe is being filled to verify venting and seating is fully functional.
- D. Count and record number of turns to open and close valve; account for any discrepancies with manufacturer's data.
- E. Set, verify, and record set pressures for all relief and regulating valves.

3.5 SUPPLEMENTS

- A. The following supplements are attached to this Specification section and incorporated herein by reference:
 - 1. 40 05 51.13, Valve Schedule

++ END OF SECTION ++

40 05 51-7
Valves

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40 05 51-8
Valves

Washwater Equalizer Tank Replacement Project
Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 40 05 51.13**VALVE SCHEDULE****1.1 DESCRIPTION**

- A. General:
1. This schedule is provided for the convenience of the CONTRACTOR. Some valves may be shown on the drawings, but not listed here.
 2. Valve specifications are given in Section 40 05 51, Valves.
- B. Valve Tag Number:
1. Tag numbers are as noted in the Drawings.
- C. Valve Type:
1. Valve types are as described in Section 40 05 51, Valves.
 2. Valve Ends:
 - a. FLG – Flanged
 - b. THD – Threaded
 - c. LUG – Lugged
- D. Installation Codes
1. EX – Exposed
- E. Valve Actuators, as described in Section 40 05 51, Valves.
1. HW – Handwheel
 2. N – 2" Nut

1.2 VALVE SCHEDULE

VALVE TAG NUMBER	VALVE TYPE	ENDS	DIAMETER	INSTALLATION	ACTUATOR
V-1002	BFV-04	LUG	6"	EX	HW
V-2002	BFV-04	LUG	6"	EX	HW
V-3201	MDV-01	FLG	10"	EX	N
V-3202	MDV-01	FLG	10"	EX	N
V-3204	BFV-01	FLG	6"	EX	N
V-500	GAV-01	THD	2"	EX	HW

++ END OF SECTION ++

 40 05 51.13-1
 Valve Schedule

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40 05 51.13-2
Valve Schedule

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 40 05 58

FABRICATED SLIDE GATES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: This Section describes the design, fabrication, and supply of fabricated stainless steel slide gates, including wall thimbles (if applicable), pipe adapters (if applicable), discs, guide frames, stem guides, seats, operating stem, operator, and anchorage. Gate supplier shall provide all materials, equipment, and accessories necessary to furnish and install slide gates as described herein and as shown on Drawings.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with requirements and recommendations of the following references, except as otherwise specified:
1. AWWA C561-12, Fabricated Stainless Steel Slide Gates
 2. NSF/ANSI 61, Drinking Water System Components Health Effects
 3. ASTM A 276, Specification for Stainless Steel Bars and Shapes
 4. American Gear Manufacturers Association (AGMA)
 5. Anti-Friction Bearing Manufacturers Association (ABMA)
- B. Manufacturer's Qualifications: Gate manufacturer shall have a minimum of five years of experience of producing substantially similar equipment and shall be able to show evidence of at least ten installations in satisfactory operation for at least five years.
- C. Unit Responsibility: All equipment specified herein shall be coordinated and provided by a single gate manufacturer. Manufacturer assumes full responsibility for coordination of all components.
- D. Source Quality Control:
1. Shop Tests:
 - a. Test each slide gate fully assembled for proper seating, operation, and for leakage.
 - b. Fully open and close gate disc in its guide system to ensure that it operates freely.
- E. Warranty: Provide a 1-year warranty on all equipment from date of start-up. Warranty shall cover defects in workmanship, design, and materials. If any component should fail during the warranty period, it shall be corrected and the unit restored to service at no expense to the OWNER.

1.3 SUBMITTALS

- A. Shop Drawings:

40 05 58-1
Fabricated Slide Gate

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Detailed drawings showing component and assembly dimensions, location of mechanical connections, weights of all equipment, installation details, and accessory details.
2. Drawings, templates and directions for installation of anchor bolts and stem couplings.
3. Certificate of Compliance that all material utilized comply with NSF/ANSI 61 Standards.

B. Product Data:

1. Descriptive literature, specifications, and engineering data.
2. Materials of construction for all components and accessories.
3. Force calculations for gate operator and stem, including seismic loading calculations.
4. Shipping, storage, protection and handling instructions.
5. Installation directions.
6. Operation and Maintenance Manual.

C. Shop Test Results:

1. Submit results of the required shop tests.

D. Field Test Results:

1. Submit a written report giving the results of the field tests required.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Gate manufacturer shall provide any special unloading, storage and handling instructions.

PART 2 - PRODUCTS

2.1 PRODUCT AND MANUFACTURER:

- A. Rodney Hunt
- B. Golden Harvest
- C. Fontaine-Aquanox
- D. Whipps, Inc.
- E. Or equal

2.2 GOVERNING STANDARD

- A. Except as modified or supplemented herein, fabricated slide gates and their appurtenances shall conform to the applicable requirements of AWWA C561.

40 05 58-2
Fabricated Slide Gate

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2.3 SERVICE CONDITIONS AND PERFORMANCE

A. Gate Schedule:

Tag	SG-100
Location	EQ Tank Dividing Wall
Service	Backwash Residual Water
Operation	Open-Close
Size (W x H)	3'-0" x 4'-0"
Self-Contained	Yes
Seating Head	0'-21.5'
Unseating Head	0'-21.5'
Inv. Elevation	As shown on Drawings
Operating Floor Elevation	As shown on Drawings
Mounting	Wall
Top Seal	Yes
Actuator	Handwheel on Wall Mount Pedestal
Gate Opening Direction	Upwards
Stem Movement	Non-rising
Stem Cover Type	Clear Plastic
Limit Switches	No

B. Performance:

1. Closed leakage shall not exceed 0.05 gallons per minute (GPM) per foot of gate periphery under seating or unseating head conditions.

2.4 COMPONENTS

A. General:

1. Slide gates and all appurtenances shall be provided by one gate manufacturer.
2. All components of the gates shall have a minimum thickness of ¼-inch.
3. Gates shall be either self-contained or non self-contained of the rising stem or non-rising configuration as indicated on the gate schedule.
4. The gates for this Project will be wall mounted over plain-end wall fittings provided by the CONTRACTOR or over openings in concrete walls, as shown on the Drawings. No wall thimbles or pipe adaptors are required.

B. Frame:

1. Frame Material: ASTM A-276 Type 316L SS.
2. Designed for maximum rigidity as column to take the thrust developed during the slide gate operation under maximum head.
3. Bolt-together guide frames are not allowed.
4. Guide frame corners shall be factory welded.
5. The guides shall extend above or beneath the opening a sufficient amount to support the disc in the fully open or closed position.

40 05 58-3
Fabricated Slide Gate

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

6. The frame configuration shall be of the flush-bottom type and shall allow the replacement of the top and side seals without removing the gate frame from the wall.
 7. Provide bolt holes in upper portion of sides of frame for connection to supporting angle.
- C. Disc:
1. Material: ASTM A-240 Type 316L SS.
 2. Disc shall be reinforced as necessary to limit deflection under the design operating head to less than 1/360 of the gate span.
 3. Reinforcing members shall be 316L SS angle or channels welded to the plate.
- D. Guides and Seals:
1. The guides shall be provided with frame mounted ASTM D-4020 ultra high molecular weight polyethylene (UHMWPE) seals that contact both sides of the slide disc and shall be of such length as to retain and support two thirds of the vertical height of the slide in the fully open position.
 2. Side and top seals shall be ASTM D-4020 UHMWPE, and shall be mechanical and fully adjustable in the field, or shall be self-adjusting type with a continuous compression cord.
 3. Lower seals shall be flush bottom resilient neoprene, mounted to the bottom of the disc or to the frame.
- E. Yoke and Pedestal (For Self-Contained Gates):
1. Self-contained gates shall be provided with a yoke to support the operating bench stand. The yoke shall be formed by two structural members welded at the top of the guides to provide a one piece rigid frame. The maximum deflection of the yoke shall be 1/360 of the gate's span.
- F. Pedestal (For Non Self-Contained Gates):
1. Non-self contained gates shall be provided with pedestal mounted lifts. Pedestal shall be cast iron or mild steel and provided with shop coating.
- G. Stem:
1. Material: ASTM A-276 Type 316L SS.
 2. Diameter shall be 1-1/2 inch minimum, and be sized as necessary to withstand two times the compressive force when 40 pounds of force are applied at the operator.
 3. Stem shall be supported such that the L/r ratio for unsupported lengths does not exceed 200.
 4. Threaded portions of the stem shall be full-depth ACME type cold rolled threads with a maximum surface roughness of 0.000016 inches. Machine cut threads will not be accepted.
 5. Join stems of more than one section by stainless steel or silicon bronze couplings threaded and keyed to the stems. All threaded and keyed couplings of the same size shall be interchangeable.
 6. Provide rising stems with an adjustable stop collar on the stem on all gates with manual operators.
 7. Connect the stem to the disc by means of a bolted connection with a minimum of two bolts.
- H. Stem Guides:

40 05 58-4
Fabricated Slide Gate

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Provide Type 316 stainless steel stem guides when necessary to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less per AWWA C561 standards. Maximum stem spacing allowed is 10 feet.
 2. Guides shall consist of collar with UHMWPE bushings, and bracket with slotted holes for adjustment in two directions.
 3. Inside diameter of the collar and bushings shall be slightly larger than the gate stem to prevent binding.
- I. Stem Cover (For Rising Stem Gates):
1. Transparent stem covers, where indicated on Gate Schedule, shall be clear polycarbonate, lexan or butyrate plastic pipe stem cover. Covers shall be furnished with an adaptor for mounting covers to floor stands. Stem covers shall be designed and furnished with gasketing and vents to eliminate water intrusion into operators and condensation within the covers.
 2. Aluminum stem covers shall be slotted with legible engraved markings showing, at a minimum, the gate position at 1/4 open, 1/2 open, 3/4 open and full open.
- J. Manual Actuator:
1. Handwheel Type:
 - a. Direct Drive without reduction gearing
 - 1) Maximum handwheel diameter shall be 30 inches.
 2. Furnish threaded bronze lift nut to engage threaded portion of stem.
 - a. Lift nut shall be flanged and supported on roller bearings.
 - b. Lift nut shall be capable of thrust developed during opening and closing of the gate without damage.
 - c. Provide adjustable bronze stop collar for OPEN and CLOSED position limitation.
 - d. Distance from center of radius of crank arm or center of handwheel to ground shall be less than 48 inches.
- K. Fasteners and Anchor Bolts:
1. All fasteners necessary for installation and operation shall be furnished by the gate manufacturer.
 2. Fasteners shall be Type 316 stainless steel
 3. Fasteners shall be 1/2-inch diameter minimum, and adequately sized to withstand all operational stresses.
 4. Provide Type 316 stainless steel anchor bolts as required for stem guides, floorstands, and all equipment or appurtenances which must be secured to concrete walls or floors. Anchor bolts shall be of ample size and strength for the purpose intended, and shall be furnished by the gate manufacturer. Anchor bolts shall have a minimum diameter of 1/2-inch. Anchor bolts shall conform to the requirements of Specification Section 05 05 06, Anchors, Inserts, and Epoxy Dowels.
- L. Spare Parts: Provide the following spare parts:
1. Bronze lift nuts:
 - a. One for each stem diameter provided
 - b. Provide one additional lift nut for every two electric actuated gates provided
 2. Special tools required for servicing operator
- M. Identification:

40 05 58-5
Fabricated Slide Gate

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Identify each slide gate with gate manufacturer's nameplate stamped with the approved designation as shown in the Gate Schedule. Manufacturer's nameplate shall be permanently fastened to the gate at the factory.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be as shown on the Drawings and in accordance with gate manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

- A. Conduct functional and performance tests under approved simulated operating conditions.
- B. Functional Tests:
 1. Each slide gate with appurtenances shall be field tested. Tests shall demonstrate to ENGINEER that each part and all parts together function in the manner intended. All necessary testing equipment and manpower shall be provided by CONTRACTOR at his expense. OWNER will furnish all power, and incidental material and labor required for the tests.
- C. Leakage Tests:
 1. Maximum permissible leakage shall be in accordance with the requirements of Sub-Section 2.2, above. Excess leakage shall be reduced to meet specified requirements by adjusting the gate, or replacement will be required.
- D. In the event that the gate manufacturer is unable to demonstrate to ENGINEER that his equipment meets the requirements of the tests, the deficient equipment will be rejected, and adjustments and/or modifications shall be made. Retest the equipment as often as necessary to meet the specified requirements. No separate payments shall be made for adjustments and/or modifications.

3.3 MANUFACTURER'S FIELD SERVICES:

1. Minimum 2 trips for Manufacturer's Field Services:
 - a. 1 person-day for installation assistance
 - b. 1 person-day for inspection, testing, alignment, and training

++ END OF SECTION ++

40 05 58-6
Fabricated Slide Gate

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 40 05 91

TESTING OF PRESSURE PIPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide all labor, materials, equipment, and incidentals as shown on the Drawings required to perform the pressure testing of piping systems.

1.2 SUBMITTALS

- A. Testing Plan: Submit prior to testing and include at least the information that follows.
 - a. Testing dates
 - b. Piping systems and section(s) to be tested
 - c. Test type
 - d. Method of isolation
 - e. Calculation of maximum allowable leakage for piping section(s) to be tested
- B. Certifications of Calibration: Testing equipment
- C. Certified Test Report

1.3 REFERENCE

- A. Reference Section 40 05 03.01, Pipe Schedule for test pressure.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 NOTIFICATION

- A. Notify ENGINEER in writing 5 days in advance of testing. Perform testing in presence of ENGINEER.

3.2 PRESSURE TESTING

- A. General:
 - 1. Complete installation of piping system, including all thrust restraint, prior to pressure testing.
 - a. If thrust blocking is specified, wait 5 days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to 2 days.
 - 2. Prior to test, remove and replace with pipe spools or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.

40 05 91-1

Testing of Pressure Piping Systems

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

3. New Piping Connected to Existing Piping: Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to ENGINEER.
 4. Piping to be Pressure Tested and Test Pressure: as indicated on Piping Schedule.
- B. Hydrostatic Testing (Pipe Other than PSDS HDPE2):
1. Testing Fluid: Clean, potable water.
 2. Pipeline Protection:
 - a. Maximum Filling Velocity: 0.25 foot per second, applied over full area of pipe.
 - b. Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.
 3. Exposed Piping:
 - a. Perform testing on insulated piping prior to application of insulation
 - b. Maintain hydrostatic test pressure continuously for 60 minutes, minimum, and for such additional time as necessary to conduct examinations for leakage.
 - c. Examine joints and connections for leakage.
 - 1) Correct visible leakage and retest as specified.
 - 2) Empty pipe of water prior to final cleaning or disinfection.
 4. Buried Piping:
 - a. Test after backfilling has been completed.
 - b. Expel air from piping system during filling.
 - c. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
 - d. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.
 - e. Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.
 - f. Maximum Allowable Leakage:

$$L = \frac{SD(P)^{1/2}}{133,200}$$

where:

- L = Allowable leakage, in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of pipe, in inches.
P = Test pressure during leakage test, in pounds per square inch.
- g. Correct leakage greater than allowable, and retest as specified.

3.3 PIPE PRESSURE TESTING LOG

- A. All pressure tests shall be witnessed by ENGINEER. CONTRACTOR shall keep a pipe pressure testing log to document the pressure testing and ENGINEER's approval of such.
1. Specific details of the contents and format pipe pressure testing log shall be determined by the CONTRACTOR and approved by the ENGINEER.
 2. At a minimum, pipe pressure testing log shall record, on a daily basis for any day when pipe pressure testing is performed:
 - a. Test Report Documentation:
 - 1) Test date
 - 2) Description and identification of piping tested
 - 3) Test fluid

40 05 91-2

Testing of Pressure Piping Systems

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- 4) Test pressure
- 5) Remarks, including:
 - a) Leaks (type, location)
 - b) Repair/replacement performed to remedy excessive leakage
3. Pipe pressure testing log shall be kept on-site. Pipe pressure testing log shall be signed on a daily basis, for any day when pipe pressure testing log work is performed, by the supervisor of the CONTRACTOR's field crew and by the ENGINEER.
4. Any piping system which was pressure tested, but which was not recorded in the pipe pressure testing log, shall be re-tested at the ENGINEER's discretion.

++ END OF SECTION ++

40 05 91-3

Testing of Pressure Piping Systems

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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40 05 91-4

Testing of Pressure Piping Systems

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 40 42 13

PIPING INSULATION

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Manufacturer's data on materials, construction, end connections, ratings, overall lengths, etc.

PART 2 - PRODUCTS

2.1 PIPE INSULATION

- A. **INS-02:** Rigid Fiberglass with Aluminum Jacket
 - 1. Insulation Materials:
 - a. Insulation: UL rated, preformed, sectional rigid fiberglass
 - b. Thickness: 1-inch.
 - c. Vapor Barrier Jacket: Kraft paper with aluminum foil with pressure sensitive adhesive lap
 - d. Temperature Rating: 0 degrees to 850 degrees Fahrenheit
 - e. Conductivity in accordance with ASHRAE 90.1 and minimum of 0.27 BTU-in/hr-ft² degrees F at 75 degrees F per ASTM C177 or ASTM C518.
 - f. Minimum water vapor transmission of 0.02 perm-inch per ASTM E96
 - g. Flame Spread Rating: Less than 25 per ASTM E84
 - 2. Field-Applied Aluminum Jacket:
 - a. Field-applied jackets shall comply with ASTM C1136; Type I or Type II.
 - 1) At Below-Ambient Temperatures: Type I.
 - 2) At Above-Ambient Temperatures: Type II, where a vapor barrier is not required.
 - b. ASTM C1729, Class A, 0.016 in thick aluminum jacket with 3 mil thick polyfilm moisture barrier factory-heat-laminated to the interior surface.
 - c. Manufacturers:
 - 1) ITW Insulation Systems, Houston, TX 77022; www.itwinsulation.com
 - 2) Or approved equal.
 - d. Provide Identification Labels per the requirements of 10 05 03 – Identification Devices
 - 3. Accessory Materials:
 - a. Provide accessories per insulating system manufacturer's recommendations, including the following:
 - 1) Closure Materials: Butt strips, bands, wires, staples, mastics, adhesives, and pressure-sensitive tapes.
 - a) Mold resistant mastics are recommended for chilled water applications.
 - 2) Field-Applied Jacketing Materials: Sheet metal, plastic, canvas, fiberglass cloth, insulating cement, PVC fitting covers.
 - 3) Support Materials: Hanger straps, hanger rods, saddles, support rings, and high-density inserts.

- 4) Adhesives for Indoor Applications: VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Fittings and valves:
 - a. Insulate with fabricated sections of insulation
 - b. Wrap with vapor barrier jacket
 - c. Provide preformed fitting covers specifically designed for fittings and valves
5. Manufacturers and Products:
 - a. Owens-Corning Fiberglass; ASJ/SSL-II with Aluminum Jacket
 - b. Johns Manville Corp; Micro-Lok with Aluminum Jacket
 - c. Or Equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Insulate all piping, valves and fittings for the piping systems where insulation is called for in 15100 PS - Piping Schedule
- B. Install insulation according to manufacturer's instructions
 1. Install insulation only after piping system has passed pressure testing.
 2. Requirement for insulation does not negate the requirement for coating of the piping system. Apply piping coating system as called for in 15100 PS – Piping Schedule. Allow coating system to completely cure prior to installation of pipe insulation.
 3. If heat tracing is required on piping system, do not install pipe insulation until after heat tracing has been installed and successfully tested.
 4. Do not "gap" insulation at pipe supports. Trim insulation to allow for pipe support while providing continuous insulation of piping in those parts of the pipe not in contact with pipe support.
 5. Install removable/replaceable insulation sections and cover panels over fittings or valves which require maintenance access.
 6. Use accessories, adhesives and tapes per manufacturer's recommendations.
- C. Finishing
 1. Overall installation shall result in smooth, straight, neat and clean piping insulation system. No frayed ends, irregular lumps or other unsightly installation result will be acceptable.

++ END OF SECTION ++

SECTION 40 61 13

PROCESS CONTROL SYSTEM GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all labor, materials, equipment and incidentals as stated and specified in the Contract Documents and install, calibrate, test, start-up, commission and place in satisfactory operation a complete Process Control System (PCS). PCS shall be as specified by Division 40, Process Integration, and all controls systems provided by others in all Divisions as specified on the Contract Documents.
- B. The PCS is designed to control and monitor equipment operation and information. The unit processes, which the PCS shall control and monitor are shown and described in the Contract Documents.
- C. Equipment Suppliers are defined as suppliers or vendors who provide instrumentation, panels, equipment or services that interface with the PCS as specified in Division 40, Process Integration or other Divisions of the Contract Documents. Equipment Suppliers shall coordinate with the PCSS (responsibilities as defined below).
- D. The CONTRACTOR shall procure and pay for the services of a Process Control System Supplier (PCSS). The PCSS shall configure all Computer Control System (CCS) software for the supplied CCS. However, CONTRACTOR shall be responsible for all hardware configurations, loop testing of signals, and communications testing for new and modified existing control equipment through the CCS. Contractor shall assume ultimate responsibility for all work for a complete and operational system, including testing, startup, and training, etc.
- E. PLC programming, testing of PLC logic, and startup/training activities associated with programmed portions of the PLC will be supplied by the contractor through the PCSS.
- F. Human Machine Interface (HMI) graphics development, HMI software configuration, database development, report development, and startup/training activities associated with the configured portions of the HMI system will be supplied by the contractor through the PCSS.
- G. All control loops shall function as described in the specifications and Drawings of the Contract Documents.
- H. Auxiliary and accessory devices necessary for system operation or performance, such as transducers, relays, signal amplifiers, intrinsic safety barriers, and signal isolators, to interface with existing equipment or equipment provided by others under other Sections of these specifications, shall be included whether they are shown on the Drawings or not.

40 61 13-1

Process Control Systems General Requirements

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

- I. All instruments shall be field calibrated by the CONTRACTOR and witnessed by the OWNER.

1.2 QUALITY ASSURANCE

A. General:

1. The CONTRACTOR shall acquire the services of a PCSS for coordination of the furnishing, approval, installation, testing, commissioning, and training for all aspects of the PCS. The PCSS shall be the CONTRACTOR's representative for all subcontractors providing PCS equipment.
2. CONTRACTOR in conjunction with the PCSS shall be responsible for coordination and supervision of the supply, storage, installation, testing, startup, commissioning and training of all electrical equipment, instrumentation, panels and services defined in the Contract Documents to produce a fully functional PCS.
3. CONTRACTOR in conjunction with the PCSS shall be responsible for proper operation of the PCS with related equipment and materials furnished by other suppliers stated in the Contract Documents.

B. PCSS Qualifications:

1. Have experience at designing, supplying, installing, testing, start-up and commissioning PCS's.
2. Have experience in coordinating, reviewing and the handling of equipment submittals.
3. Have experience with integration, implementation and have supported standard lines of digital and analog processing control instrumentation equipment.
4. Have working knowledge in hardware application, data highway systems and computer control systems software programming procedures.
5. Have experience in coordinating or providing standard training course offerings in general process control applications and in operation, programming and maintenance of the control systems and related equipment.
6. Have a thorough working knowledge of wastewater treatment processes and control philosophy in accordance with standard practices of the wastewater treatment industry.
7. Have thorough knowledge of relevant NEC, OSHA, MIL, NRC, ISA, SAMA, NFPA, UL and API standards and all relevant state and local codes.
8. Have experience in coordinating, reviewing, handling of and presenting equipment operations and maintenance training materials.

C. PCSS Responsibilities:

1. General:
 - a. Attend the Pre-Construction Conference for the presentation of the responsibilities of the PCSS.
 - b. Coordinate with the CONTRACTOR in the generation of the Progress Schedule to incorporate PCS construction activities into the Progress Schedule.
 - c. Attend the project Construction Progress Meetings.
 - d. Coordinate PCS Progress Meetings as described below.
 - e. Maintain a punch list of items to be completed / corrected for the PCS. Provide an updated copy of this punch list to the ENGINEER at each construction progress meeting.

2. Reviews:
 - a. Review Contract Documents(Specifications, P&ID's, Process Drawings, Electrical Drawings, Installation Details, etc,) and develop a list of concerns or problems noted for the completion of the complete operating PCS. Submit list to the ENGINEER prior to review of equipment submittals.
 - b. Coordinate and review all PCS submittals and related equipment submittals in accordance with the Contract Documents, prior to submission of submittal to the ENGINEER.
3. Installation:
 - a. Verify delivery and proper storage of all PCS equipment.
 - b. Supervise the installation of the CCS instruments, panels, consoles, cabinets, wiring and other components required.
 - c. Coordinate with the CONTRACTOR in the development of all Maintenance of Plant Operations plans (MOPO's) affecting PCS equipment installation or activities.
 - d. Coordinate proper interfacing of CCS hardware, software, field devices and panels, including required interfacing with packaged control systems furnished by other equipment suppliers, and with the plant electrical system.
4. Testing:
 - a. Coordinate all calibration, testing, start-up and commissioning of the PCS as outlined in the Contract Documents.
 - b. PCSS shall submit to the ENGINEER a schedule with proposed start dates and test procedure guidelines for start-up, commissioning and field testing at least four weeks in advance of the test start date. Prior to testing each process area, coordinate with the CCS VENDOR to insure that the installation of the CCS software, including any modifications and software configuration testing is completed prior to testing each process area.
 - c. Complete testing of each process loop through the CCS shall be documented by PCSS and submit the signed document to the ENGINEER upon successful completion of tests.
 - d. Maintain a copy of Field Calibration Forms, Loop Test Forms, Equipment Test Reports, Loop Commissioning Forms, Factory Acceptance Test forms and other related documents in a single PDF for submittal to the ENGINEER to be transmitted to the OWNER at the conclusion of the project.
 - e. Attend all factory tests that are inclusive of the overall PCS.
5. Commissioning and Substantial Completion:
 - a. Coordinate and provide review comments of all PCS Vendor Equipment Operations and Maintenance Manuals (VEOMM) prior to submission of manual to the ENGINEER.
 - 1) Maintain a red-line of the VEOMM 's electrical drawings and schematics used during construction to reflect changes or deviations that occur during installation, start-up, and commissioning for incorporation into the final VEOMMs. Submit the red-lined electrical drawings and schematics to the provider of the equipment for updates as VEOMM Record Documents for submittal to the ENGINEER to be transmitted to the OWNER prior to Substantial Completion of the project.
 - b. Maintain red-line ISSUED FOR CONSTRUCTION DRAWINGS used during construction to reflect changes or deviations that occur during installation, start-up, and commissioning for incorporation into the final Record Drawings. Submit

the red-lined ISSUED FOR CONSTRUCTION DRAWINGS to the ENGINEER prior to Substantial Completion of the project.

- c. Coordinate and supervise training of OWNER'S personnel in operation and maintenance of the process control system as required in the Specifications.

D. Reference Standards:

1. The following organizations have generated standards that are to be used as guides in assuring quality and reliability of components and systems; govern nomenclature; define parameters of configuration and construction, in addition to specific details in the Contract Documents.
 - a. ISA, The International Society of Automation.
 - b. API, American Petroleum Institute.
 - c. UL, Underwriters' Laboratories, Inc.
 - d. AWWA, American Water Works Association.
 - e. Nuclear Regulatory Commission.
 - f. NEMA, National Electrical Manufacturers Association.
 - g. OSHA, Occupational Safety and Health Administration.
 - h. ANSI, American National Standards Institute.
 - i. MIL, Military Standards.
 - j. NFPA, National Fire Protection Association.
 - k. SAMA, Scientific Apparatus Manufacturers Association.
 - l. NFPA, National Fire Protection Association 79, Annex "D" Standards.
 - m. IEEE, Institute of Electrical and Electronic Engineers.
 - n. NEC, National Electrical Code.
 - o. FM, Factory Mutual.

1.3 COORDINATION AND PROGRESS MEETINGS

- A. Schedule and coordinate the system installation with all other Work on the site and in accordance with the provisions of the General Conditions. This coordination shall be documented on the Project Schedule.
- B. PCS coordination and progress meetings will be scheduled by the PCSS. The CONTRACTOR, ENGINEER, OWNER, and appropriate Equipment Suppliers shall be required to attend meetings during the time of active work on the PCS. A representative of the CCS vendor shall be required to attend meetings during the time of active work on the CCS. PCSS shall provide meeting minutes and updates to the project schedule.
 1. The purpose of the meetings shall be to review the progress of the Work involving the PCS and provide coordination for installation, testing, commissioning, and training of the equipment to ensure that the Project Schedule is met.
 2. Representatives at the meetings shall have the competence and authority to make any and all necessary decisions. Decisions and statements made at the meetings shall commit CONTRACTOR to agreed procedures and schedules.
 3. A project kickoff coordination meeting shall be held within two weeks after submitting the Project Plan and Schedule Submittal. The purpose of the meeting shall be to discuss the PCSS's Project Plan and Schedule Submittal, to summarize the PCSS's understanding of the project; discuss any proposed substitutions or alternatives; schedule testing and delivery deadline dates; provide a forum to coordinate hardware

and software related issues; and request any additional information required from the OWNER.

1.4 SUBMITTALS

A. Shop Drawings:

1. General:

- a. Shop Drawing submittals are to be in accordance with the requirements of the Contract Documents and shall conform to the requirements of individual specification sections.
- b. Manufacture or shipment of the PCS components shall not commence until related submittals have been reviewed by ENGINEER.
- c. Shop Drawings shall be submitted in complete packages grouped to permit review of related items.
- d. Review of Shop Drawings will be for conformance with Contract Documents and with regard to functions specified to be provided.

2. Submittal Requirements:

- a. Product information for all PCS equipment. Include the following:
 - 1) Manufacturer's product name and complete model number.
 - 2) Equipment CMMS Tag and loop number from the Contract Documents.
 - 3) Manufacturer's data sheets and catalog literature. Provide data sheets as shown in ISA-20-1981. For instruments not included in ISA-20, submit data sheets using a similar format.
 - 4) Description of construction features.
 - 5) Performance and operation data.
 - 6) Installation and mounting details, instructions and recommendations.
 - 7) Service requirements.
 - 8) Dimensions.
 - 9) List of recommended spare parts.
 - 10) UL/UR Listing Numbers.
 - 11) Electrical control schematics and field wiring diagrams
 - 12) Ranges and set points of field and control panel instruments
- b. Control Panel Information:
 - 1) Control panels shall be furnished in accordance with the requirements as shown on the Drawings and specifications.

B. Submit a Project plan. The Project Plan shall be submitted and approved before any further submittals shall be accepted. The Project Plan shall, as a minimum, contain the following:

1. Overview of the proposed control system describing the PCSS understanding of the project work, preliminary system architecture drawing, interfaces to other systems, schedule, startup, and coordination.
2. Approach to work describing how the PCSS intends to execute the work. A discussion of switchover, startup, replacement of existing equipment with new, and other tasks as required by these specifications shall be included as applicable.
3. Preliminary HMI software, PLC software, and PLC hardware submittal information solely to determine compliance with the requirements of the Contract Documents prior to development of system programming. Review and approval of software and hardware systems as part of this Project Plan stage shall not relieve the PCSS of

- meeting all the functional and performance requirements of the system as specified herein. Substitution of manufacturer or model of these systems after the submittal is approved is not allowed without ENGINEER approval.
4. Project personnel and organization including the PCSS project manager, project engineer, and lead project technicians. Include resumes of each key individual and specify in writing their commitment to this project.
 5. Preliminary coordination meeting agendas as specified herein.
 6. Preliminary testing plan.
 7. Preliminary training plan.
 8. Sample formats of the shop drawings to be submitted and in conformance with the requirements of the Specifications. At a minimum include samples of panel fabrication drawings, loop, I/O wiring diagrams, and graphical display presentations.
- C. Exceptions to the Specifications or Drawings shall be clearly defined in a separate Deviation List. The Deviation List shall consist of a paragraph by paragraph review of the Specifications indicating acceptance or any proposed deviations, the reason for exception, the exact nature of the exception and the proposed substitution so that an evaluation may be made by the ENGINEER. The acceptability of any device or methodology submitted as an "or equal" or "exception" to the specifications shall be at the sole discretion of the ENGINEER. If no exceptions are taken to the specifications or drawings the PCSS shall make a statement as such. If there is no statement by the PCSS, then it is acknowledged that no exceptions are taken.
1. Project schedule shall be prepared and submitted using Primavera, Microsoft Project, or equal scheduling software. Schedule shall be prepared in Gantt chart format clearly showing task linkages for all tasks and identifying critical path elements. PCSS schedule must be based on the CONTRACTOR schedule and must meet all field installation, testing, and start-up milestones in that schedule. The project schedule shall illustrate all major project milestones including the following:
 - a. Schedule for all subsequent project submittals. Include in the time allotment the time required for CONTRACTOR submittal preparation, ENGINEER's review time, and a minimum of two complete review cycles.
 - b. Proposed dates for all project coordination meetings.
 - c. Hardware purchasing, fabrication, and assembly (following approval of related submittals).
 - d. Software purchasing and configuration (following approval of related submittals).
 - e. Shipment of all instrument and control system equipment.
 - f. Installation of all instrument and control system equipment.
 - g. Testing: Schedule for all testing. Testing schedule shall include submittal of test procedures a minimum of 30 days prior to commencement of testing. Schedule shall also include submittal of completed test procedure forms for review and approval by the ENGINEER prior to shipment, startup, or subsequent project work.
 - h. Schedule for system cutover, startup, and/or going on-line for each major system. At a minimum include the schedule for each process controller and HMI server/workstation provided under this Contract.
 - i. Schedule for all training including submittal and approval of O&M manuals, factory training, and site training.

2. The I/O list shall be arranged such that each control panel has a dedicated worksheet. At a minimum, I/O worksheet tables shall include the following information:
 - a. TAG NUMBER(S): The identifier assigned to a device that performs a function in the control system. As part of this information, the loop number of the tag shall be broken out to allow for sorting by loop.
 - b. DESCRIPTION: A description of the function of the device (text that includes signal source, control function, etc.) Include the text "Spare Points" for all I/O module points that are not connected to equipment.
 - c. PHYSICAL LOCATION: The Control Panel designation of where the I/O point is wired to.
 - d. PHYSICAL POINT ADDRESS: Rack, Slot, and Point (or Channel) assignment for each I/O point.
 - e. LOGICAL POINT ADDRESS: I/O address of each point.
 - f. I/O TYPE: use DO - Discrete Output, DI - Discrete Input, AO - Analog Output, AI - Analog Input, PI - Pulse Input, or PO - Pulse Output.
 - g. RANGE/STATE: The range in engineering units corresponding to an analog 4-20 mA signal, or, the state at which the value of the discrete points are "1."
 - h. ENGINEERING UNITS: The engineering units associated with the Analog I/O.
 - i. ALARM LIMITS: Include alarm limits based on the control descriptions and the Drawings.
 - j. P&ID - the P&ID or drawing where the I/O point appears on. Mark as "NA" (Not Applicable) if the I/O point is derived from a specification requirement and is not on the P&IDs.
3. Where multiple mechanical components are provided for process redundancy, their field connections to I/O modules shall be arranged such that the failure of a single I/O module will not disable all mechanical components of the redundant system. This applies to all I/O types.

D. Field Instruments Submittal

1. Submit complete documentation of all field instruments using ISA-S20 data sheet formats. Submit a complete Bill of Materials (BOM) or Index that lists all instrumentation equipment ordered by the loop numbering system as shown in the Contract Documents.
2. Submit separate data sheets for each instrument including:
 - a. Plant Equipment Number and ISA tag number per the drawings
 - b. Product (item) name used herein and on the Contract Drawings
 - c. Manufacturer's complete model number
 - d. Location of the device
 - e. Input - output characteristics
 - f. Range, size, and graduations in engineering units.
 - g. Physical size with dimensions, enclosure NEMA classification and mounting details in sufficient detail to determine compliance with the requirements of the Contract Documents.
 - h. Materials of construction for enclosure and wetted parts.
 - i. Instrument or control device sizing calculations where applicable
 - j. Certified calibration data for all flow metering devices.
 - k. Two-wire or four-wire device type as applicable.

3. Submit index and data sheets in electronic format. Electronic format shall be in Microsoft Excel or Word.
- E. Hardware Submittal and Software Packages Submittal
1. For each hardware component indicated below, submit a cover page that lists, at a minimum, date, specification number, product name, manufacturer, model number, Location(s), and power required. Preferred format for the cover page is ISA S20, general data sheet; however, other formats will be acceptable provided they contain all required information.
 2. Catalog cuts for supplied Programmable Logic Controller (PLC), process controller equipment, remote telemetry units (RTU), including central processing units, memory, input modules, output modules, modems, network interface modules, mounting racks, and power supplies. Submit descriptive literature for each hardware component that fully describes the units being provided. Submit list of 3 firms that are located within 60 miles of the project site that are actively installing, programming, supporting, and maintaining the submitted PLC. Any deviation of the hardware systems from the preliminary hardware submittal included in the Process Plan shall be described in detail.
 3. Catalog cuts for HMI servers, HMI workstation, laptops, historian servers, memory, printers, mass storage devices, modems, peripherals, power supplies, and all other hardware being provided. Submit descriptive literature for each hardware component, which fully describes the units being provided.
 4. Complete system architecture diagram showing in schematic form, the interconnections between major hardware components including control centers, panels, power supplies, consoles, computer and peripheral devices, networking equipment, processors, I/O modules, local operator interfaces, and like equipment. The system architecture shall be complete and shall depict all required cables, media type between components, network protocol used at each network level, details on connection requirements such as cable pin-outs, port numbers, and rack slot numbers. The intent of this specification requirement is for the PCSS to develop a diagram that is complete in every aspect to allow purchase of all required equipment by part number, and to allow a qualified technician to interconnect all equipment without having to refer to additional manuals or literature.
 5. Submit details of field instrument, valve, power monitoring, and field device digital networks. Submittal shall include details of the field device digital networks technology including type, wiring requirements, configuration details, device addressing, and interface to the process control system. Include details of the field device digital network configuration for each field level digital network and subnetwork.
 6. Submit details of the controller development software package, the local operator graphic panel development software package, and the HMI software application packages to be used for each piece of equipment. Indicate all standard and optional features provided. Confirm in the submittal that the licenses will be assigned to the OWNER at the time of purchase. Any deviation of the software platforms from the preliminary software submittal included in the Project Plan shall be described in detail.

F. Panel Layout Drawings and Wiring Diagrams Submittal

1. Where direct hardwired interfaces exist between the PCSS control panels and vendor provided control panels furnished under other Divisions, the CONTRACTOR shall provide to the PCSS the approved shop drawings and submittals in order for the PCSS to provide complete wiring diagrams showing all wiring connections in the I/O system. This includes but is not limited to terminal block numbering, relay contact information, instruments, equipment, and control panel names. These drawings will be included in the Final Documentation submittal. Leaving this information blank on the Final Documentation drawings is not acceptable.
2. Panel Layout Drawings: Drawings shall be furnished for all panels, consoles, and equipment enclosures specified. Panel assembly and elevation drawings shall be drawn to scale and detail all equipment in or on the panel. As a minimum, the panel drawings shall include the following:
 - a. Interior and exterior panel elevation drawings to scale.
 - b. Nameplate schedule.
 - c. Conduit access locations.
 - d. Panel construction details.
 - e. Cabinet assembly and layout drawings to scale. The assembly drawing shall include a bill of material on the drawing with each panel component clearly defined. The bill of material shall be cross-referenced to the assembly drawing so that a non-technical person can readily identify any component of the assembly by manufacturer and model number.
 - f. Fabrication and painting specifications including color (or color samples).
 - g. Submit construction details, NEMA ratings, intrinsically safe barrier information, gas sealing recommendations, purging system details, etc. for panels located in hazardous locations or interfacing to equipment located in hazardous areas.
 - h. Heating and cooling calculations for each panel supplied indicating conformance with cooling requirements of the supplied equipment and environmental conditions. Calculations shall include the recommended type of equipment required for both heating and cooling.
 - i. Submit evidence that all control panels shall be constructed in conformance with UL 508 and bear the UL seal confirming the construction. Specify if UL compliance and seal application shall be accomplished at the fabrication location or by field inspection by UL inspectors. All costs associated with obtaining the UL seal and any inspections shall be borne by the CONTRACTOR and included in the Project Bid Price.
3. Panel Wiring Diagrams: Panel wiring diagrams depicting wiring within and on the panel as well as connections to external devices. If ISA Loop Wiring Diagrams are specified below, equipment external to the control panel and related external connections do not need to be shown on the Panel Wiring Diagrams. Panel wiring diagrams shall include power and signal connections, UPS and normal power sources, all panel ancillary equipment, protective devices, wiring and wire numbers, and terminal blocks and numbering. Field device wiring shall include the device ISA-tag and a unique numeric identifier. The diagrams shall identify all device terminal points that the system connects to, including terminal points where I/O wiring lands on equipment not supplied by the PCSS. Wiring labeling used on the drawings shall match that shown on the Contract Documents or as developed by the PCSS and approved by the ENGINEER. I/O wiring shall be numbered with rack number, slot number, and point number. Two-wire and four-wire equipment shall be clearly identified and power sources noted.

4. ISA Loop Wiring Diagrams: Detailed ISA loop wiring diagrams showing requirements for each loop which is shown on the contract drawings. The Loop Drawings shall be prepared in accordance with ISA Standard S5.4 latest edition with the layout following Figures 5 and 6 (shown in the S5.4 Standard), titled Minimum Required Items Plus Optional items". Loop drawings shall be 11"x17" minimum in size. The information required on the Loop Drawings in order to satisfy the "minimum" and "optional" requirements is as follows:
- a. Minimum Required Items – The following information shall be provided on Loop Drawings in order to meet this requirement:
 - 1) Identification of the loop and loop components shown on the P&IDs. Other principal components of the loop to be shown and identified under ISA-5.1, "Instrumentation Symbols and Identification".
 - 2) Word description of loop functions within the title. If not adequate, use a supplemental note. Identify any special features or functions of shutdown and safety circuits.
 - 3) Indication of the interrelation to other instrumentation loops, including overrides, interlocks, cascaded set points, shutdowns and safety circuits.
 - 4) All point-to-point interconnections with identifying numbers or colors of electrical cables, conductors, pneumatic multitubes, and individual pneumatic and hydraulic tubing. This identification of interconnections includes junction boxes, terminals, bulkheads, ports, and grounding connections.
 - 5) General location of devices such as field, panel, auxiliary equipment, rack, termination cabinet, cable spreading room, I/O cabinet, etc.
 - 6) Energy sources of devices, such as electrical power, air supply, and hydraulic fluid supply. Identify voltage, pressure, and other applicable requirements. For electrical sources, identify circuit or disconnect numbers.
 - 7) Process lines and equipment sufficient to describe the process side of the loop and provide clarity of control action. Include what is being measured and what is being controlled.
 - 8) Actions or fail-safe positions (electronic, pneumatic, or both) of control devices such as controllers, switches, control valves, solenoid valves, and transmitters (if reverse- acting). These are to be identified in accordance with ISA-5.1, "Instrumentation Symbols and Identification".
 - b. Additional Required Items – The following information shall be provided on Loop Drawings (in a tabular format as shown in Figures 5 and 6 of ISA 5.4) in order to meet this requirement:
 - 1) Process equipment, lines, and their identification numbers, source, designation, or flow direction.
 - 2) Reference to supplementary records and drawings, such as installation details, P&IDs, location drawings, wiring diagrams or drawings, and instrument specifications.
 - 3) Specific location of each device, such as elevation, area, panel subdivision, rack or cabinet number and location, I/O location.
 - 4) Cross reference between loops that share a common discrete component, such as multipen recorders, dual indicators, etc.
 - 5) References to equipment descriptions, manufacturers, model numbers, hardware types, specifications or data sheets, purchase order numbers.
 - 6) Signal ranges and calibration information, including setpoint values for switches, and alarm and shutdown devices.

- 7) Software reference numbers, such as I/O addresses, control block types and names, network interfaces, point names.
- 8) Engraving or legend information that helps identify the instrument or accessory. Per ISA-5.4-1991 11.
- 9) Accessories, tagged or otherwise identified, such as regulators, filters, purge meters, manifold valves, root valves.
- 10) References to manufacturer's documentation such as schematics, connection details, operating instructions.
- 11) Color code identification for conductors or tubes that use numbers for differentiation.

G. Testing Plan Submittals

1. Test Procedure Submittals: Submit the procedures proposed to be followed for each test. Procedures shall include test descriptions, forms, and checklists to be used to control and document the required tests. Include sign-off forms for each testing phase or loop with sign-off areas for the PCSS, ENGINEER, and OWNER.
2. Test Documentation: Upon completion of each required test, document the test by submitting a copy of the signed off test procedures. Testing shall not be considered complete until the signed-off test procedures have been submitted and favorably reviewed. Submittal of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.
3. Each loop shall have a Loop Status signoff form to organize and track its inspection, adjustment and calibration. These forms shall include the following information and checkoff items:
 - a. Project Name.
 - b. Loop Number.
 - c. Detailed test procedure indicating exactly how the loop will be tested including all required test equipment, necessary terminal block numbers, and simulation techniques required.
 - d. Tag Number for each component.
 - e. Checkoffs/signoffs for each component.
 - 1) Tag/identification
 - 2) Installation
 - 3) Termination - wiring
 - 4) Termination - tubing
 - 5) Calibration/adjustment
 - f. Checkoffs/signoffs for the loop.
 - 1) Panel interface terminations
 - 2) I/O interface terminations
 - 3) I/O signal operation
 - 4) Inputs/outputs operational: received/sent, processed, adjusted
 - 5) Total loop operation
 - 6) Space for comments.
 - 7) Sign off and date fields for the CONTRACTOR, the ENGINEER, and the PCSS.
4. Each active analog subsystem element shall have a Component Calibration form. These forms shall have the following information including space for data entry:
 - a. Project Name.
 - b. Loop Number.

- c. ISA Tag Number and I/O Module Address.
- d. Manufacturer.
- e. Model Number/Serial Number.
- f. Summary of Functional Requirements. For example:
 - 1) For Indicators: Scale ranges
 - 2) For Transmitters/Converters: Scale and chart ranges
 - 3) For Computing Elements: Function
 - 4) For Controllers: Action (direct/reverse) control modes (PID)
 - 5) For Switching Elements: Unit range, differential (FIXED/ADJUSTABLE), reset (AUTO/MANUAL)
 - 6) For I/O Modules: Input or output
- g. Calibrations; for example:
 - 1) For Analog Devices: Required and actual inputs and outputs at 0, 50 and 100 percent of span.
 - 2) For Discrete Devices: Required and actual trip points and reset points.
 - 3) For Controllers: Mode settings (PID).
 - 4) For I/O Modules: Required and actual inputs or outputs for 0, 50 and 100 percent of span.
- h. Space for comments.
- i. Sign off and date fields for the CONTRACTOR, the ENGINEER, and the PCSS.

H. Training Plan Submittals

- 1. Preliminary Training Plan Submittal: Prior to the preparation of the Final Training Plans, submit outlines of the specific training, resumes of trainers, prerequisite requirements for each class, and general samples of handouts for review.
- 2. Final Training Plan Submittal: Upon receipt of the ENGINEER's comments on the preliminary training plan, submit the specific proposed training plan. The training plan shall include:
 - a. Definitions of each course.
 - b. Specific course attendance.
 - c. Schedule of training courses including dates, duration and locations of each class.
 - d. Complete copy of all proposed handouts and training materials. Training information shall be logically arranged in a three-ring binder with all materials reduced to a maximum size of 11 inch by 17 inch, then folded to 8.5 inch by 11 inch for inclusion into the binder.

I. Spares, Expendables, and Test Equipment Lists Submittal

- 1. This submittal shall include for each Subsystem:
 - a. A list of, and descriptive literature for, spares, expendables, and test equipment.
 - b. A list of, and descriptive literature for, additional spares, expendables, and test equipment recommended by the manufacturer.
 - c. Unit and total costs for the additional spare items specified or recommended for each subsystem.

J. Final System Documentation

- 1. The Final System Documentation shall consist of operations and maintenance manuals as specified herein. Provide AE Operator Manuals. The document shall be bookmarked and indexed with active navigation links.

2. The operations and maintenance manuals shall, at a minimum, contain the following information:
 - a. Table of Contents
 - 1) A Table of Contents shall be provided for the entire manual with the specific contents of each volume clearly listed. The complete Table of Contents shall appear in each volume.
 - b. Instrument and Equipment Lists
 - 1) The following lists shall be developed in Excel and provided not only as a hardcopy in O&M but also electronically on a CD.
 - 2) An instrument list for all devices supplied including tag number, description, specification section and paragraph number, manufacturer, model number, serial number, range, span, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.
 - 3) An equipment list for all non-instrument devices supplied listing description, specification section and paragraph number, manufacturer, model number, serial number, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.
 - c. Data Sheets with Vendor Operations and Maintenance Information
 - 1) ISA S20 data sheets shall be provided for all field instruments.
 - 2) Cover page for each device, piece of equipment, and OEM software that lists, at a minimum, date, specification number, product name, manufacturer, model number, Location(s), and power required. Preferred format for the cover page is ISA S20, general data sheet; however, other formats will be acceptable provided they contain all required information.
 - 3) Final vendor O&M documentation for each device, piece of equipment, or OEM software shall be either new documentation written specifically for this project, or modified standard vendor documentation. All standard vendor documentation furnished shall have all portions that apply clearly indicated with arrows or circles. All portions that do not apply shall be neatly lined out or crossed out. Groups of pages that do not apply at all to the specific model supplied shall be removed.
 - 4) For any component requiring dip switch settings or custom software configuration, that information shall be included along with the corresponding data sheets and O&M information.
 - d. As-Built Drawings
 - 1) Complete as-built drawings, including all drawings and diagram specified in this Section under the "Submittals" section. These drawings shall include all termination points on all equipment the system is connected to, including terminal points of equipment not supplied by the PCSS.
 - 2) As built documentation shall include information from submittals, as described in this Specification, updated to reflect the as-built system. Any errors in or modifications to the system resulting from the Factory and/or Functional Acceptance Tests shall be incorporated in this documentation.
 - e. Original Licensed Software
 - 1) Submit original software keys and licenses. Submit license agreement information including serial numbers, license agreements, User Registration

Numbers and related information. All software provided under this Contract shall be licensed to the OWNER at the time of purchase.

- f. Electronic O&M Information
 - 1) Electronic documents shall be supplied in Adobe Acrobat format.
 - 2) Provide electronic files for all custom-developed manuals.
 - 3) Provide electronic files for all drawings produced. Drawings shall be in AutoCAD ".dwg" format and in Adobe Acrobat format. Drawings shall be provided using the AutoCAD eTransmit feature to bind external references, pen/line styles, and fonts into individual zip files along with the drawing file.
 - 4) If specified in the training section, provide digital copies of all training videos. Format and shall be a minimum of 800 by 600 pixels and shall include sound.

K. Report Forms:

- 1. Field Calibration Forms, Loop Test Forms, Equipment Test Reports, Loop Commissioning Forms, Factory Acceptance Test forms and other related forms shall be submitted to the PCSS.

1.5 EQUIPMENT DELIVERY, HANDLING AND STORAGE

- A. All arrangements for transportation, delivery and storage of the equipment and materials to be in accordance with the requirements of the Contract Documents and the requirements of equipment manufacturers.
- B. PCS equipment shall be packaged at the factory prior to shipment to protect each item from damage during shipment and storage. Containers shall be protected against impact, abrasion, corrosion, discoloration or other damages. Clearly label contents of each container and provide information on the required storage conditions necessary for the equipment. Keep OWNER and ENGINEER informed of equipment delivery.
- C. All equipment shall be handled and stored in accordance with manufacturer's instructions and relevant organization standards. Equipment shall be protected from weather, moisture and other conditions that could cause damage. Items that require a controlled environment for storage such as panels and microprocessor units shall be stored in a climate-controlled warehouse or facility. Equipment supplier shall notify CONTRACTOR and PCSS, in writing, with copies to OWNER and ENGINEER of the storage requirements and recommendations for the equipment prior to shipment.
- D. Provide shop as-built control panel drawings upon delivery of the control panel.

1.6 GENERAL REQUIREMENTS

- A. Power Supplies:
 - 1. All electrically powered equipment and devices shall be suitable for operation on 115-volt 60 Hz power. If a different voltage, a suitable transformer shall be provided if approved by ENGINEER and OWNER.
 - 2. Appropriate power supplies shall be furnished by CONTRACTOR for all two wire transmitters, loops for monitoring discrete inputs and all necessary outputs.

3. Power supplies shall be mounted in enclosures and installed in the appropriate control room or field panel.
 4. Design all power supplies for a minimum of 130 percent of the maximum simultaneous current draw.
- B. Signal Requirements:
1. The control system shall be designed to use 4 to 20 mADC analog signals, unless otherwise specified.
 2. Provide signal converters and repeaters, where required. In addition, analog inputs to the computer control system shall be through appropriate repeaters to provide signal isolation where series looped with other devices, and to allow the loop to maintain integrity even if the CCS is out of service. Power supplies shall be sized adequately for signal converter and repeater loads.
 3. Provide protocol converters where required to integrate communications.
 4. Signals shall be isolated from ground.
 5. The system and associated input/output wiring will be used in a plant environment where there can be high energy AC fields, DC control pulses, and varying ground potentials between the sensors/transducers or input contact locations and the system components. The system design shall be adequate to provide proper protection against interferences from all such possible situations.
- C. Miscellaneous:
1. All instrumentation and PCS components shall be heavy-duty types, designed for continuous service in a municipal wastewater treatment plant environment. The system shall contain products of a single manufacturer, where possible, and consist of equipment models, which are currently in production. All equipment provided shall be of modular construction and be capable of field expansion through the installation of plug-in circuit cards and additional cabinets as necessary.
 2. Design all logic and control loops to fail-safe. Fail-safe is to protect system if a field wire becomes disconnected.
 3. All field-mounted instruments and PCS components shall be designed for installation in humid and corrosive service conditions. All field mounted instrument enclosures and appurtenances shall conform to NEMA ratings listed in Division 26, Electrical, unless otherwise specified.
 4. Ranges and scales specified herein shall be coordinated to suit equipment actually furnished.
- D. Environmental Conditions and material requirements:
1. Refer to the environmental conditions and material requirements in section 26 00 00 General Electrical provisions.
 2. Outdoor enclosures with electronics and temperature sensitive instruments, shall be provided with sunshade structures and appropriately sized air conditioner, if required. Submit vendor information or temperature calculations for each outdoor enclosure. Sunshade structures shall be constructed as shown on drawings.
 3. The control system shall be designed and constructed for continuous operation under the following temperature and humidity conditions:
 - a. Ambient Conditions:
 - 1) Air temperature: -23 to 40 degrees C (-10 to 104 degrees F)
 - 2) Elevation: 4,550 feet (MSL).

- 3) Humidity: 20 to 95%
- b. Control Rooms Ratings:
 - 1) Ambient Temperature: 60°F to 80°F normal range; 40°F to 105°F occasional maximum extremes.
 - 2) Relative Humidity: 80 percent, normal; 95 percent maximum.
- c. Indoor locations ratings:
 - 1) Ambient Temperature: 40°F to 120°F.
 - 2) Relative Humidity: 98 percent maximum.
- d. Outdoor locations ratings:
 - 1) Ambient Temperature: -10°F to 131°F.
 - 2) Relative Humidity: 100 percent maximum.
- e. Area Classifications:
 - 1) Materials and equipment shall conform to the area classification(s) shown on the Drawings, specified, and required.
 - 2) Materials identified below are the minimum required. The drawings may include additional requirements.
 - 3) Corrosive Locations: The following areas shall be considered corrosive locations:
 - a) Chemical storage and pumping areas.
 - b) Indoor process areas.
 - c) Outdoor areas.
 - 4) Hazardous Locations:
 - a) Hazardous areas shall be as shown on the Drawings.
 - 1. Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503.
 - 2. Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.
 - 3. Materials, equipment and incidentals in areas identified as hazardous locations shall meet NEC requirements for the Class and Division designated.
 - 4. Devices that are not labeled for use in the hazardous area in which they are installed shall be wired from intrinsic safety barrier relays installed in accordance with NEC and UL requirements.
 - 5. For installations within hazardous locations or in the presence of H2S or other corrosive gases, provide protection for the transmitter/analyzer by sealing off conduits once installed. Instrument shall not be left unsealed during construction.
- 4. Instrument must be rated for the environment in which it is installed. Refer to hazardous location drawings in the contract documents. If instrument is not available in the appropriate rating, provide an intrinsically safe barrier relay in a suitably rated enclosure.
- 5. Enclosures shall meet the requirements indicated in specification section General Electrical Provisions. Instruments shall also meet the environmental requirements indicated in specifications section Process Control System Primary Sensors and Field Instruments.

E. System Designs:

1. Range, scale and setpoint values specified are for initial setting and configuration. Modifications to these values may be required based on actual equipment furnished and as necessary to implement proper and stable process action and that is determined as systems are placed in operation. These modifications shall be done at no additional cost to OWNER.
2. For any items where ranges, scales and setpoints may not have been specified, CONTRACTOR shall submit a recommendation to ENGINEER for review.

1.7 SYSTEM START-UP, COMMISSIONING AND FIELD TESTING

A. Equipment and System Start-up and Performance Testing shall include the additional requirements:

1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install all equipment and coordinate all activities required to perform start-up, commissioning and field testing of the Process Control System. Field testing shall include an integrated system field test and operational availability demonstration.
2. Retain the services of the EQUIPMENT SUPPLIERS and CCS VENDOR to supervise and/or perform start-up, commissioning and field testing of all system components. As part of these services, the EQUIPMENT SUPPLIERS shall include for the equipment items not manufactured by the EQUIPMENT SUPPLIER, the services of an authorized manufacturer's representative to check the equipment installation and place the equipment in operation. The manufacturer's representative shall be thoroughly knowledgeable about the installation, operation and maintenance of the equipment.

B. System Check-Out and Start-Up

1. With the aid of the EQUIPMENT SUPPLIERS, responsibility belongs to CONTRACTOR to perform the following:
 - a. Check and approve the installation of all computer control system components and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation. Check-out shall include the following items as a minimum:
 - 1) All wiring shall be checked at each termination point for correct wire size, type, color, termination and wire number.
 - 2) Analog wiring shall be checked for correct polarity and ground continuity at each termination point in the loop.
 - 3) All control and monitoring loops shall be checked for signal continuity from source (such as field instrument/equipment, control panel, etc) to end destination.
 - b. Conduct a complete system checkout and adjustment, including calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. When there are future operational functions included in this Work, they should be included in the system checkout. All problems encountered shall be promptly corrected to prevent any delays in start-up of the various unit processes.
 - c. All instruments and devices shall be checked to verify compliance with the Specifications and approved Shop Drawings.

2. Provide all test equipment required to perform the testing and field calibration of instruments during system checkout and start-up.
 3. Furnish to the ENGINEER certified calibration reports for field instruments and devices as soon as calibration is completed. Factory calibrations are not acceptable as a replacement for field calibrations. All instruments must be field calibrated and witnessed by the ENGINEER and OWNER.
 - a. Receipt of any calibration certificate shall in no way imply acceptance of the work or instrument.
 - b. Each calibration certificate shall be signed and dated by an authorized representative of CONTRACTOR. Three copies of each completed certificate shall be submitted to ENGINEER.
 4. Furnish to the ENGINEER two copies of an installation inspection report certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by authorized representatives of both CONTRACTOR and the EQUIPMENT SUPPLIER.
 5. All spare parts must be on-site and accepted prior to commencing integrated system field tests.
- C. Commissioning
1. Following the Process Control System checkout and initial operation, CONTRACTOR, with the aid of the EQUIPMENT SUPPLIERS and CCS VENDOR, perform a complete system test in the presence of the ENGINEER to verify that all equipment is operating properly as a fully integrated system, and that the intended monitoring and control functions are fully implemented and operational.
 - a. Commissioning can only begin when all instruments and control panels are installed and wired. Operation and Maintenance manuals and a schedule for training must be approved prior to Commissioning.
 - b. All spare parts must be on-site and accepted prior to Commissioning.
 - c. Submit to the ENGINEER a schedule for Commissioning, including a proposed start date and Commissioning test sheet examples at least three weeks in advance.
 2. Commissioning shall exercise field signals between field equipment or instrumentation and each Input/Output Panel through the CCS's workstation graphic display. As a minimum, perform the following checks for each test:
 - a. All wiring shall be checked at each termination point for correct wire size, type, color, termination and wire number.
 - b. All instruments and devices shall be checked to verify compliance with the Specifications and approved Shop Drawings. The calibration of analog devices shall be verified including the zero and span.
 - c. Analog wiring shall be checked for correct polarity and ground continuity at each termination point in the loop.
 - d. All analog loops shall be verified at each termination point at 0%, 25%, 50%, 75% and 100% signal levels.
 3. Provide the following documentation for use during the Commissioning effort.
 - a. Complete panel schematic and internal point-to-point wiring interconnect drawings.
 - b. Complete electrical control schematics.
 - c. Complete panel layout drawings.
 - d. Complete field wiring diagrams.

- e. Complete instrument loop diagrams.
 - f. Completed calibration certificates for all field and panel devices which require adjustment and/or calibration.
 - g. Provide one set of Commissioning documentation for the OWNER'S personnel, one set for the ENGINEER'S use, one set for field use, and the required number of sets for CONTRACTOR'S use.
- 4. The Drawings corrected and modified during Commissioning shall form the basis for the "As-Built" Record Drawing requirement as specified in this Section.
 - 5. Any defects or problems found during the Commissioning effort shall be corrected by CONTRACTOR and then retested to demonstrate proper operation.
- D. Integrated System Field Test
- 1. Following the completion of Process Control System checkout and initial operation and CCS software testing the CONTRACTOR, with the aid of the EQUIPMENT SUPPLIER and CCS VENDOR, shall remain on-site and be available during this period to correct instrumentation and control system hardware problems. The integrated field test shall be performed to verify all equipment/instrumentation is operating properly as a fully integrated system with the CCS, and that the intended monitoring and control functions are fully implemented and operational.
 - 2. Following software testing and demonstration of all system functions, the Process Control System including field sensors/transducers and instruments shall be running and fully operational for a continuous 48 hour period. The Operational Availability Demonstration specified below shall not begin until the continuous 48 hour integrated system test has been successfully completed and OWNER and ENGINEER agree that the Operation Availability Demonstration can begin.
 - 3. Any defects or problems found with the instrumentation, control system hardware, control panel components/wiring and field devices during the integrated field testing effort shall be corrected by CONTRACTOR and then retested to demonstrate proper operation.

1.8 PROCESS CONTROL SYSTEM TRAINING

- A. Requirements and Responsibilities
- 1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to perform and coordinate all required training at times acceptable to OWNER and ENGINEER.
 - 2. Retain the services of all PCS EQUIPMENT SUPPLIERS to provide operation and maintenance training for all Process Control System equipment as specified herein.
 - 3. For equipment items not manufactured by the EQUIPMENT SUPPLIERS, the EQUIPMENT SUPPLIER shall provide for on-site training by an authorized representative of the equipment manufacturer as part of the Supplier's services. The manufacturer's representative shall be fully knowledgeable in the operation and maintenance of the equipment.
 - 4. Responsibility for all costs associated with training both on-site and at the EQUIPMENT SUPPLIER'S facilities, including all required materials, texts and required supplies, belongs to CONTRACTOR.
 - 5. All training shall be conducted in the normal eight hour working days until conclusion of the training course.

6. Training schedule shall incorporate a 15 minute city employee break in the morning and afternoon, and a one-half hour lunch break each day. Each continuous session shall last no longer than 2 hours.
 7. Schedule training with the City at least 2 months in advance of planned start date. The City shall have the authority to exclude certain dates from training.
- B. Submittals
1. Submit training plans as follows: Included in the plan shall be course outlines and schedules for training to be provided at the EQUIPMENT SUPPLIER'S facilities.
- C. On-Site Training
1. Training Covering the Control Equipment:
 - a. The Equipment Suppliers shall provide 40 hours of operations training covering all system components.
 - b. Training course shall accomplish the following:
 - 1) Provide all instructions required to operate and utilize all system components.
 - 2) Provide all instruction required to monitor and control the system processes from the designated control panel.
 - 3) Explain procedures for control of the system during scheduled or rescheduled shutdown and the subsequent start-up.
 - 4) Provide instructions for routine preventative and troubleshooting maintenance.
 2. CCS Training:
 - a. The CCS Vendor shall provide 40 hours of training that covers the CCS as follows:
 - 1) Provide an overview of system hardware and software.
 - 2) Train staff in configuration, operation and programming the CCS.
 - 3) The emphasis shall be placed on how to perform set point changes, minor programming changes, range changes, diagnostics and upkeep of documentation.
 - 4) Instruction for hardware and software maintenance, troubleshooting and maintenance planning.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials or products which can contact drinking water or a water treatment chemical furnished and installed under this division shall require NSF/ANSI 61, Drinking Water System Components Health Effects, approval or comply with Arizona Administrative Code R18-4-213, Standards for Additives, Materials, and Equipment.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and

similar devices indicated are approximate only. Exact locations of all devices shall be as approved by the ENGINEER during construction. Obtain in the field, all information relevant to the placing of process control equipment and in case of any interference with other work, proceed as directed by the CONTRACTOR and furnish all labor and materials necessary to complete the work in an approved manner at no additional cost to the OWNER.

- B. The P&IDs and Drawings indicate the intent and not the precise nature of the interconnection between the individual instruments. Where indicated on the P&IDs or Drawings as not requiring installation, provide the instruments suitably packaged for storage.
- C. All equipment used in areas designated as hazardous shall be designed for the Class, Group and Division as required for the locations as shown on the Drawings and specified in Division 26, Electrical. All work shall be in strict accordance with codes and local rulings.
- D. Unless specifically indicated, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shutoff and drain valves. For differential pressure transmitters, 5-valve manifolds for calibration, testing and blow down service shall also be provided. For chemical or corrosive fluids, diaphragm seals with flushing connections shall be provided.
- E. All piping and tubing to and from field instrumentation shall be provided with necessary unions, calibrations and test tees, couplings, adaptors, and shut-off valves. Process tubing shall be installed to slope from the instrument toward process for gas measurement service and from the process toward the instrument for liquid measurement service. Provide drain/vent valves or fittings at any process tubing points where the required slopes cannot be maintained.
- F. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed as shown and not interfere with any other equipment.
- G. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded at only one ground point for each shield.
- H. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, ship material in sections sized to permit passing through restricted areas in the building. Provide on-site service to oversee the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the Engineer's approval. Certify that field wiring associated with equipment is installed in accordance with best industry practice.
- I. Installation of fiber optic cable within control panel and console assemblies. Refer to cable manufacturer's specifications for bend radius. Use cable breakout assembly as recommended by the cable manufacturer. Provide wire basket, strain relief as required to meet manufacturer's strain requirements.

- J. Provide local electrical shutoffs and disconnects for all 4-wire field instruments requiring 120 VAC power. Electrical disconnects shall be suitably rated disconnect switches or manual motor starters as specified under Division 26, Electrical.
- K. Provide sunshades for equipment mounted outdoors in direct sunlight. Sunshades shall include standoffs to allow air circulation around the cabinet. Orient equipment outdoors to face to the North or as required to minimize the impact of glare on LED, LCD, or other digital readouts.
- L. Loop Tuning - All electronic control stations incorporating PID controllers shall be tuned following device installation but prior to commencement of the field tests.
 - 1. Optimal loop tuning shall be achieved either by auto-tuning software or manually by trial and error, Ziegler-Nichols step-response method, or other documented process tuning method. Assigning common PID factors for identical loops following field tuning of a single typical loop is acceptable.
 - 2. Determine and configure optimal tuning parameters to assure stable, steady state operation of final control elements running under the control of field mounted, dedicated PID controllers or software based PID controllers residing as part of the programmable logic controller system. Each control loop that includes anti-reset windup features shall be adjusted to provide optimum response following startup from an integral action saturation condition.
 - 3. Tune all PID control loops to eliminate excessive oscillating final control elements. Loop parameters shall be adjusted to achieve 1/4 amplitude damping or better. In addition, loop steady state shall be achieved at least as fast as the loop response time associated with critical damping.
 - 4. Loop performance and stability shall be verified in the field following tuning by step changes to setpoint. Submit loop tuning methodology and verification as part of the final system documentation as specified in Part 1.
 - 5. For cascade loops, tune both sets of controllers so that the cascade loop achieves the loop tuning characteristics specified herein

++ END OF SECTION ++

SECTION 40 61 96**PROCESS CONTROL DESCRIPTIONS****PART 1 - GENERAL****1.1 SCOPE OF WORK**

- A. Develop the control system applications to implement the operational control descriptions for the systems specified in Part 3. All SCADA PLC controller programming and SCADA Operator Interface Terminal (OIT) or Operator Workstation Station (OWS) graphics and programming shall be furnished by the owner's representatives, APCO Inc. This section is provided to clarify control strategies to be used to program the system. APCO will not program any vendor PLC and or OWS equipment but, shall integrate all vendor systems to insure a fully functional facility that will network and communicate with the existing plant control system (SCADA).

1.2 RELATED WORK

- A. Refer to the specific system Process and Instrumentation Drawings (P&IDs).
- B. Refer to specifications on major equipment and vendor package systems.
- C. Refer to electrical design documents for power coordination and distribution.
- D. Refer to electrical loop diagrams.
- E. Specific system functional control descriptions.

1.3 DEFINITIONS**A. List of Terms**

HMI	human machine interface
LCP	local control panel
LOR	local-off-remote
MCC	motor control center
P&IDs	process and instrumentation diagrams
PLC	programmable logic controller
SCADA	supervisory control and data acquisition
VFD	variable frequency drive

- B. All elevations are stated in feet above mean sea level.
- C. The following list of ISA abbreviations is typical of those utilized. The description, following the abbreviation, summarizes the basic function to be implemented in the SCADA PLC/OWS software.

1. HS: Represent selector switches or pushbuttons, which shall be implemented by keyboard entry. Function shall be similar to their hardware counterparts. Examples are as follows:
 - a. HSH- Open Command
 - b. HSL- Close Command
 - c. HSS-Start/Stop Command
 2. YI: Represents equipment status (i.e., availability, running, in remote, etc.) implemented by a change of color on the OWS symbol for this equipment. For motor driven equipment such as pumps, blowers, compressors, etc., availability contact represents remote operation and no alarm conditions. Examples are as follows:
 - a. YCI-Selector switch in computer, auto or remote position
 - b. YRI-Motor running status
 - c. YFI- Motor failure or overload status
 - d. YMI- Selector switch in maintenance position
 3. PAL, AAH, UA, etc.: Represent high or low alarms implemented on the OWS.
 4. FIC, PIC, AIC, etc.: Represent PID process controllers implemented in a computer logic algorithm incorporating proportional, integral, and/or derivative modes. Local/remote and manual/auto capabilities shall be provided.
 5. FIK, PIK, AIK, etc.: Represent control stations implemented in logic (via keyboard entry and CRT display) to allow downloading of a set point to a FIC, PIC, AIC, etc., and display of the process variable or controller output.
 6. FI, PI, AI, etc.: Represent digital output display on the CRT of a process variable in engineering units and/or a dynamic representation of the variable by symbol or graphical means.
 7. FIR, PIR, AIR, Represent values stored on the hard disk to provide the data for historical trend graphics of process variables against time (or other selected variables).
 8. ZSH, ZSL etc.: Represent high or low, open or close limit positions implemented on the OWS
- D. Any interlocks that are represented, before the local operational descriptions, or are stated as hardwired interlocks, shall interlock all the controls locally and at the SCADA PLC/OWS or at the vendor PLCs. The SCADA PLC shall be programmed to shutdown that equipment if that hardwired interlock is also wired to the SCADA PLC.
- E. Any interlocks that are represented in a particular layer of the operational descriptions, shall interlock all the controls in that layer and the layer after it. However the interlock shall not interlock the commands in the layer before it.
- F. The SCADA system shall stop a motor or drive in its program if it does not receive the auto or remote status or one of its software interlocks trip. If the drive or motor is in hand or remote it will continue to run but the SCADA start/stop output will be open.
- G. Any motor that is requested to start by an operator or an automatic program shall alarm if the run confirm status for that motor does not activate within two seconds. If a motor stops by an interlock or stops without any operator or SCADA intervention then that motor shall go into alarm. Any motors that are stopped by a program or the operator shall not go into an alarm.

- H. Any valve that is requested to open by an operator or an automatic program shall alarm if the open feedback status for that valve does not activate within ten seconds. Any valve that is requested to close by an operator or an automatic program shall alarm if the close feedback status for that valve does not activate within ten seconds.
- I. Motors that have an H/O/A shall alarm the operator that the pump is being run in the "Hand" position. A pump is being run in "Hand" when the "Auto" position is not true at the OWS and the run confirm status is true at the OWS. If not in "Auto" the SCADA PLC shall open up its output contact to stop (shutdown) the pump from SCADA.
- J. Pump motors shall be programmed to restart on normal power if that motor is still in auto when the motor stops due to a power outage. If a motor stops and the HOA switch is not in auto, the motor shall not be restarted automatically by the SCADA system without operator or SCADA logic intervention. Thus, the only way that motor when placed back in auto can be started by the SCADA system is if the operator reinitiates the start command for that motor on the OWS or when that motor control at the OWS is placed in complete automatic mode and the SCADA computer through logic/interlocks requests the motor to run.
- K. Terminology associated with interlocks is as follows:
 - 1. When a contact or status is true, the SCADA computer will receive power to its input channel. The SCADA computer registers this as a binary bit of one.
 - 2. When a contact or status is false, the SCADA computer will receive no power (open circuit) to its input channel. The SCADA computer registers this as a binary bit of zero.
- L. When an analog signal goes outside the 4-20 mA range due to a failure at the instrument or PLC card, the following SCADA programming shall take place:
 - 1. If the analog signal is associated with a control loop or ratio control loop that loop shall go into manual.
 - 2. If the analog signal is used in a calculation, that calculation shall use the last good analog signal. The computer shall place the control loop in manual if using the calculation.
- M. All high analog alarms shall be initially programmed to trip at 90 % of range. All low analog alarms shall be initially programmed to trip at 10 % of range.
- N. All interlocks that shutdown (Stop a piece of equipment and prevent it from being restarted or moved) shall be shown on the faceplate pop-up graphic for that piece of equipment.
- O. All alarm interlocks shall be wired failsafe to the discrete input cards and thus shall be programmed as fail-safe. A fail-safe alarm is input that opens when it is in alarm.
- P. The run confirms or on status of all motors and lamps shall be accumulated to get a run time status of the equipment on the OWS graphic. Each run time accumulation shall come with a reset button on the OWS screen.
- Q. All motor driven equipment with alarm indication of faults, which are not automatically reset by manufacturer's recommendations and design, shall have local

and PLC output reset commands to acknowledge alarms once service or conditions allow for reactivation of service.

- R. The severity of alarms is defined for the purpose of this document as follows:
1. Level 1 (Emergency): Reserved for fire system alarms only. Fire call-out initiated followed by operator call-out.
 2. Level 2 (Critical): For alarms that require immediate action and initiates operator call-out.
 3. Level 3 (Urgent): For alarms that require action within a limited time period (less than an hour) and initiates operator call-out.
 4. Level 4 (Warning): For alarms that do not require immediate action, no call-out initiated.
 5. Level 5 (Routine): Event only, no call-out initiated.

1.4 SUBMITTALS

- A. Shop Drawings
1. Process Descriptions shall be developed by the Manufacturer and submitted for all process sequences including:
 - a. Start Up
 - b. Overall Plant Flow and Unit coordination
 - c. Shut Down
 - d. Other applicable control sequences.
- B. Develop detailed loop descriptions based on the information in the Contract Documents, and submit as specified in Division 1, Division 26 and Division 40.
1. For each control loop, provide a detailed functional description of the operation of the equipment, signals, and controls shown on the P&IDs:
 - a. Include all functions depicted or described in the Contract Documents.
 - b. Include the following within each loop description:
 - 1) All requirements specific to that loop.
 - 2) Common control requirements applicable to that loop.
 - 3) List of all ranges, setpoints, timers, values, counters, etc.
 2. Where there are similar loops with identical control only 1 loop description need be developed and the remaining loops may reference that loop description as denoted by the wording "typical of."
- C. Loop description format:
1. Loop number and title.
 2. References:
 - a. List P&IDs that are specifically referenced.
 3. Abstract:
 - a. General description of how the loop works, what devices are involved, and how the process will be controlled.
 - b. Process values, setpoints, and limits, including units and ranges:
 - 1) Show span and range values for analog inputs and outputs, and operating point and deadband for discrete inputs.
 4. Hardwired control:

- a. Detailed description of the control functions at the local level.
- b. Function of local operator interfaces.
- c. Operation of hardwired field pilot controls:
 - 1) Pushbuttons.
 - 2) Selector switches.
 - 3) Potentiometers.
 - 4) Pilot lights, indicators, and other displays.
5. Hardwired interlocks:
 - a. Explanation of the operation of system interlocks and hardwired permissive conditions.
6. PLC control:
 - a. Detailed description of the control functions that are under control of the PLC.
 - b. Operator controls and automatic controls.
 - c. Setpoints, alarms, etc.:
 - 1) Include units and ranges for analog values.
 - 2) Include span and range for analog inputs and outputs.
 - 3) Include operating point and deadband for discrete inputs, and identify conditions where contacts are open, and when they close.
 - d. Control sequences.
7. Software interlocks:
 - a. Operation of system software interlocks.
8. HMI control:
 - a. Detailed description of the operator controls.
9. SCADA control:
 - a. Detailed description of the operator controls.
 - b. Setpoints, alarms, etc.
10. Indicators and alarms:
 - a. List any indicators and alarms specific to the loop that are not covered in the common control strategies.
11. Failure modes:
 - a. List any failure modes specific to the loop that are not covered in the common control strategies.

1.5 SPECIAL CONSIDERATIONS

- A. Trending is to be provided for all instruments provided in this project. Programming and transmitters shall be selected accordingly.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

- A. The control narrative for systems shall include
 1. Loop number and title

2. References such as P&IDs and vendor documents
 3. Abstract
 - a. General description of how the loop works, what devices are involved and intent of process control
 - b. Control
 - 1) Local Controls
 - 2) Master control panels, typically furnished by vendors
 - 3) MCC/VFD controls
 - 4) Hardwired interlocks
 - 5) PLC controls
 - 6) SCADA
 - 7) Software interlocks
 - c. Alarms and monitoring
- B. Control narratives will be furnished for:
1. 40 61 96.13 I&C-Control Description-Washwater Pumps and Washwater Equalization Tank

++ END OF SECTION ++

SECTION 40 68 66

PROGRAMMING AND CONFIGURATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all programming, configuration, and related services required to achieve a fully integrated and operational system as specified herein. All equipment shall be in accordance with the contract drawings, process control descriptions, specifications, engineering data, instructions, and recommendations of the equipment manufacturer. Coordinate the control system for proper operation with related equipment and materials furnished by other suppliers under other Sections of these specifications and with related existing equipment.
 - 1. Provide programming, configuration, and integration for a complete communications network, including fiber optic, Ethernet, and other communications systems shown on the drawings. Programming services shall include all hardware such as servers, programmable logic controllers, and human- machine interface devices.
 - 2. Provide configuration of the PLCs provided as shown on the drawings, except for controls equipment shown being provided as part of a vendor package system.
 - 3. Provide configuration of the HMI System Software, Operator Interface Terminals, and drivers provided for all equipment shown on the drawings, including equipment provided by vendor package systems.
 - 4. Provide configuration of the SCADA Historian Software.
 - 5. Provide configuration of system reports using the Reporting Software provided.
 - 6. Provide for and test communications and functionality between all networked devices and the HMI software packages, including devices supplied by others, as depicted on the network diagrams.
- B. All work shall be coordinated with plant operating personnel to minimize impacts on daily operation.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit standards and conventions that will be used on this project. The submittal shall define, at a minimum:
 - a. Graphic display standards, including color conventions, equipment symbols, display format, equipment control pop-up displays, trend displays, and display navigation. Include samples of each proposed type of graphic display (i.e. overview, detail, diagnostic, tabular, etc.)
 - b. System naming conventions, such as graphic displays naming, database naming, tag names, and computer naming.
 - c. System configuration, including network addressing and PLC/RTU addressing
 - d. Alarm configuration standards, including priorities and logging
 - e. Security configuration standards, including user groups and privileges
 - f. PLC/RTU standard programming modules, including analog input scaling, flow totalization, equipment runtime, motor start/stop, valve open/close, and any other standard logic planned to be used.

40 68 66-1

Programming and Configuration

Washwater Equalizer Tank Replacement Project

2. Following the approval of the standards and conventions submittal, submit a draft of all proposed graphic displays, examples of each type of pop-up (faceplate) displays, and examples of trends. For those graphics which will be duplicated more than once for similar type of equipment, submit the graphics for the first equipment only.
 3. Submit the following for each controller using the controller manufacturer's built in printing functions. Review will be for general program organization, level of documentation, and overall programming standards (basic pump and valve control, for example). The review will not attempt to confirm the logic works correctly for every loop.
 - a. PLC programs showing ladder logic, function block, high level language or other controller language used. Include individual rung, network, and/or command descriptions with abundant comments to clearly identify function and intent of each code segment.
 - b. Submit a memory usage report for the controller. This report shall indicate total memory capacity and unused memory capacity.
 4. Submit details of control system communication. Submit a "memory map" or other means showing which signals are exchanged between PLCs. Also submit a HMI tag database showing all signals exchanged between the PLCs and HMI. Any specific communication block memory addresses shall be defined.
 5. submit historical data management system data including the following:
 - a. A complete listing of all signals to be collected and stored. This listing shall include data sampling rate and duration for which the data will be immediately accessible. Provide trending for all analog values.
 - b. Storage space requirements and supporting calculations.
 - c. Description of methodology for restoring data collected locally during times that the historical data management system is not available. Description of database failure and recovery, including data correction.
 6. List of data source interfaces to be used with the system (for example, OPC, file collection, historian-historian collector, HMI applications, etc.)
 7. Submit the reports generation system information including the following:
 - a. A complete list of all reports to be developed.
 - b. A complete listing of all signals to be reported, including calculated values.
 - c. Procedures for recall, generation and printing of reports
 8. Printout of each report to be provided with details of each cell, where data comes from, and calculation of raw data.
- B. O&M Manuals
1. Provide Operator's Manuals prior to final acceptance of the system.
 2. These manuals shall contain all information necessary for the operator to monitor and control the plant from the control system. The manuals shall be organized for quick access to each detailed description of the operator's procedure. Manuals shall contain the following information:
 - a. A comprehensive table of contents of the manual.
 - b. A simple overview of the entire system indicating the function and purpose of each piece of equipment.
 - c. A detailed description of the operation of the HMI and OIT including all appropriate displays. Including a screenshot of each HMI and OIT display screen and annotating each function in text is an acceptable format for presenting this information.

- d. Step-by-step procedures for starting up or shutting down an individual component of the control system and also of the entire system.
- e. Login / logout procedures.
- f. Complete, step-by-step procedures for printing reports and entering manual data.
- g. Complete, step-by-step procedures for performing system or selected file backup and restoration including archiving historical data. Include recommended archiving schedule for historical data.
- h. Operational description for operating HMI computer equipment and peripherals including printers, CD-ROMs, removable bulk storage devices, UPS, etc. Description shall include procedures for typical maintenance and troubleshooting tasks.
- i. A complete glossary of terms and definition of acronyms.

1.3 MEETING AND WORKSHOPS

- A. Schedule and conduct a standards and conventions workshop. The purpose of this workshop shall be to review the standards, conventions, and methodologies that will be used to program and develop the programs (i.e., HMI and PLC databases, HMI graphics, and PLC programming, etc.) and will solicit ENGINEER and OWNER's input. Submit an agenda with examples for items to be discussed at a client workshop.
- B. Schedule and conduct a programming and graphics review meeting. The purpose of this meeting shall be to present the developed draft program, graphics, alarming, historian, and reporting for the OWNER's and ENGINEER's review and feedback prior to creating the full set of graphics and reports for review. For repetitive graphics such as graphics for multiple process trains, include an example of the first graphic only for discussion. Include discussion of process and overview displays, examples of pop-ups, trends, and system navigation tools. Expect major comments and incorporate any changes resulting from those comments.
- C. Schedule and conduct a factory testing coordination meeting two weeks prior to factory testing. The purpose of this meeting is to discuss the specifics of the proposed tests and to provide a forum for coordinating the required factory testing.
- D. Schedule and conduct a field-testing coordination meeting two weeks prior to field testing. The purpose of this meeting is to discuss the specifics of the proposed tests and to provide a forum for coordinating the required field-testing.

1.4 WARRANTY

- A. Provide telephone technical support within 4 hours of warranty claim. If failure cannot be resolved by telephone, provide onsite technical support within 24 hours of warranty claim.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. The system shall function as indicated on the contract drawing, including P&IDs, the control descriptions in the specifications, and as required to interface with vendor provided equipment.
- B. Perform calculations, proportional-integral-derivative (PID) feedback control. Sequencing, data collection and storage, trending, alarming, and operator interface controls as indicated and required.
- C. Perform diagnostics and reporting. PLC system diagnostic screens, showing the operational status, and fault conditions of all PLC components, including processors, I/O modules, OIT's, power supplies and UPS units.
- D. Communications diagnostic screens, showing the details of network status, communications status of all major components including Operator Work Stations, peripheral devices and network components.
- E. Provide graphical user displays for all data and interface information.
- F. All data points shall be graphically displayed to indicate pump running, trouble, analog values, setpoints, etc.
- G. Applications programs shall be structured such that the logic progresses in an intuitive manner that may be followed by technical plant staff with basic programming knowledge.
- H. Graphic displays shall continuously update the displayed process variables, date and time of day. All process values shall be displayed in engineering units. All displays shall incorporate references to both instrumentation tag numbers and plant equipment numbers.
- I. Operator commands controlling field devices shall require multiple keystrokes or mouse actions to protect against inadvertent operations. The operator shall receive confirmation of the selected point to be controlled, at which time a cancellation of the control can be affected.
- J. Graphic displays shall be based on the P&ID's, site plan drawings, mechanical drawings and electrical drawings included in these Contract Documents.
- K. Main graphical screens shall include a title bar, main graphic area, navigational buttons, and alarm summary bar. Title bar shall be displayed on the top of each screen and include display name, description and time/date. The main graphical area shall contain primary screen data in graphical format. Navigational buttons shall include a minimum

of main menu, trends, main alarm summary, and security log in. The alarm summary bar shall display the last three valid alarms on the bottom of each screen.

- L. Individual treatment process screens shall graphically screen key process variables and equipment. No operator entries shall be done from these screens. Individual process flow screens for each process shall include all process components, including tanks, pumps, blowers, mixers, drives, flow meters, valves, mechanical devices, as well as manual shutoff and isolation valves. These diagrams shall be generally depicted from the P&ID's and there shall be at least 1 screen per P&ID on average.
- M. Individual unit process screens depicted from the P&ID's are used for control and screen of each major item of process equipment, process variables, and control devices, including pumps, blowers, valves, gates, mixers, drives etc. Navigational buttons shall consist of the P&ID's flow arrows to other individual unit processes. The unit process screens shall provide the ability for the operator to go to individual equipment popup screens. These diagrams shall be generally depicted from the P&ID's and there shall be at least 2 screens per P&ID on average.
- N. Popup screens shall be provided for each piece of equipment to start/stop equipment, open / close valves, implement automatic control, adjust set points, establish and adjust tuning parameters, set alarm limits and initiate a sequence.
- O. Animations shall be provided to indicate level changes in tanks or vessels. Valve colors shall change when opened and closed.
- P. All timers, setpoints, alarm actuation levels, etc., shall be adjustable from the operator interface.
- Q. Trend screens with the capability to screen up to eight, operator assigned, analog and/or digital process variables. Each analog value will be shown on a trend screen.
- R. Maintenance screens shall screen the raw value for each analog and digital I/O point in the system. They shall also allow the operators/maintenance personnel to enter an override value for an analog point that is then used by the system instead of the value read from the input card / communications link.
- S. The equipment status shall be logged whenever a change in status occurs (i.e., start, stop). The equipment status log shall include the time, equipment name, tag number, and the particular change in status. All process analogs and all flow totals and run time indications of all primary process equipment motors shall be sampled and stored in the historical data management system.
- T. Manual Input Data Handling: This data shall consist of additional values not obtainable by the system such as laboratory analysis for use in reports. All manually entered data shall be entered and stored in the appropriate engineering units. All data entered shall be displayed for confirmation on the display prior to incorporation to the database.
- U. Alarm conditions shall report to the operator workstation, actuate an audible alarm, and provide a visual blinking image on the associated graphic page. All alarms and events should be displayed on the screen and archived. The alarm log shall display all alarms as they occur. The alarm message shall include the time of occurrence, tag name, tag

number, and whether it is a low, high, or failure alarm. When the point in alarm returns to normal, the time, point identification number, and return to normal shall be displayed. All reports shall include the plant equipment number of the associated device.

- V. Main alarm summary screen shall screen the following information on each alarm: Time, tag name, description, alarm type, current value and status. An acknowledge alarm button shall acknowledge all new unacknowledged alarms. The acknowledged and unacknowledged alarms shall be different colors. Acknowledged alarms shall clear automatically after the condition is corrected.
- W. The system shall be configured and implemented with security to prevent unauthorized access. The system shall allow authorized changes to system operation through defined user accounts and password verification.

3.2 REPORTS

- A. Quantity and format of reports shall be coordinated with the owner and as a minimum shall include shift, daily, monthly and yearly reports.
- B. The system shall be able to generate reports from on-line historical data files or prompt the user for the appropriate archived data files.
- C. Reports shall be initiated automatically based upon time of day or manually upon operator request.
- D. User interface displays for report generation shall be developed with easy recall of reports by entering time:day:year target values.
- E. User interface displays shall allow the operator to define the destination of the report (e.g., display, printer, computer file, etc.) and when it is to be printed (e.g., immediately, on demand, or automatically at a specified time).
- F. It shall be possible to print quality tags alongside the value.
- G. Values for which there are no data available shall be identified with a special character. Thus, only values which are actually zero shall be printed as such.
- H. Operational Report Types. The following operational report types shall be provided with the system:
 - 1. Shift Operation Summary Report:
 - a. An operator-adjustable time interval shift operation report shall summarize plant operation from the start and finish time of operation.
 - b. The report format shall consist of the following: correct date, plant name, report name, page number, group headings, subheadings, point identification, and engineering units.
 - 2. Daily Operation Summary Report
 - a. The daily operation report shall summarize plant operation for the previous day. The printed information shall be the stored values (not averages) including scanned, lab, and manually entered data.

- b. The report format shall consist of the following: correct date, plant name, report name, page number, group headings, subheadings, point identifications, and engineering units.
 - c. The daily minimum, average, maximum, and total where applicable shall also be calculated and printed for each point and stored.
- 3. Monthly Operation Summary Report:
 - a. The monthly operation summary report shall summarize plant operation for the previous calendar month.
 - b. The report format shall be arranged so that the first several pages shall conform to the requirements of the state regulatory agencies and may be separated from the rest of the monthly operation report for transmittal to the regulatory agency.
 - c. The report format shall be similar to the daily operation summary report and shall consist of the following: month and year, plant name, report name, page number, group headings, sub-headings, point identifications, and engineering units.
 - d. Monthly minimum, average, maximum, and totals, where applicable, shall also be printed for each column of points printed.
- 4. Annual Operation Summary Report:
 - a. The annual operation summary report shall summarize plant operation for the previous calendar year. The report shall consist of scanned data, lab data, and manually entered data.
 - b. The format of the report shall be identical with the monthly operation summary report except for replacing month with year in the heading and replacing date with calendar month.

3.3 SECURITY

- A. The system shall be configured and implemented with security to prevent unauthorized access on accordance with OWNER requirements.
- B. Security levels of "display only", "operator mode", "supervisor mode", and "engineer mode" shall be available through assignable passwords. On system startup, the "display only" security level shall automatically be entered. In the "display only" mode, information is available to be displayed on the screen but no changes may be made. In the "operator mode", changes may be made to process set points, times, etc.; however, the overall control concepts may not be modified. In the "supervisor mode", all operator functions can be modified and any special reports or critical process set points (data can be modified; however, the overall control concepts may not be modified). In the "engineer mode" level, all user modifiable parameters of the system shall be available for modification.
- C. Coordinate with Owner user account information, including login name and password for each account.

3.4 TESTING

- A. Prior to leaving the site, use the OWNER's programming computer to monitor all PLC processors online, make on-line changes, upload and download the processor to ensure programming software version compatibility.

3.5 TRAINING

- A. Provide Control System seminar for the OWNER's personnel at the OWNER's facility. The seminar shall provide personnel with an overview understanding of the Control System. All aspects of the programming and graphics as described above shall be covered in the seminar. The seminar material shall be targeted to the OWNER's management, engineering, and other non-operations personnel.
- B. A minimum of 4 days of operator training shall be held. Provide a complete seminar outline and material for approval.

++ END OF SECTION ++

SECTION 40 70 03

PROCESS CONTROL SYSTEM PRIMARY SENSORS AND FIELD INSTRUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
 - 1. Provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, adjust, commission and place into satisfactory operation all primary sensors and field instruments furnished under this Section.
 - 2. Contract Documents illustrate and specify functional and general construction requirements of the sensors and field instruments and do not necessarily show or specify all components, wiring, piping and accessories required to make a completely integrated system. Provide all components, piping, wiring, accessories and labor required for a complete, workable and integrated system.
- B. Refer to the Process Control System Instrument Index specification section in these specifications for additional information on each instrument.
- C. Coordinate the installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems. Refer to installation details in the contract documents.
- D. Instrument must be rated for the environment in which it is installed. Refer to hazardous location drawings in the contract documents. If instrument is not available in the appropriate rating, provide an intrinsically safe barrier relay in a suitably rated enclosure.
- E. Probes and all wetted parts shall meet the requirements shown in the Materials of Construction for Wettable Parts table below and as modified by the Process Control System Instrument Index.
- F. Transmitters
 - 1. Provide multiparameter transmitters where indicated in the Process and Instrumentation Diagrams (P&IDs) and Process Control System Instrument Index.
 - 2. All 120Volt instruments shall include a separate 120V, 1Pole, 20A disconnect switch mounted adjacent to the transmitter.

1.2 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. Furnish primary sensors and field instruments by the named manufacturers.
 - 2. Obtain all sensors and field instruments of a given type from the same manufacturer.
- B. Manufacturers' Responsibilities and Services:
 - 1. Design and manufacture the primary sensors and field instruments in accordance with the detailed Specifications herein.

40 70 03-1

Process Control System Primary Sensors and Field Instruments

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

2. Field supervision, inspection, and start-up.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Primary sensors and field instruments shall not be delivered to the site until all product information and Shop Drawings for the sensors and instruments have been approved by ENGINEER.

1.4 SUBMITTALS

- A. Comply with the requirements specified in Section 40 90 00, Process Control System General Requirements.

1.5 CHEMICAL SERVICE

- A. Where a primary element is designated for chemical service, all wetted components and appurtenances for that primary element shall be resistant to corrosion by that chemical. Chemicals referred to commonly as "caustic", "sodium hypochlorite", "hydrochloric acid", "ferric chloride", and "methanol" shall mean the following:
1. "CAUSTIC": Sodium hydroxide (NaOH), 50 percent solution, Specific Gravity = 1.53.
 2. "SODIUM HYPOCHLORITE": Sodium Hypochlorite (NaOCl), 15 percent solution, Specific Gravity = 1.23.
 3. "HYDROCHLORIC ACID": Hydrochloric Acid (HCl), 38 percent solution, Specific Gravity = 1.4.
 4. "FERRIC CHLORIDE": Ferric Chloride (FeCl₃), 43 percent solution, Specific Gravity = 1.46.
 5. "POLYMER": Polymer Solution, 0.2 to 0.5 percent solution, Specific Gravity = 1.00.
 6. "METHANOL": Methanol (CH₃OH), 99 percent solution, Specific Gravity = 0.792.

1.6 MATERIALS OF CONSTRUCTION

- A. Provide the following materials of construction for primary sensors and field instrument parts that come in contact with the following list of process fluids, except as specifically noted in the Process Control System Instrument Index:

PROCESS FLUID	ELASTOMER	METAL	PLASTIC	SEALS, OTHER
Air	Viton, EPDM, Neoprene	Type 316 SS	PFTE, PVC	Carbon, Ceramic
Alum	Buna-N	Type 316 SS	CPVC	Carbon, Ceramic
Ammonia	Buna-N	Type 316 SS	PFTE PVDF	Carbon
Carbon	Buna-N	Type 316 SS		
Chemical Sump Drainage	Viton	Type 316 SS	Teflon Polypropylene	

40 70 03-2

Process Control System Primary Sensors and Field Instruments

Washwater Equalizer Tank Replacement Project

PROCESS FLUID	ELASTOMER	METAL	PLASTIC	SEALS, OTHER
Chlorine Gas or Liquid	Viton	Hastelloy C, Monel, or Tantalum	Wet – PTFE, Vinylester, Halar (ECTFC) Dry – CPVC, PVDF, Halar (ECTFC)	Carbon
Citric Acid	Viton	Titanium, Hastelloy C	PVDF CPVC	Carbon, Ceramic
Digested Sludge / Centrate	EPDM	Type 316 SS	Viton	Carbon, Ceramic
Digester Gas	Viton	Alloy C276 Type 316 SS	CPVC	Carbon, Ceramic
Ferric Chloride	Viton, EPDM	Tantalum	PTFE Polypropylene	Ceramic
Fluoride	Viton	Hastelloy C	PTFE PVDF	
Foul Air	EPDM Neoprene	Type 316 SS	CPVC, PTFE, PVDF	Carbon, Ceramic
Glycerine Oil	Neoprene Viton Buna-N	Type 316 SS	Teflon Polypropylene PVC/CPVC	Carbon, Ceramic
Halocarbon	Neoprene	Type 316 SS	PTFE	
Hydrochloric Acid	Viton	Tantalum Zirconium Platinum	Teflon	Ceramic
Lime		Type 316 SS	PTFE CPVC	Type 316 SS
Magnesium Chloride	Viton EPDM Buna-N	Type 316 SS	PVDF CPVC	Type 316 SS
Mixed Liquor	Viton	Type 316 SS	PTFE Polypropylene	
Methanol	EPDM	Type 316 SS	PTFE	Carbon, Ceramic
Non Potable Water	Neoprene	Type 316 SS	PTFE	Ceramic
Odor Control Scrubber Solution	EPDM Viton	Platinum	Teflon Tefzel	Ceramic
Polymer	Buna-N	Type 316 SS		
Potassium Permanganate	Viton	Carpenter 20		
Primary Effluent / Screened Primary Effluent	Viton	Type 316 SS	CPVC PVDF Polypropylene	Carbon, Ceramic

40 70 03-3

Process Control System Primary Sensors and Field Instruments

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098March 2024
Bid Documents

PROCESS FLUID	ELASTOMER	METAL	PLASTIC	SEALS, OTHER
Primary Sludge / Scum	Viton	Type 316 SS	CPVC PTFE Polypropylene	Carbon, Ceramic
Process Air				
Raw Sewage	Viton	Type 316 SS	CPVC PTFE Polypropylene	Carbon Ceramic
Sodium Chloride			Teflon	
Sodium Hydroxide	EPDM, Neoprene	Hastelloy B Zirconium Platinum	Teflon Polypropylene PVC/CPVC	Ceramic
Sodium Hypochlorite	Viton	Hastelloy C Tantalum Titanium Platinum	Teflon PVC/CPVC Kynar	Ceramic
Silicone Oil	Viton Buna-N	Type 316 SS	Teflon Polypropylene	
Sludge (RAS/WAS/Struvite Precipitated)	Neoprene Buna-N	Type 316 SS	PTFE	Ceramic

1.7 IDENTIFICATION TAGS

- A. All sensors and field instruments shall have an identification tag as indicated in the contract documents.

1.8 SUNSHADES

- A. Instruments and analyzers installed outdoors shall be firmly supported and protected by sun / rain shades, as specified or shown on DRAWINGS.
1. Product and Manufacturer: Provide one of the following:
 - a. Obrien – VIPAK
 - b. Alumaline
 - c. Or Equal

PART 2 - PRODUCTS

2.1 PROCESS TAPS, SENSING LINES AND ACCESSORIES

- A. Water Pressure Sensing Lines and Accessories for Flow and Pressure Transmitters:

40 70 03-4

Process Control System Primary Sensors and Field Instruments

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

1. Material: Type 316 stainless steel; .049 wall thickness.
 2. Pressure Rating: 250 psi or as specified Process Control System Instrument Index.
 3. Size: 1/2-inch outside diameter or as shown on the Drawings.
 4. Connections: Type 316 stainless steel compression type, "Swagelok"
 5. Product and Manufacturer: Provide one of the following:
 - a. Crawford "Swagelok"
 - b. Or engineer approved equal
 6. Shut-off Valves:
 - a. Type: Full port ball.
 - b. Pressure Rating: 250 psi unless specified differently in the Process Control System Instrument Index.
 - c. Body, Ball and Stem: Type 316 stainless steel unless specified differently in the Process Control System Instrument Index.
 - d. Packing: High Density TFE.
 - e. Handle: Nylon with metal travel stops.
 - f. Support Rings: Stainless steel.
 - g. End Connections: Removable "Swageloks".
 - h. Product and Manufacturer: Provide one of the following:
 - 1) 45 Series, as manufactured by Whitey
 - 2) Or engineer approved equal
 7. Manifolds:
 - a. Type: Five valve and three valve meter manifolds.
 - b. Materials: Type 316 stainless steel body, bonnets and stems, delrin seats, Teflon packing.
 - c. Product and Manufacturer: Provide one of the following:
 - 1) Whitey.
 - 2) Anderson-Greenwood
 - 3) Or engineer approved equal
- B. Air Pressure Sensing Lines and Accessories for Air Flow/Pressure Transmitters:
1. Material: Type 316 stainless steel tubing, ASTM A 269, .049 wall thickness.
 2. Pressure Rating: 250 psi unless specified differently in the Process Control System Instrument Index .
 3. Size: 1/2-inch outside diameter or as shown on the Drawings.
 4. Connections: Type 316 stainless steel compression type "Swageloks."
 5. Product and Manufacturer: Provide one of the following:
 - a. Crawford
 - b. Or engineer approved equal
 6. Shut-off Valves:
 - a. Type: Full port ball.
 - b. Pressure Rating: 250 psi unless specified differently in the Process Control System Instrument Index .
 - c. Body, Ball and Stem: Type 316 stainless steel unless specified differently in the Process Control System Instrument Index .
 - d. Packing: High density TFE.
 - e. Handle: Nylon with metal travel stops.
 - f. Support Rings: Stainless steel.
 - g. End Connections: Removable "Swageloks"
 - h. Product and Manufacturer: Provide one of the following:
 - 1) 43 Series, as manufactured by Whitey

- 2) Or engineer approved equal
7. Manifolds:
 - a. Type: Five valve and three valve meter manifolds.
 - b. Materials: Type 316 stainless steel body, bonnets and stems, delrin seats, teflon packing.
 - c. Product and Manufacturer: Provide one of the following:
 - 1) Whitey
 - 2) Or engineer approved equal
- C. Pressure Tap Sensing Lines and Accessories for Pressure Gages and Pressure Switches:
 1. For Process Sensing Taps in Ductile Iron, Steel and Stainless Steel Piping Systems:
 - a. Material and Fittings: Type 316 stainless steel pipe (ASTM A 312) and threaded fittings and adapters (ASTM A 403).
 - b. Sizes: 1/2-inch minimum for main sensing piping and 1/4-inch gage and switch connections or as shown on the Drawings.
 - c. Pressure Rating: Equal to or greater than the applicable system test pressure.
 - d. Accessories:
 - 1) For applications not requiring diaphragm seals, provide separate 1/4-inch Type 316 stainless steel threaded gage cocks for each gage and switch. Review Process Control System Instrument Index for alternative materials of construction.
 - 2) For applications requiring diaphragm seals, provide a separate 1/2-inch threaded Type 316 stainless steel ball valve for seal process side shutoff for each gage and switch. Review Process Control System Instrument Index for alternative materials of construction.
 2. For Process Sensing Taps in Copper and Thermoplastic Piping Systems:
 - a. Pipe Material and Fittings: Use same type of pipe material and fittings as that used in the process piping system.
 - b. Sizes: 1/2-inch minimum for main process sensing piping and for gage and switch connections.
 - c. Pressure Rating: Equal to or greater than the applicable system test pressure.
 - d. Accessories:
 - 1) For copper piping system taps with or without seals, provide a separate 1/4-inch minimum threaded brass or bronze gage cock for each gage and switch.
 - 2) For CPVC piping systems with or without diaphragm seals, provide a separate 1/2-inch threaded ball valve for process sensing line shutoff for each gage and switch.

2.2 INSTRUMENTATION

- A. General
 1. Housing: Material as indicated in the Provide enclosure with transparent vision panel for viewing the indicator and controls and equipped with brackets to allow for mounting as specified and as shown in the mounting details in the contract documents.
 2. Ranges shall be as indicated in the Process Control System Instrument Index and as modified in the individual instrument specification sections.
 3. Electrical Power supply requirement shall be 120 VAC $\pm$ 10 percent, 60 Hz $\pm$ 3Hz or 12 to 28 VDC with surge and lightning protection as indicated in the Process Control System Instrument Index.

B. LEVEL TRANSMITTER – RADAR NON-CONTACT TYPE

1. Type: Non-contact system using an antenna horn to send either continuous microwave frequency signals, i.e. Frequency Modulated Continuous Wave or short pulsed microwave signals. Transmitter shall generate and calculate the time of the signal wave, transmitted and received, which is directly proportional to the distance traveled. Transmitter shall then convert the distance into an analog output signal linearly proportional to level.
2. System Performance Requirements:
 - a. Accuracy: ± 3 mm.
 - b. Repeatability: Not more than ± 1 mm.
 - c. Minimum Operating Distance from Antenna (Deadband): Refer to the Process Control System Instrument Index.
 - d. Maximum Beam Angle: Refer to Process Control System Instrument Index.
 - e. Strapping table with a minimum of 10 points or geometric function input.
 - f. Interference False Echo Cancellation: The instrument shall allow for object false echo cancellation through setup.
 - g. Transmitter Outputs: Provide a 4 to 20mA/HART, direct acting and isolated, minimum of 500 ohm load.
 - h. Power Consumption: 5 watts, maximum.
3. Required Features:
 - a. Antenna:
 - 1) Type: Encapsulated by corrosion resistant and submergence resistant material.
 - b. Transmitter:
 - 1) Solid state construction.
 - 2) Integral LED or LCD indicator scaled in engineering units for the range required. Provide with a transparent window to permit viewing the display.
 - 3) Onboard keys and PC software for setup and programming.
 - 4) Zero and span adjustment over 0 to 100 percent of the calibrated range.
 - 5) Handheld Hart programming unit.
4. For installations within hazardous locations or in the presence of H₂S or other corrosive gases; provide protection for all internal components by conformal coating or instrument potting and sealing off conduits once installed. Instrument shall not be left unsealed during construction.
5. Product and Manufacturer: Provide one of the following:
 - a. Endress Hauser
 - b. Krohne
 - c. Rosemount
 - d. Vega
 - e. Or engineer approved equal

C. LEVEL SWITCH - FLOAT TYPE

1. General: The device shall be capable of detecting fluid level and initiating a signal.
2. Type: Direct acting float.
3. Required Features:
 - a. Sealed SPDT control switch (non-mercury), actuation by steel ball.
 - b. Material: All wetted parts to be metal selected from table in Article 1.6.A, above, based on process fluid being measured.
 - c. Heavy duty, flexible 18 gauge, three connector, PVC cable with waterproof connection. Cable length, as required.

- d. Not sensitive to rotation.
- e. Operating Temperature: Up to 60 degrees C (140 degrees F).
- f. Provide cable weight or mounting bracket to suit installation.
- 4. Product and Manufacturer: Provide one of the following:
 - a. ITT/Flygt
 - b. Or engineer approved equal

2.3 SPARE PARTS AND TEST EQUIPMENT

- A. Furnish and deliver the spare parts and test equipment as outlined below and as indicated in the individual instrument sections in this specification, all of which shall be identical and interchangeable with similar parts furnished under this Section.
- B. Spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.
- C. The following shall constitute the minimum spare parts:
 - 1. Provide two spare sensors of each type.
 - 2. Provide calibration materials for one year of recommended maintenance service.
- D. The following shall constitute the minimum test and calibration equipment.
 - 1. All tooling required to insert, extract and connect any internal or external connector, including edge connectors.
 - 2. All special calibration equipment required for system calibration.
- E. All spare parts shall have been operated and tested in the factory as part of factory testing prior to shipment of the control system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide the services of qualified factory-trained servicemen to assist in the installation of the instrumentation and control system equipment.
- B. Install each item in accordance with manufacturer's recommendations and in accordance with the Contract Documents. Transmitters and instruments require access for periodic calibration or maintenance. Transmitters and instruments shall be mounted so they are accessible while standing on the floor.
- C. All items shall be mounted and anchored using Type 316 stainless steel hardware, unless otherwise noted.
- D. Conform to all applicable provisions of the NEMA and NFPA standards, local, state and federal codes when installing the equipment and interconnecting wiring.
- E. Install all instruments installed greater than 76 inches such that the display is angled to be visible from a height of 66 inches.

3.2 START-UP, CALIBRATION, AND TESTING AND TRAINING

- A. Comply with the requirements of specifications section Proces Control System General Requirements.
- B. Calibration of Instruments:
 - 1. All instruments are to be field calibrated and witnessed by the ENGINEER through their entire range or with the required setpoints based on the requirements stated in Section 40 75 00, Process Control System Instrument Index prior to start-up. Factory calibrated instruments are required to be recalibrated in the field prior to start-up and witnessed by the ENGINEER.
- C. Primary Sensors/Transducers and Field Instruments:
 - 1. Provide on-site operation and maintenance training by EQUIPMENT SUPPLIERS and/or the EQUIPMENT MANUFACTURER REPRESENTATIVES prior to placing the equipment in continuous operation, conforming to the requirements of Division 01, General Requirements. The services of equipment manufacturer's representatives shall be provided for a minimum of 2 hours for each type of the following instruments.
 - a. Each type of analyzer
 - b. Each type of flowmeter
 - c. Radar Level
 - d. Combustible gas detector
 - 2. Training shall accomplish the following:
 - a. Provide instruction covering procedures for routine, preventive and troubleshooting maintenance and equipment calibration.

++ END OF SECTION ++

40 70 03-9

Process Control System Primary Sensors and Field Instruments

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

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40 70 03-10

Process Control System Primary Sensors and Field Instruments

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 40 70 06

MISCELLANEOUS DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
 - 1. Provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, adjust, commission and place into satisfactory operation all miscellaneous devices furnished under this Section.
 - 2. Contract Documents illustrate and specify functional and general construction requirements of the devices and do not necessarily show or specify all components, wiring, piping and accessories required to make a completely integrated system. Provide all components, piping, wiring, accessories and labor required for a complete, workable and integrated system.
- B. Coordinate the installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems.

1.2 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. Furnish miscellaneous devices by the named manufacturers.
 - 2. Obtain all miscellaneous devices of a given type from the same manufacturer.
- B. Manufacturers' Responsibilities and Services:
 - 1. Design and manufacture the miscellaneous devices in accordance with the detailed Specifications herein.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Miscellaneous devices shall not be delivered to the site until all product information and Shop Drawings for the miscellaneous devices have been approved by ENGINEER.

1.4 SUBMITTALS

- A. Comply with the requirements specified in Section 40 90 00, Process Control System General Requirements.

1.5 IDENTIFICATION TAGS

- A. All miscellaneous devices shall have an identification tag where possible as indicated in the contract documents.

1.6 SUNSHADES

- A. Instruments and analyzers installed outdoors shall be firmly supported and protected by sun / rain shades, as specified or shown on DRAWINGS.

40 70 06-1
Miscellaneous Devices

1. Product and Manufacturer: Provide one of the following:
 - a. Obrien – VIPAK
 - b. Alumaline
 - c. Or Equal

PART 2 - PRODUCTS

2.1 SUNSHADES

- A. Provide sun / rain shades, as indicated in the specs or shown on DRAWINGS.
 1. Product and Manufacturer: Provide one of the following:
 - a. Obrien – VIPAK
 - b. Alumaline
 - c. Or Equal

2.2 PANEL-MOUNTED DIGITAL INDICATORS

- A. Type:
 1. Digital indicator.
- B. Function/Performance:
 1. Accuracy: plus or minus 0.25 percent of calibrated range.
 2. Operating Temperature: -20 to 70 degrees C (4 to 158 degrees F).
 3. Input: 4 to 20 mA.
 4. Output: retransmitted 4 to 20 mA.
 5. Digital Outputs: Two Form C programmable contacts rated for 5A at 120/240 VAC.
 6. Display: 5-digit LED display.
 7. Indicator Failure: Failure of the indicator will not cause failure of the 4-20 mA loop.
- C. Physical:
 1. Suitable for panel mounting.
 2. NEMA 4X and explosion-proof approved for Class I1, Division 1, Groups C and D areas.
 3. Programmable via integrated keypad.
 4. Power Requirements (choose one): 120 VAC/60 Hz.
- D. Manufacturer(s):
 1. Red Lion Controls PAXDP Series.
 2. Equal.

2.3 4 TO 20 MA LOOP CALIBRATOR

- A. Type:
 1. Portable 4-20 mA loop calibrator capable of reading, sourcing, and simulating control loop currents.
- B. Function/Performance:
 1. Modes of Operation:
 - a. Read: Read the 4-20 mA control current in a loop.

40 70 06-2
Miscellaneous Devices

- b. Simulate: Simulates operation of 2-wire transmitter in a current loop with external power.
 - c. Source: Provides 24 VDC power to a current loop and regulates the current at a selected value.
 - d. Read/Power: Provides 24 VDC power to a transmitter and reads the transmitter output.
- 2. Button to step through current values of 4, 12, and 20 mA.
- 3. Current output of calibrator selectable to any value between 0 and 24 mA.
- 4. Accuracy: plus or minus 0.05 percent of full scale.
- 5. Operating Temperature: -10 to 50 degrees C (14 to 122 degrees F).
- 6. Display: LCD display, showing current in mA or percent.
- C. Physical:
 - 1. Powered by single 9 V battery.
- D. Accessories Required:
 - 1. Leads for connection of the calibrator into the control loop circuit.
 - 2. One spare battery.
 - 3. Carrying case.
- E. Product and Manufacturer: Provide one of the following:
 - 1. Rochester Instrument CL-4002
 - 2. Fluke 705
 - 3. Or engineer approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide the services of qualified factory-trained servicemen to assist in the installation of the instrumentation and control system equipment.
- B. Install each item in accordance with manufacturer's recommendations and in accordance with the Contract Documents. Transmitters and instruments require access for periodic calibration or maintenance. Transmitters and instruments shall be mounted so they are accessible while standing on the floor.
- C. All items shall be mounted and anchored using Type 316 stainless steel hardware, unless otherwise noted.
- D. All field instruments shall be rigidly secured to walls, stands or brackets, as required, by the manufacturer and as shown on the Drawings. Mounting instruments on handrails will not be allowed.
- E. Conform to all applicable provisions of the NEMA and NFPA standards, local, state and federal codes when installing the equipment and interconnecting wiring.

3.2 START-UP, CALIBRATION, AND TESTING AND TRAINING

- A. Comply with the requirements of Section 40 61 13, Process Control System General Requirements.
- B. Calibration of Instruments:
 - 1. All instruments are to be field calibrated and witnessed by the ENGINEER through their entire range or with the required setpoints based on the requirements stated in Specification 17053 – Process Control System Instrument Index prior to start-up. Factory calibrated instruments are required to be recalibrated in the field prior to start-up and witnessed by the ENGINEER. Utilized form 17001-B - Calibration Test Data Form as provided in Specification 01 33 13 – Certificates and Reference Forms to document the field calibration.
- C. Primary Sensors/Transducers and Field Instruments:
 - 1. Provide on-site operation and maintenance training by equipment suppliers and/or the equipment manufacturer representative prior to placing the equipment in continuous operation. The services of equipment manufacturer's representatives shall be provided for a minimum of 1 hours for each type of the following instruments.
 - a. Each type of flow meters
 - b. Each type of level instrument
 - c. Each type of analyzer.
 - 2. Training shall accomplish the following:
 - a. Provide instruction covering procedures for routine, preventive and troubleshooting maintenance and equipment calibration.

++ END OF SECTION ++

40 70 06-4
Miscellaneous Devices

Washwater Equalizer Tank Replacement Project

Paradise Irrigation District
WWE Project No. 22-098

March 2024
Bid Documents

SECTION 40 75 00

PROCESS CONTROL SYSTEM INSTRUMENT INDEX

PART 1 - GENERAL

1.1 DESCRIPTION

A. Calibration of Instruments:

1. All instruments are to be field calibrated and witnessed by the ENGINEER through their entire range or with the required setpoints based on the requirements stated in Section 40 75 00, Process Control System Instrument Index.

40 75 00-1

Process Control System Instrument Index

Washwater Equalizer Tank Replacement Project

PART 2 - PRODUCTS**2.1 TABLE**

P&ID Drawing Number	Tag (Area-Type-Number)	Type-Class Name	Status	Device	Instrument Description	Signal	Range	Engineering Unit	Setpoints / Range	COMMENTS
N-004	LSL-321	Field Discrete Instrument	New	Level Float Switch	Washwater Equalization Tank No. 1 Low Level Float Switch	Discrete	NA	feet	2	Sealed SPDT Control Switch (non mercury), all wetted parts to be 316SS
N-004	LSH-321	Field Discrete Instrument	New	Level Float Switch	Washwater Equalization Tank No. 1 High Level Float Switch	Discrete	NA	feet	19	Sealed SPDT Control Switch (non mercury), all wetted parts to be 316SS
N-004	LIT-321	Field Analog Instrument	New	Level Indicating Transmitter	Washwater Equalization Tank No. 1 Level Transmitter	4-20 mA	0 - 20	feet		
N-004	LSL-322	Field Discrete Instrument	New	Level Float Switch	Washwater Equalization Tank No. 2 Low Level Float Switch	Discrete	NA	feet	2	Sealed SPDT Control Switch (non mercury), all wetted parts to be 316SS
N-004	LSH-322	Field Discrete Instrument	New	Level Float Switch	Washwater Equalization Tank No. 2 High Level Float Switch	Discrete	NA	feet	19	Sealed SPDT Control Switch (non mercury), all wetted parts to be 316SS
N-004	LIT-322	Field Analog Instrument	New	Level Indicating Transmitter	Washwater Equalization Tank No. 2 Level Transmitter	4-20 mA	0 - 20	feet		

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

40 75 00-2

Process Control System Instrument Index

Washwater Equalizer Tank Replacement Project