



LAKE HAVASU CITY

INVITATION TO BID

CONTRACT DOCUMENTS

AND

TECHNICAL SPECIFICATIONS

North Havasu Additional Tank & Distribution Line

B26-PW-108031-500784

LAKE HAVASU CITY
CONTRACT DOCUMENTS
VOLUME 1

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The following specifications are contained within this Invitation For Bids:

LHC 1210 - MEASUREMENT AND PAYMENT
TIC - SPECIFICATIONS

The remaining applicable specifications can be accessed at:

<https://www.lhcaz.gov/public-works/engineering>

Please scroll down to the bottom of the webpage and notice there are clickable page numbers to access all specification documents.

SECTION 00020
NOTICE INVITING BIDS
Lake Havasu City

PROJECT NO.: **B26-PW-108031-500784**

PROJECT NAME: **North Havasu Additional Tank & Distribution Line**

PRE-BID MEETING: A **NON-MANDATORY Pre-Bid Meeting** will be held at 900 London Bridge Rd, Lake Havasu City, AZ 86404, Conference Room A 101 at 11:00 AM, Arizona Time, on Thursday, April 2, 2026.

BID DUE DATE: **April 15, 2026**

BID DUE TIME: **3:00 p.m., ARIZONA TIME**

PROJECT DESCRIPTION:

This project consists of demolition of existing pavement and one manhole, removal of existing fence, site grading, construction of one (1) 750,000-gallon potable water welded steel tank with tank foundation consisting of 6" oil impregnated sand base, cathodic protection system, aluminum dome roof, inlet, outlet and interconnecting piping, installation of extended chain link fencing and other items per plans and specs.

QUESTIONS: All questions that arise relating to this solicitation shall be directed in writing to purchasing@lhcaz.gov with a copy to capitalprograms@lhcaz.gov. To be considered, written inquiries shall be received at the above-referenced email address by April 6, 2026, 3:00 p.m. Arizona Time. Inquiries received will then be answered in an Addendum.

Sealed bids for the project specified will be received by the **City Clerk's Office, 2330 N. McCulloch Boulevard, Lake Havasu City, Arizona, 86403** until the time and date stated. **Bids received by the correct time and date will be opened and read aloud immediately thereafter in Room 109 of Lake Havasu City Hall.** Public openings may be attended virtually by accessing the following video conferencing system:

To join the meeting on a computer or mobile phone:

<https://tinyurl.com/3f94b2ww>

Meeting ID: 270 366 031 956

Passcode: jcVbxK

Join with a video conferencing device

160264325@teams.bjn.vc

Video Conference ID: 112 219 692 0

Bids must be clearly addressed to the City Clerk's Office, 2330 McCulloch Blvd. N, Lake Havasu City, Arizona, 86403, and received no later than the exact time and date indicated above. Late bids will not be considered under any circumstances.

Bids must be submitted in a sealed envelope with the Project Number and the bidder's name and address clearly indicated on the envelope. All bids must be completed in ink or typewritten on a form to be obtained from the specifications and a complete Invitation for Bid returned along with the offer no later than the time and date cited above.

Bidders interested in taking advantage of the streamlined e-Bid and e-Bond process shall submit their bids electronically via the City's DemandStar Network at <https://www.demandstar.com/app/buyers/bids/521860/details>. Paper bids and paper bid bonds will continue to be accepted. Bidders submitting e-Bids will be required to scan and enclose their paper bid bond/cashier's check with their electronic bid submission. The apparent low bidder shall submit their original bid bond/cashier's check within three (3) business days following the Bid opening.

Bid documents and specifications are available on Lake Havasu City's website at www.lhcaz.gov or on DemandStar at www.demandstar.com. For documents obtained outside of DemandStar please contact purchasing@lhcaz.gov to be added to the planholders' list.

BONDS:

Bid Bond:	<u>10%</u>
Labor and Material Bond:	<u>100%</u>
Faithful Performance Bond:	<u>100%</u>

Project Completion Date: 280 calendar days after Notice to Proceed.

Lake Havasu City reserves the right to accept or reject any or all bids or any part thereof and waive informalities deemed in the best interest of the City.

Pursuant to the Americans with Disabilities Act (ADA), Lake Havasu City endeavors to ensure the accessibility of all of its programs, facilities and services to all persons with disabilities. If you need an accommodation for this meeting, please contact the City Clerk's office at (928) 453-4142 at least 24 hours prior to the meeting so that an accommodation may be arranged.

Publication Dates: TODAY'S NEWS HEARLD - March 18th, and 25th, 2026
ARIZONA BUSINESS GAZETTE - March 19th, and 26th, 2026

**** END OF SECTION ****

SECTION 00040
INTENT TO BID NOTIFICATION

ITB NO.: B26-PW-108031-500784

ITB TITLE: North Havasu Additional Tank & Distribution Line

CLOSING DATE & TIME: April 15, 2026, at 3:00 PM, Arizona Time

LETTER OF INTENT TO BID SUBMITTAL

This is notification that it is our present intent to submit a bid in response to the above referenced ITB. Please add our company to your planholders list.

The individual to whom all information regarding this ITB should be transmitted is:

Company Name: _____

Contact Name: _____

Street Address: _____

City, State, & Zip: _____

Phone Number: Fax Number: _____

E-Mail Address: _____

Submit this Letter of Intent by the deadline for requests for clarification and protests, which must be physically received by **April 6, 2026 at 3:00 p.m., Arizona Time.**

Clarification/Protest/Question/Letter of Intent to Bid
ITB No.: B26-PW-108031-500784 Lake Havasu City
Administrative Services Department, Procurement
Email to: purchasing@lhcaz.gov

** END OF SECTION **

SECTION 00100
INFORMATION FOR BIDDERS

1. RECEIPT AND OPENING OF BIDS

The City of Lake Havasu City, Arizona, (hereinafter called the "Owner") invites Bids on the form attached hereto. All blanks must be appropriately filled in. The Bidder shall also complete and submit a form listing proposed subcontractors as enclosed herein. Any subcontractors proposed to be used on the project but not listed on this form shall not be considered when evaluating the Contractor's qualifications and ability to perform the work. Bids **North Havasu Additional Tank & Distribution Line, Project No. B26-PW-108031-500784** will be received by the **City Clerk's office, 2330 N. McCulloch Boulevard, Lake Havasu City, Arizona 86403 no later than 3:00 P.M., Arizona Time, April 15, 2026**, where said Bids will be publicly opened and virtually read aloud immediately thereafter in the Room 109 of Lake Havasu City Hall.

The Owner may consider informal any Bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all Bids. Any Bid may be withdrawn prior to the above scheduled time for the opening of Bids or authorized postponement thereof. Any Bid received after the time and date specified shall not be considered. No Bidder may withdraw a Bid within ninety (90) days after the actual date of the opening thereof.

Bidders interested in taking advantage of the streamlined e-Bid and e-Bond process shall submit their bids electronically via the City's DemandStar Network at <https://www.demandstar.com/app/buyers/bids/521860/details>. Paper bids and paper bid bonds will continue to be accepted.

Bidders submitting e-Bids will be required to scan and enclose their paper bid bond/cashier's check with their electronic bid submission. The apparent low bidder shall submit their original bid bond/cashier's check within three (3) business days following the Bid opening.

2. PREPARATION OF BID

Each Bid must be submitted on the prescribed Form. Each Document must be submitted with an original signature of the Bidder, as well as all witnesses indicated therein. All blank spaces for Bid prices must be filled in, in ink or typewritten, in both words and figures.

Each Bid must be submitted in a sealed envelope bearing on the outside the name of the Bidder, the Bidder's address, and the name and number of the project for which the Bid is submitted. If forwarded by mail, the sealed envelope containing the Bid must be enclosed in another envelope addressed as specified in the Bid form.

3. FACSIMILE BIDS OR MODIFICATIONS

No facsimile ("FAX") Bids or bid modifications will be accepted. Any modifications to the Bid shall be made by an authorized representative of the bidding company in person.

4. QUALIFICATIONS OF BIDDER

The Owner may make such investigations as he deems necessary to determine the qualifications of and the ability of the Bidder to perform the Work, and the Bidder shall furnish the Owner such information and data for this purpose as the Owner may request. The Owner may request that the Bidder provide a list of key people for the project with their related work experience.

The Owner reserves the right to reject any Bid if the evidence submitted by or investigation of such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein in a timely manner. Conditional Bids will not be accepted.

All Bidders and listed subcontractors must be valid Arizona Licensed Contractors at the time of Bidding, approved by the Arizona State Registrar of Contractors to do the type and amount of work specified in these documents. In accordance with the Arizona State Registrar of Contractors, the Bidder must possess a minimum of a Class A Arizona Contractor's License to perform the type and amount of work specified in these documents. **Failure of any bidder to possess all contractors' licenses as listed in the bid packet, at the time of bidding, shall result in the bid being considered non-responsive and not in substantial compliance, and any such bid shall not be considered.** Refer to Section 00420, page 3, item 13.

5. ARITHMETIC DISCREPANCIES IN THE BID

A. For the purpose of the evaluation of Bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the Bid Schedule as submitted by Bidders:

1. Obviously misplaced decimal points will be corrected;
2. In case of discrepancy between unit price and extended price, the unit price will govern;
3. Apparent errors in extension of unit prices will be corrected;
4. Apparent errors in addition of lump sums and extended prices will be corrected; and
5. In case of discrepancy between words and figures in unit prices, the amount shown in words shall govern.

B. For the purpose of Bid evaluation, the Owner will evaluate the bids on the basis of the unit prices, extensions, and totals arrived at by resolution of arithmetic discrepancies as provided above.

6. INCOMPLETE BIDS

Failure to submit a Bid on all items in the Schedule will result in an incomplete Bid and the Bid may be rejected. **UNIT OR LUMP SUM PRICES MUST BE SHOWN FOR EACH BID ITEM WITHIN THE SCHEDULE.**

NOTE: FAILURE TO INDICATE UNIT OR LUMP SUM PRICES IN THE APPROPRIATE COLUMN, WITH THE EXTENSION OF THE PRICES IN THE FAR RIGHT COLUMN, WILL CAUSE THE BID TO BE "NON-RESPONSIVE".

All forms indicated in the Bid Proposal, Section 00300, must be completely filled out, executed, and submitted with the Bid. Failure to do so will render the bid "non-responsive" and the bid will not be accepted.

7. BID SECURITY

Each Bid must be accompanied by certified check, cashier's check, or a Bid Bond prepared on the form attached hereto or on a similar form acceptable to the Owner, duly executed by the Bidder as principal and having as surety thereon a surety company approved by the Owner, in the amount of ten percent (10%) of the Bid. Bid Bonds shall be valid for at least ninety (90) days after the date of the receipt of Bids. Such cash, check or Bid Bond will be returned to all except the three (3) lowest Bidders within fifteen (15) business days after the opening of Bids. The remaining checks, or Bid Bonds will be returned promptly after the Owner and the accepted Bidder have executed the Contract, or if no award has been made within ninety (90) days after the date of the opening of Bids, upon demand of the Bidder at any time thereafter, so long as he has not been notified of the acceptance of his Bid.

8. LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT

The successful Bidder, upon his failure or refusal to execute and deliver the Contract, Bonds, and certificates required within ten (10) calendar days from the date of the Notice of Award, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the difference between his bid and the amount of the contract actually entered into with another party should he not enter into a contract at the bid price and provide the required payment and performance bonds and certificates of insurance. Liquidated damages for failure to enter into the contract shall not exceed the amount of the Bid Bond.

9. SECURITY FOR FAITHFUL PERFORMANCE AND PAYMENT

Simultaneously with his delivery of the executed Contract, the Bidder shall furnish **on the forms provided herein**, in 100% of the amount of this Contract, 1) a surety bond as security for faithful performance of this Contract, and 2) a surety bond as security for the payment of all persons performing labor on the project under this Contract and persons furnishing materials in connection with this Contract, and 3) a listing of all subcontractors who will be performing or providing more than one-half percent (0.50%) of the contract work, as specified in the General Conditions included herein. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the Owner, listed on the Treasury Department's most current list (Circular 570 as amended), and authorized to transact business in the State of Arizona.

10. POWER OF ATTORNEY

Attorneys-in-fact who sign Bid Bonds or Contract bonds must file with each bond a certified

and effectively dated copy of their power-of-attorney.

11. LAWS AND REGULATIONS

The Bidder's attention is directed to the fact that all applicable Federal Laws, State Laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though herein written out in full.

12. METHOD OF AWARD

A. The City will award the Contract on the basis of the Bid or Bids most advantageous to the City. In determining whether a Bid is most advantageous, in addition to price, the City may consider the following:

1. The ability, capacity, and skill of the Bidder to perform the Contract or provide the service indicated;
2. Whether the Bidder can perform the Contract or provide the service promptly, and within the time specified without delay or interference;
3. The character, integrity, reputation, judgment, experience, and efficiency of the Bidder;
4. The quality of performance on previous contracts;
5. The previous compliance with laws and ordinances by the Bidder;
6. The financial responsibility of the Bidder to perform under the Contract or provide the service;
7. The limitations of any license the Bidder may be required to possess;
8. The quality, availability, and adaptability of the product or service;
9. The ability of the Bidder to provide future maintenance and/or service;
10. The number and scope of any conditions attached to the Bid; and;
11. The life cycle, maintenance, and performance of the equipment or product being offered.

13. OBLIGATION OF THE BIDDER

At the time of the opening of Bids, each Bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the Plans and Contract documents (including all Addenda, if applicable). The failure or omission of the Bidder to examine any form, instrument or document, or site changes due to natural causes, shall in no way relieve any Bidder from any obligation in respect to his Bid. Site changes due to natural causes prior to Bid opening shall not be cause for Bid alteration or withdrawal.

14. TIME OF COMPLETION AND LIQUIDATED DAMAGES

The Bidder must agree to commence work on or before a date to be specified in a written "Notice to Proceed" from the Owner, and to complete the work within **280 calendar days** of the date of the Notice to Proceed.

The Bidder further agrees to pay as liquidated damages, the sum indicated in the following Schedule of Liquidated Damages for each consecutive calendar day thereafter, plus any additional costs incurred by the Engineer as provided in Section 17 of the General Conditions, that the Contract remains incomplete. For the purposes of determining the Liquidated Damages for the project, the Original Contract Amount shall be that which is included in the Contract between the Owner and the Contractor for the project.

SCHEDULE OF LIQUIDATED DAMAGES		
Original Contract Amount		Daily Charges
From More Than	To and Including	Calendar Day or Fixed Rate
0	25,000	210
25,000	50,000	250
50,000	100,000	280
100,000	500,000	430
500,000	1,000,000	570
1,000,000	2,000,000	710
From More Than	To and Including	Calendar Day or Fixed Rate
2,000,000	5,000,000	1,070
5,000,000	10,000,000	1,420
10,000,000	---0---	1,780

15. CONDITIONS OF WORK

Each Bidder must inform himself fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful Bidder of his obligation to furnish all material and labor necessary to carry out the provisions of his Contract. Insofar as possible, the Contractor, in carrying out his work, must employ such methods or means as will not cause any interruption of or interference with the work of any other Contractor.

16. ADDENDA AND INTERPRETATIONS

All questions that arise relating to this solicitation shall be directed in writing to: purchasing@lhcaz.gov with a copy to CapitalPrograms@lhcaz.gov.

Administrative Services Department, Procurement Division
Lake Havasu City
2330 McCulloch Blvd. North
Lake Havasu City, AZ 86403

To be considered, written inquiries shall be received by the above-referenced contact by **April 6, 2026, 3:00 p.m. Arizona Time**. Inquiries received will then be answered in an Addendum. Any and all such interpretations and any supplemental instructions will be in the form of written Addenda to the Specifications which, if issued, will be available to all prospective Bidders, not later than five (5) calendar days prior to the date fixed for the opening of Bids. Failure of any Bidder to incorporate any such Addendum or interpretation shall not relieve such Bidder from any obligation under his/her Bid as submitted. All Addenda so issued shall become part of the Contract documents.

No informal contact initiated by offerors on this solicitation will be allowed with members of City staff from the date of distribution of this solicitation until after the closing date and time for the submissions of quotations. All questions or issues related to this solicitation shall be submitted in writing.

17. CONFLICT OF INTEREST

Pursuant to A.R.S. Section 38-511, this Contract is subject to cancellation by Buyer if any person significantly involved initiating, negotiating, securing, drafting or creating the Contract on behalf of Lake Havasu City is, at any time while the Contract is in effect, an employee of any other party to the Contract in any capacity or a consultant to any other party of the Contract with respect to the subject matter of the Contract.

18. NO COLLUSION

The bidder will be required to complete, notarize and submit as part of this bid package the "No Collusion Affidavit" form, as attached herein. Failure of the bidder to submit a properly executed affidavit may be grounds for rejection of the bid.

19. EMPLOYMENT ELIGIBILITY VERIFICATION

The bidder will be required to complete, notarize and submit as part of this bid package the "Employer Verification of Employment Eligibility" form, as attached herein. Failure of the bidder to submit a properly executed verification of eligibility form may be grounds for rejection of the bid.

20. EXAMINATION OF THE PLANS AND SPECIFICATIONS

Each Bid shall be made in accordance with the Plans and Specifications which may be examined at the following locations:

- A. Lake Havasu City, 2330 N. McCulloch Boulevard, Lake Havasu City, AZ 86403, 928.855.2116
- B. Dodge Data & Analytics, 3315 Central Avenue, Hot Springs, AR, 71913,

871.375.2946, FAX 501.625.3544, www.construction.com,
dodge.bidding@construction.com

- C. Colorado River Building Industry Association, 2182 McCulloch Blvd, Suite 3, Lake Havasu City AZ 86403, 928.453.7755, FAX 928.453.3175, www.crbia.org, frontdesk@criba.org
- D. Northern AZ Home Builders, 1500 E. Cedar Avenue, Suite 86, Flagstaff AZ 86004, 928.779.3071, FAX 928.779.4211, www.nazba.org, info@nazba.org
- E. Performance Graphics Blueprinting, 4140 Lynn Drive, Suite 107, Fort Mohave, AZ, 86426, 928.763.6860, FAX 928.763.6835, prints@pgblueprinting.net
- F. Construction Market Data, 30 Technology Parkway South, Suite 500, Norcross, GA 30092-2912, 800.876.4045, FAX 800.303.8629, www.cmdgroup.com, projects@cmdgroup.com
- G. ISqFt, 3301 N 24th Street, Phoenix, AZ, 85016, 800.364.2059, FAX 800.792.7508, www.isqft.com, arizonaplanroom@isqft.com
- H. Integrated Digital Technologies, LLC, 4633 E Broadway Blvd., Tucson, AZ 85711, PO Box 13086, Tucson AZ, 85732, 520.319.0988, FAX, 520.319.1430, www.contractorsplanroom.com, content@idtplans.com
- I. Yuma/Southwest Contractors Association, 350 W. 16th Street, Suite 207, Yuma, AZ 85364, Phone: 928-539-9035, Fax: 928-539-9036, www.yswca.com, plans@yswca.com
- J. Arizona Builders Exchange, 1700 N. McClintock Drive, Tempe, AZ, 85281, (480) 227-2620, www.azbex.com, rkettenhofen@azbex.com
- K. Construction Reports.com, 4110 N Scottsdale Road, Suite 335, Scottsdale, AZ, 85251, 480.994.0020, FAX 480.994.0030, www.constructionreports.com, jess@constructionreports.com
- L. Construction Reporter, 1609 2nd Street NW, Albuquerque, NM, 87102, 505.243.9793, FAX 505.242.4758, www.constructionreporter.com, jane@constructionreporter.com
- M. PlanRoom Central at A&E Reprographics, 1030 Sandretto Drive, Suite F, Prescott, AZ, 86305, 928.442.9116, www.a-erepro.com, planroom1@a-erepro.com
- N. Shirley's Plan Service, 425 S. Plumer Ave, Tucson, AZ, 85719, 520.791.7436, FAX 520.882.9208, www.shirleysplanservice.com, bids@shirleysplanservice.com
- O. Construction Notebook Nevada, 3131 Meade Ave, Suite B, Las Vegas, NV, 89102-7885, 702.876.8660, FAX 702.876.5683, www.constructionnotebook.com

- P. The Blue Book Building & Construction Network, Jefferson Valley, NY 10535, 800.431.2584, www.thebluebook.com, info@thebluebook.com, tdizon@mail.thebluebook.com
- Q. Integrated Marketing Systems (IMS), 945 Hornblend Street, Suite G, San Diego, CA 92109, 888.467.3151, FAX 858.490.8811, www.imsinfo.com , ims@imsinfo.com

** END OF SECTION **

SECTION 00300
BID PROPOSAL

Lake Havasu City, Arizona

The undersigned, as bidder, declares that we have received and examined the documents entitled "**North Havasu Additional Tank & Distribution Line, Project No. B26-PW-108031-500784**" and will contract with the Owner, on the form of Contract provided herewith, to do everything required for the fulfillment of the contract for the construction of the **North Havasu Additional Tank & Distribution Line, Project No. B26-PW-108031-500784** at the prices and on the terms and conditions herein contained.

We agree that the Contract Documents include Volumes I and II of the Contract Documents as well as the referenced documents.

We agree that the following shall form a part of this proposal and are included herein as our submittal:

<u>Section</u>	<u>Title</u>	<u>Enclosed</u>
00300	Bid Proposal	✓
00310	Bid Schedule	_____
00400	Arizona Statutory Bid Bond	_____
00420	Bidder's Statement of Qualifications	_____
00430	Affidavit of Contractor Certifying That There Was No Collusion In Bidding For Contract	_____
00450	Hazard Communication Program	_____
00460	Employment Eligibility Verification	_____

We acknowledge that addenda numbers _____ through _____ have been received and have been examined as part of the Contract Documents.

We certify that our proposal is genuine, and not sham or collusive, nor made in the interest or behalf of any undisclosed person, organization, or corporation, and that we have not directly or indirectly induced or solicited any other bidder to put in a sham bid, or directly or indirectly induced or solicited any other potential bidder to refrain from bidding, and that we have not in any manner sought by collusion to secure an advantage over any other bidder.

The bidder agrees that this Bid shall be good and may not be withdrawn for a period of ninety (90) calendar days after the scheduled closing time for receiving Bids.

Upon receipt of written notice of the acceptance of this bid, Bidder shall execute the formal Contract attached within 10 days and deliver a Performance Bond, Payment Bond, and Certificates of Insurance as required by Paragraph 25 of the General Conditions and the Special Provisions.

We hereby declare that we have visited the site and have carefully examined the Contract Documents relating to the work covered by the above bid or bids.

Enclosed herewith is a certified or cashier's check or bid bond, payable to Lake Havasu City, Arizona,

in the amount of ten percent (10%) of the total bid. This check or bond is submitted as a guarantee that we will enter into a Contract, and furnish the required bonds in the event a contract is awarded us. The bid security attached, without endorsement, is to become the property of Lake Havasu City, Arizona, in the event the Contract and Bonds are not executed within the time set forth, as liquidated damages for delay and additional work caused thereby.

Cooperative Use of Contract

This solicitation is being prepared by the City of Lake Havasu, Arizona ("City") for the use of the City. While this solicitation is for the use of the City, other eligible public agencies may have an interest in utilizing the resulting contract. After an award, and with the approval of the bidder, this solicitation may be utilized by eligible public agencies. Any such usage by other entities must be in accordance with the ordinance, charter and/or procurement rules and regulations of the respective political entity.

Please indicate below your acceptance or rejection regarding such participation of other governmental entities. Your response will not be considered a bid response requirement in awarding a contract. If you do not wish to grant such access to other eligible public agencies, please so state in your bid response below. In the absence of a statement to the contrary, the City will assume that you do wish to grant access to any contract that may result from this solicitation.

Bidder hereby grants , or does not grant _____, cooperative purchase access to other eligible public agencies. We understand that Lake Havasu City, Arizona reserves the right to reject any and/or all bids, or to waive any informalities in any bid, deemed by them to be for the best interests of Lake Havasu City, Arizona.

We understand that Lake Havasu City, Arizona reserves the right to reject any and/or all bids, or to waive any informalities in any bid, deemed by them to be for the best interests of Lake Havasu City, Arizona.

Dated in _____ this ____ day of _____, ____.

Respectfully Submitted By:

By: _____

Title: _____

Name of Firm: _____

Address: _____

Phone: _____ FAX: _____

Email Address: _____

Seal - If bid by a Corporation:

Arizona Contractor's License No.: _____ Type: _____

Federal Tax ID No.: _____

**** END OF SECTION ****

BID SCHEDULE
LAKE HAVASU CITY

North Havasu Additional Tank & Distribution Line
B26-PW-108031-500784

Lake Havasu City Council
Lake Havasu City
2330 N. McCulloch Boulevard
Lake Havasu City, AZ 86403

The City Council:

Pursuant to request for bids to be opened April 15, 2026 at 3:00 P.M., Arizona Time, at Room 109 of Lake Havasu City Hall, for the above project, the Contractor proposes to complete work, including furnishing all labor and materials, per the Specifications and Plans at the Following prices.

This Schedule of Items and Prices shall be completed in ink or typed by the Bidding Contractor. In case of discrepancy between the word and figure amount description, the word description shall control extensions.

Prices must be entered for each item and the appropriate subtotal and total blank shall be filled out. Bid prices shall include sales tax and all other applicable taxes and fees.

Bidder agrees to perform all the necessary work to complete the **North Havasu Additional Tank & Distribution Line, Project No. B26-PW-108031-500784**

SECTION 310

BID SCHEDULE – North Havasu Additional Tank & Distribution Line B26-PW-108031-500784

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>EST QTY</u>	<u>UNIT OF MEASURE</u>	<u>UNIT PRICE¹ (Word)</u>	<u>UNIT PRICE (Figure)</u>	<u>ITEM TOTAL² COSTS</u>
<u>BASE BID</u>						
1210.1	Mobilization/Demobilization, Bonds and Insurance	1	L.S.	_____	\$ _____	\$ _____
1210.2	Demolition of Existing Pavement and Manhole	1	L.S.	_____	\$ _____	\$ _____
1210.3	20-Inch Inlet Piping	83	L.F.	_____	\$ _____	\$ _____
1210.4	12-Inch Interconnect Piping	70	L.F.	_____	\$ _____	\$ _____
1210.5	24-Inch Outlet Piping	65	L.F.	_____	\$ _____	\$ _____
1210.6	12-Inch Overflow Piping	20	L.F.	_____	\$ _____	\$ _____
1210.7	Site Grading	1	L.S.	_____	\$ _____	\$ _____
1210.8	Chain Link Fence Installation	385	L.F.	_____	\$ _____	\$ _____
1210.9	Tank Foundation	1	L.S.	_____	\$ _____	\$ _____
1210.10	Tank 6" Oil Impregnated Sand Base	1	L.S.	_____	\$ _____	\$ _____

¹ The "Unit Price" column shall indicate unit or lump sum prices for each bid item and shall be indicated in written and numerical form.

² The "Item Total Costs" column shall indicate the extension of the unit prices, which is obtained by multiplying the "Estimated Quantity" column by the "Unit Price" column.

1210.11	750,000 Gallon Welded Steel Tank with Aluminum Dome Roof	1	L.S.	_____	\$ _____	\$ _____
1210.12	Tank Interior and Exterior Coatings	1	L.S.	_____	\$ _____	\$ _____
1210.13	Tank Electrical, Instrumentation, and Controls	1	L.S.	_____	\$ _____	\$ _____
1210.14	Cathodic Protection System for Welded Steel Tank	1	L.S.	_____	\$ _____	\$ _____
1210.15	Additional Reinforced Concrete	20	Cu. Yd.	_____	\$ _____	\$ _____
1210.16	Additional Excavation	20	Cu. Yd.	_____	\$ _____	\$ _____
1210.17	Additional Compacted Structural Backfill	20	Cu. Yd.	_____	_____	_____
1210.18	Force Account	1	L.S.	Fifty Thousand Dollars	\$ 50,000.00	\$ 50,000.00
BID TOTAL³ + FORCE ACCOUNT				_____	\$ _____	\$ _____

Above line items and totals shall include all work shown on the plans and specified herein, including taxes, insurance and bonding.

³ The "Bid Total" amount shall be the sum of all costs listed in the "Item Total Costs" column.

The unit prices for **North Havasu Additional Tank & Distribution Line, Project No. B26-PW-108031-500784**, shall include all labor, materials, water disposal, bailing, shoring, removal, disposal, overhead, profit, insurance, and all other related costs and work to cover the finished work of the several kinds called for. Changes in the Contract shall be processed in accordance with Paragraph 16 of the General Conditions.

Bidder understands that the Owner reserves the right to reject any or all Bids, or portions thereof, and to waive any informalities in the bidding.

The Bidder agrees that this Bid shall be good and may not be withdrawn for a period of ninety (90) calendar days after the scheduled closing time for receiving Bids.

Upon receipt of written notice of the acceptance of this Bid, Bidder shall execute the formal Contract attached within 10 days and deliver a Performance Bond, Payment Bond, and Certificates of Insurance as required by Paragraph 25 of the General Conditions and the Special Provisions.

The Bid security attached in the sum of \$_____ is to become the property of the Owner in the event the Contract and Bond(s) are not executed and provided within the time above set forth, as liquidated damages for the delay and additional expense to the Owner caused thereby.

Bidder hereby acknowledges receipt of the following Addenda: ____, ____, ____.

RESPECTFULLY SUBMITTED BY:

BY: _____

TITLE: _____

FIRM: _____

ADDRESS: _____

PHONE: _____ FAX _____

EMAIL: _____

Seal - if Bid by a corporation

AZ Contractor's License No: _____ Type _____

**** END OF SECTION ****

SECTION 00400
ARIZONA STATUTORY BID BOND

PURSUANT TO TITLES 28, 34 AND 41, ARIZONA REVISED STATUTES
(Penalty of this bond must not be less than 10% of the bid amount)

KNOW ALL MEN BY THESE PRESENTS:

That, _____(hereinafter "Principal"), as Principal, and _____, (hereinafter "Surety"), a corporation organized and existing under the laws of the State of _____, with its principal offices in the City of _____, holding a certificate of authority to transact surety business in Arizona issued by the Director of the Department of Insurance pursuant to Title 20, Chapter 2, Article 1, as Surety, are held and firmly bound unto Lake Havasu City, Arizona, (hereinafter "Obligee"), as Obligee, in the amount of Ten Percent (10%) of the amount of the bid of Principal, submitted by Principal to the Obligee for the work described below, for the payment of which sum, the Principal and Surety bind themselves, and their heirs, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for

North Havasu Additional Tank & Distribution Line, B26-PW-108031-500784

NOW, THEREFORE, if the Obligee shall accept the proposal of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of the proposal and give the bonds and certificates of insurance as specified in the standard specifications with good and sufficient surety for the faithful performance of the contract and for the prompt payment of labor and materials furnished in the prosecution of the contract, or in the event of the failure of the Principal to enter into the contract and give the bonds and certificates of insurance, if the Principal pays to the Obligee the difference not to exceed the penalty of the bond between the amount specified in the proposal and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by the proposal then this obligation is void. Otherwise it remains in full force and effect provided, however, that this bond is executed pursuant to the provisions of Section 34-201, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of that section to the extent as if it were copied at length herein.

Witness our hands this ____ day of _____, _____.

PRINCIPAL

SEAL

SURETY

SEAL

By: _____
Principal

By: _____
Attorney-in-Fact

Its: _____
Principal's Title

Agency of Record

Agency Address

7. Have you ever failed to complete any work awarded to you? If so, indicate when, where and why:

8. Has any Officer or Partner of your Organization ever been an Officer or Partner of another Organization that failed to complete a construction contract? _____ If so, state circumstances:

9. List major construction projects your Organization has under contract on this date:

Project Name	Name, Email Address & Telephone Number of Owner	Project Location	Contract Amount	Contract Date	Percent Complete	Scheduled Completion

10. List similar construction projects your Organization has completed in the past five years:

Project Name	Name, Email Address & Telephone Number of Owner	Project Location	Contract Amount	Date Awarded	Date Completed	Percent with Own Forces

11. List the construction experience of the principal individuals in your Organization:

Individual's Name	Construction Experience - Years	Within Your Organization		
		Present Position & Years Experience	Dollar Volume Responsibility	Previous Position & Years Experience

12. Business in Arizona: The City will not enter into contracts with Bidders (or any company(ies)) not

granted authority to transact business, or not in good standing in the State of Arizona by the Arizona Corporation Commission, unless the Bidder asserts a statutory exemption prior to entering into a contract with the City. The Undersigned agrees to furnish, upon request by the Owner, within seven days after the Bid Opening, a current Certificate of Good Standing and Compliance, and other related documents as requested.

13. List states and categories in which your Organization is legally qualified to do business:

14. List all Arizona Contractor licenses currently held by your Organization; the status of each license; and provide a photocopy of each license with your bid proposal.

	<u>License Class / #</u>	<u>Status</u>
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____

Please attach a list of additional Arizona Contractor licenses, if any.

15. Bank References:

16. Trade References:

17. Name of Bonding and Insurance Companies and Name and Address of Agents: Maximum Bonding Capacity _____

18. The Undersigned agrees to furnish, upon request by the Owner, within seven days after the Bid Opening, a current Statement of Financial Conditions, including Contractor's latest regular dated financial statement or balance sheet which must contain the following items:

Current Assets: (Cash, joint venture accounts, accounts receivable, notes receivable, accrued interest on notes, deposits, and materials and prepaid expenses), net fixed assets and other assets.

Current Liabilities: (Accounts payable, notes payable, accrued interest on notes, provision for income taxes, advances received from owners, accrued salaries, accrued payroll taxes), other liabilities, and capital (capital stock, authorized and outstanding shares par values, earned surplus).

Date of statement or balance sheet: _____

Name of firm preparing statement: _____

By: _____
(Agent and Capacity)

19. List of Subcontractors. In accordance with paragraph 1.0 of Instructions to Bidders, the following

SECTION 00450
HAZARD COMMUNICATION PROGRAM
Lake Havasu City

HAZARD COMMUNICATION PROGRAM FOR _____
(Name of Company)

The purpose of this program is to ensure that potential hazards and hazard control measures for chemicals used by this company are understood by company employees.

The written program is available for employee review at any time. It is located _____ . A copy of the program will be provided to any employee or employee representative, upon request.

CONTAINER LABELING:

_____ will verify that all containers received for use by this company will: (name/title of individual)

- * be clearly labeled as to the contents, matching identification on MSDS;
- * note the appropriate hazard warnings;
- * List the name and address of the manufacturer.

No containers will be released for use until the above data is verified.

MATERIAL SAFETY DATA SHEETS:

Copies of MSDS's for all hazardous chemicals to which employees may be exposed will be kept

_____ .
_____ will be responsible for ensuring that:
(name/title of individual)

- * MSDS's for the new chemicals are available;
- * MSDS's will be available for review to all employees during each work shift;
- * Copies will be available on request.

EMPLOYEE TRAINING AND INFORMATION:

Each employee will be provided the following information and training before working in areas where hazardous chemicals exist. In addition, if a new hazardous material is introduced into the workplace, affected employees will be given new information and training concerning that material.

A. Minimum Information Provided:

(1) All operations and locations in the work area where hazardous chemicals are present.

GENERAL INDUSTRY

A. Minimum Information Provided:

- (1) The location and availability of the written hazard communication program, including list(s) of hazardous chemicals used and related material safety data sheets;
- (2) The method the company will use to inform employees of potential hazards of non-routine tasks (jobs that are not routine for an individual because of infrequency, location or type.)

B. Minimum Training Provided:

- (1) Methods and observations used to detect the presence or release of a hazardous chemical in the work area (such as company monitoring programs, continuous monitoring device, visual appearance, odor or to other characteristics of hazardous chemicals;
- (2) The physical and health hazards of chemicals in the assigned work area;
- (3) The measures to take to protect against such hazards, including specific company procedures concerning work practices, emergencies and care and use of protective equipment.
- (4) Details of the company hazard communication program, including explanation of the labeling system, the material safety data sheets, and how to obtain and use the appropriate hazard information.

(OPTIONAL) Upon completion of the training, each employee will sign a form acknowledging receipt of the written hazard communication program and related training.

HAZARDOUS NON-ROUTINE TASKS: (If applicable.)

If company employees are required to do hazardous non-routine tasks, such as welding in confined spaces, or cleaning of tanks, the employer must address how the employees doing the work will be informed about the specific hazards to which they will be exposed, what personal protective equipment will be provided and who will be responsible to oversee the operation or operations. If the company does not have any hazardous non-routine tasks, line through this section and state "NO HAZARDOUS NON-ROUTINE TASKS".

CHEMICALS IN UNLABELED PIPES: (If applicable.)

If the company has chemicals in unlabeled pipes, the company must inform the employees of the hazards associated with those chemicals. If the company does not have any chemicals in unlabeled pipes, line through this section and state "NO CHEMICALS IN UNLABELED PIPES".

INFORMING CONTRACTORS:

Providing contractors and their employees with the following information is the responsibility of

(Name/title of individual)

SECTION 00450
HAZARD COMMUNICATION PROGRAM
Lake Havasu City

- (1) Hazardous chemicals to which they may be exposed while on the job site;
- (2) Measures the employees may take to lessen the possibility of exposure;
- (3) Steps the company has taken to lessen the risks;
- (4) Where the MSDS's are for chemicals to which they may be exposed;
- (5) Procedures to follow if they are exposed.

CONTRACTORS INFORMING EMPLOYERS:

Contractors entering this workplace with hazardous materials will supply this employer with MSDS's covering those particular products the contractor may expose this company's employees to while working at this site.

LIST OF HAZARDOUS CHEMICALS IN THIS WORKPLACE

CONTRACTOR:

By: _____

Name: _____

Title: _____

Address: _____

END OF SECTION

LAKE HAVASU CITY
EMPLOYMENT ELIGIBILITY VERIFICATION & FORM

INSTRUCTIONS FOR COMPLETION OF EMPLOYMENT ELIGIBILITY VERIFICATION FORM

WHO MUST COMPLETE THIS FORM:

In accordance with Lake Havasu City Code Chapter 3.30, Employment of Unauthorized Aliens, all contractors and subcontractors furnishing labor, time, or effort for construction or maintenance of any structure, building, transportation facility, or improvements of real property must complete this form.

Contractors or subcontractors, as described above, must certify that they have complied, in good faith, with the applicable requirements of the Federal Immigration Control and Reform Act with respect to the hiring of covered employees. This certification must be executed by an authorized representative.

WHEN THIS FORM MUST BE COMPLETED:

This form must be completed by all contractors and subcontractors and submitted to the City department awarding the contract, license agreement, or lease no later than notification of successful direct selection, bid, request for proposals, request for qualification, or any similar competitive or noncompetitive procurement or bidding process.

**LAKE HAVASU CITY
EMPLOYMENT ELIGIBILITY VERIFICATION & FORM**

LIST OF ACCEPTABLE DOCUMENTS:

LIST A		LIST B		LIST C
Documents that Establish Both	OR	Documents that Establish	AND	Documents that Establish
U.S. Passport (unexpired or expired)		Driver's license or ID Card issued by a state or outlying possession of the United States provided it contains a photograph or information such as name date of birth		U.S. social security card issued by the Social Security Administration
Certificate of U.S. Citizenship		ID card issued by a federal, state or local government agencies or entities, provided it contains a photograph or information		Certification of Birth Abroad issued by the Department of State
Certificate of Naturalization		School ID card with photograph		Original or certified copy of a birth certificate issued by a state, county, municipal authority or outlying Native American tribal document
Unexpired foreign passport with I-551 stamp or attached federal Form I-94		Voter's registration card		U.S. Citizen ID Card
Permanent Resident Card or Alien		U.S. Military card or draft record		ID Card for the use of Resident Citizen in the
Unexpired Temporary		Military dependent's ID card		Unexpired employment authorization document issued by DHS
Unexpired Employment		U.S. Coast Guard Merchant Mariner Card		
Unexpired Reentry		Native American tribal		
Unexpired Refugee Travel Document		Driver's license issued by a		
Unexpired Employment Authorization Document issued by DHS that contains a		For persons under age 18 who are unable to present a document listed above: School record or report card; Clinic,		

EMPLOYER VERIFICATION OF EMPLOYMENT ELIGIBILITY & FORM

The undersigned attests under penalty of perjury, that they have reviewed the documents presented to them by their employees, and that the documents provided to the undersigned by their employees, as more particularly identified in the attached exhibit entitled "list of acceptable documents" appear to be genuine and appear to relate to the employee name, and to the best of the undersigned's knowledge, the employee is eligible to work in the United States based upon the undersigned's review of the documents presented.

Signature of Authorized Representative of Covered Employer/Contractor/Subcontractor	Print Name	Title
Business or Organization Name	Business Phone Number	Date (month/date/year)
Address (Street Name and Number)		
City, State, Zip Code		

SECTION 00500
CONTRACT

THIS CONTRACT is entered into by and between LAKE HAVASU CITY, ARIZONA, a municipal corporation ("OWNER"), and _____a(n) ARIZONA corporation, **Federal I.D. #** ("CONTRACTOR").

WHEREAS, OWNER has developed plans for and desires to commence the North Havasu Additional Tank & Distribution Line B26-PW-108031-500784 ("PROJECT"); and

WHEREAS, CONTRACTOR represents that it possesses the experience, competence, equipment and financing to properly complete the PROJECT, and has formally proposed to do so, and to furnish all necessary labor, materials, and equipment and services therefore in accordance with said plans, and subject to the terms and conditions hereof.

NOW, THEREFORE, in consideration of these promises and the mutual covenants herein, it is hereby agreed as follows:

1. CONTRACTOR shall commence and complete the construction of the PROJECT;
2. CONTRACTOR shall furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of the PROJECT.
3. CONTRACTOR shall commence the PROJECT in accordance with the CONTRACT DOCUMENTS within TEN (10) calendar days after the date of the Notice to Proceed. Final completion of the PROJECT shall occur within **280 calendar days** of the date of the Notice to Proceed. The period for completion may be extended through the authorized and approved change order process.
4. Liquidated Damages: OWNER and CONTRACTOR recognize that time is of the essence of this CONTRACT and that OWNER will suffer financial loss if the PROJECT is not completed within the time specified in paragraph 3 above, plus any extensions thereof allowed in accordance with the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual losses or damages (including special, indirect, consequential, incidental and any other losses or damages) suffered by OWNER if a complete acceptable PROJECT is not delivered on time.

Accordingly, and instead of requiring proof of such losses or damages, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay the OWNER **\$XXX** for each calendar day that expires after the time specified in paragraph 3 for delivery of acceptable Bid Items, plus any costs incurred by the Engineer as provided in Section 17 of the General Conditions.

5. CONTRACTOR agrees to complete the PROJECT in accordance with all of the terms and conditions of the CONTRACT DOCUMENTS for the sum of **\$XXXXX** as shown

in the Bid Schedule.

6. CONTRACTOR shall submit a completed Section 00450 entitled Hazard Communication Program with the executed copy of this CONTRACT.
7. The term "CONTRACT DOCUMENTS" means and includes the following:
 - 00020 Notice Inviting Bids
 - 00100 Information for Bidders
 - 00300 Bid Proposal
 - 00310 Bid Price Schedule
 - 00400 Bid Bond
 - 00420 Bidder's Statement of Qualifications
 - 00430 Bidder's Affidavit of No Collusion
 - 00450 Hazard Communication Program
 - 00460 Employment Eligibility Verification
 - 00500 CONTRACT
 - 00500A Indemnification and Insurance Requirements
 - 00500B Contractor Claim Handling Procedure
 - 00510 Arizona Statutory Performance Bond
 - 00520 Arizona Statutory Payment Bond
 - 00670 Notice of Award
 - 00680 Notice to Proceed
 - 00685 Certificate of Substantial Completion
 - 00690 Certificate of Final Completion
 - 00700 General Conditions
 - 00800 Special Provisions
 - Technical Specifications and Details
 - Construction Contract Drawings
 - Change Orders
 - Lien Releases (Conditional and Final)
 - Addenda
8. OWNER shall pay CONTRACTOR in the manner and at such times as set forth in the General Conditions and in such amounts as required by the CONTRACT DOCUMENTS.
9. In the event CONTRACTOR fails to perform any portion of the PROJECT or satisfy any term or condition of the CONTRACT DOCUMENTS, OWNER may at its sole discretion file notice and/or claim of such failure with CONTRACTOR'S surety.
10. Israel. If applicable, Contractor certifies that it is not currently engaged in, and agrees for the duration of this Contract that it will not engage in, a boycott of goods and services from Israel, as defined in A.R.S. § 35-393.
11. Conflict of Interest. The Contract may be cancelled in accordance with Arizona Revised Statutes Section 38-511.

12. Forced Labor of Ethnic Uyghurs Certification. If applicable, Contractor certifies that it does not currently, and agrees for the duration of the Contract that it will not, use: (1) the forced labor of ethnic Uyghurs in the People's Republic of China; (2) any goods or services produced by the forced labor of ethnic Uyghurs in the People's Republic of China; or (3) any contractors, subcontractors, or suppliers that use the forced labor or any goods or services produced by the forced labor of ethnic Uyghurs in the People's Republic of China. If Contractor becomes aware it is not in compliance with this certification, it shall notify the City within five business days after becoming aware. This Contract will terminate upon failure to remedy the noncompliance within 180 days of the notification. (A.R.S. § 35-394)
13. Export Administration Act. The CONTRACTOR warrants compliance with the Export Administration Act.
14. Recyclable Products. The CONTRACTOR shall use recyclable products and products which contain recycled content to the maximum extent economically feasible in the performance of the work set forth in the CONTRACT.
15. Asbestos License. The CONTRACTOR shall possess an asbestos abatement license if required under A.R.S. Title 32 or 49.
16. Assignment. No right or interest in this CONTRACT shall be assigned by CONTRACTOR without prior, written permission of the OWNER signed by the City Manager; and no delegation of any duty of CONTRACTOR shall be made without prior written permission of the OWNER signed by the City Manager. Any attempted assignment or delegation by CONTRACTOR in violation of this provision shall be a breach of this CONTRACT by CONTRACTOR.

[SIGNATURES ON FOLLOWING PAGE]

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this CONTRACT in two (2) copies, each of which shall be deemed an original. The last date of signature shall be the effective date of this CONTRACT.

OWNER:

Lake Havasu City, Arizona

By: _____

Date: _____

Name: _____

Title: _____

APPROVED AS TO FORM:

Lake Havasu City Attorney's Office

By: _____

Date: _____

CONTRACTOR:

By: _____

Date: _____

Name/Title: _____

Address: _____

ATTEST:

BY: _____

Name/Title: _____

**** END OF SECTION ****

LAKE HAVASU CITY CONSTRUCTION CONTRACT
INDEMNIFICATION AND INSURANCE REQUIREMENTS
(long form)

I. INDEMNIFICATION

CONTRACTOR agrees to indemnify, defend, save, and hold harmless the CITY, its departments, agencies, boards, commissions, officers, officials, agents, volunteers, and employees from and against any and all claims, actions, liabilities, damages, losses, or expenses (including court costs, attorney's fees, and costs of claim processing, investigation, and litigation) ("Claims") for bodily injury or personal injury (including death), or loss or damage to tangible or intangible property caused, or alleged to be caused, in whole or in part, by the CONTRACTOR or any of its owners, officers, directors, agents, employees, or contractors. This Indemnity includes any claim or amount arising out of or recovered under Workers' Compensation law or arising out of the failure of the CONTRACTOR to conform to any federal, state, or local law, statute, ordinance, rule, regulation, or court decree. It is the specific intention of the parties that the CITY shall, in all instances, except for Claims arising solely from the negligent or willful acts or omissions of the CITY, be indemnified by CONTRACTOR from and against any and all claims. It is agreed that CONTRACTOR will be responsible for primary loss investigation, defense, and judgment costs where this indemnification is applicable. The amount and type of insurance coverage requirements required by this Agreement will in no way be construed as limiting the scope of indemnity in this Section.

II. INSURANCE REQUIREMENTS

A. CONTRACTOR and its subcontractors shall procure and maintain until all of their obligations have been discharged, including any warranty periods under this CONTRACT, are satisfied, insurance against claims for injury to persons or damage to property which may arise from or in connection with the performance of the work hereunder by the CONTRACTOR, its agents, representatives, employees or subcontractors.

B. The insurance requirements herein are minimum requirements for this CONTRACT and in no way limit the indemnity covenants contained in this CONTRACT. City in no way warrants that the minimum limits contained herein are sufficient to protect the CONTRACTOR from liabilities that might arise out of the performance of the work under this CONTRACT by the CONTRACTOR, its agents, representatives, employees or subcontractors, and CONTRACTOR is free to purchase additional insurance.

C. MINIMUM SCOPE AND LIMITS OF INSURANCE: CONTRACTOR shall provide coverage with limits of liability not less than those stated below. Limits may be met with a combination of GL and excess coverages.

1. Commercial General Liability – Occurrence Form

Policy shall include bodily injury, property damage, personal injury and broad form contractual liability coverage.

- | | |
|--|-------------|
| a. General Aggregate | \$5,000,000 |
| b. Products – Completed Operations Aggregate | \$2,000,000 |
| c. Personal and Advertising Injury | \$1,000,000 |

- d. Blanket Contractual Liability – Written and Oral \$1,000,000
- e. Fire Legal Liability \$ 50,000
- f. Each Occurrence \$2,000,000

- i. The policy shall be endorsed to include the following additional insured language: ***"Lake Havasu City, its departments, agencies, boards, commissions, and its officers, officials, agents, volunteers and employees shall be named as additional insureds with respect to liability arising out of the activities performed by or on behalf of the CONTRACTOR"***.
- ii. Policy shall contain a waiver of subrogation against Lake Havasu City, its departments, agencies, boards, commissions, and its officers, officials, agents, volunteers and employees for losses arising from work performed by or on behalf of the CONTRACTOR.
- iii. Completed operations coverage shall remain effective for at least two years following expiration of CONTRACT.

2. Business Automobile Liability

- a. Bodily Injury and Property Damage for any owned, hired, and/or non-owned vehicles used in the performance of this CONTRACT.

Combined Single Limit (CSL) \$1,000,000

- i. The policy shall be endorsed to include the following additional insured language: "Lake Havasu City, its departments, agencies, boards, commissions, and its officers, officials, agents, volunteers and employees shall be named as additional insureds with respect to liability arising out of the activities performed by or on behalf of the CONTRACTOR, involving automobiles owned, leased, hired or borrowed by the CONTRACTOR."
- ii. Policy shall contain a waiver of subrogation against Lake Havasu City, its departments, agencies, boards, commissions, and its officers, officials, agents, volunteers and employees for losses arising from work performed by or on behalf of the CONTRACTOR.

3. Workers' Compensation and Employers' Liability

- a. Workers' Compensation Statutory
- b. Employers' Liability Each Accident \$ 500,000
 - Disease – Each Employee \$ 500,000
 - Disease – Policy Limit \$1,000,000

- i. Policy shall contain a waiver of subrogation against Lake Havasu City, its departments, agencies, boards, commissions, and its officers, officials, agents, volunteers and employees for losses arising from work performed by or on behalf of the CONTRACTOR.
- ii. This requirement shall not apply if exempt under A.R.S. Section 23-901.

4. Professional Liability (Errors and Omissions Liability)*

***If Applicable**

- a. Each Claim \$1,000,000
- b. Annual Aggregate \$2,000,000

- i. In the event that the professional liability insurance required by this CONTRACT is written on a claims-made basis, CONTRACTOR warrants that any retroactive date under the policy shall precede the effective date of this CONTRACT; and that either continuous coverage will be maintained or an extended discovery period will be exercised for a period of two (2) years beginning at the time work under this CONTRACT is completed.
- ii. The policy shall cover professional misconduct or lack of ordinary skill for those positions defined in the Scope of Work of this CONTRACT.

5. Builders' Risk (Property) Insurance (Vertical Construction Only)

a. CONTRACTOR shall purchase and maintain, on a replacement cost basis Builders' Risk insurance in the amount of the initial CONTRACT amount as well as subsequent modifications thereto, including modifications through Change Order, for the entire work at the site. Such Builders' Risk insurance shall be maintained until final payment has been made or until no person or entity other than CITY has an insurable interest in the property required to be covered, whichever is earlier. This insurance shall include interests of CITY, CONTRACTOR and any tier of CONTRACTOR's subcontractors in the work during the life of the CONTRACT and course of construction, and shall continue until the work is completed and accepted by CITY. For new construction projects, CONTRACTOR agrees to assume full responsibility for loss or damage to the work being performed and to the buildings or structures under construction. For renovation construction projects, CONTRACTOR agrees to assume responsibility for loss or damage to the work being performed at least up to the full CONTRACT amount, unless otherwise required by the Contract documents or amendments thereto.

b. Builders' Risk insurance shall be on an all-risk policy form and shall also cover false work and temporary buildings or structures and shall insure against risk of direct physical loss or damage from external causes including debris removal, demolition occasioned by enforcement of any applicable legal requirements and shall cover reasonable compensation for architects' and engineers' services and expenses, and other "soft costs," required as a result of such insured loss.

c. Builders' Risk insurance must provide coverage from the time any covered property falls within CONTRACTOR's control and/or responsibility and continue without interruption during construction or renovation or installation, including any time during which covered property is being transported to the construction or installation site, and while on the construction or installation site awaiting installation. The policy will provide coverage while the covered premises or any part thereof is occupied. Builders' Risk insurance shall be primary and not contributory.

d. If the CONTRACT requires testing of equipment or materials or other similar operations, at the option of CITY, CONTRACTOR will be responsible for providing property insurance for these exposures under a Boiler Machinery insurance policy.

6. Contractor's Personal Property

CONTRACTOR and each of its subcontractors and suppliers shall be solely responsible for any loss or damage to its or their personal property and that of their employees and workers, including, without limitation, property or materials created or provided pursuant to this CONTRACT, any subcontract or otherwise, its or their tools, equipment, clothing, fencing, forms, mobile construction equipment, scaffolding, automobiles, trucks, trailers or semi-trailers including any machinery or apparatus attached thereto, temporary structures and uninstalled materials, whether owned, used, leased, hired or rented by CONTRACTOR or any subcontractor, consultant or supplier or employee or worker (collectively, "Personal Property"). CONTRACTOR and its subcontractors, consultants and suppliers, at its or their option and own expense, may purchase and maintain insurance for such Personal Property and any deductible or self-insured retention in relation thereto shall be its or their sole responsibility. Any such insurance shall be CONTRACTOR's and the subcontractors', suppliers' volunteers and employees' and workers' sole source of recovery in the event of loss or damage to its or their Personal Property. Any such insurance purchased and maintained by CONTRACTOR and any subcontractor, consultant or supplier shall include a waiver of subrogation as to Owner. CONTRACTOR waives all rights of recovery, whether under subrogation or otherwise, against all such parties for loss or damage covered by CONTRACTOR's property insurance. CONTRACTOR shall require the same waivers from all subcontractors and suppliers and from the insurers issuing property insurance policies relating to the Work or the Project purchased and maintained by all subcontractors and suppliers. The waivers of subrogation referred to in this subparagraph shall be effective as to any individual or entity even if such individual or entity (a) would otherwise have a duty of indemnification, contractual or otherwise, (b) did not pay the insurance premium, directly or indirectly, and (c) whether or not such individual or entity has an insurable interest in the property which is the subject of the loss or damage.

7. Theft, Damage, or Destruction of Work

In the event of theft, damage or destruction of the Work, CONTRACTOR will re-supply or rebuild its Work without additional compensation and will look to its own resources or insurance coverages to pay for such re-supply or rebuilding. CONTRACTOR will promptly perform, re-supply or rebuild, regardless of the pendency of any claim by CONTRACTOR against any other party, including Owner, that such party is liable for damages, theft or destruction of CONTRACTOR's Work. This subparagraph shall apply except to the extent that the cost of re-supply or rebuilding is paid by Owner's builder's risk insurance; in such event, Owner waives (to the fullest extent permitted by the builder's risk policy) all rights of subrogation against CONTRACTOR and each of its subcontractors to the extent of such payment by Owner's builder's risk insurer.

8. Contractor's Pollution Liability

- a. Each Claim \$1,000,000
- b. Annual Aggregate \$2,000,000

- i. The policy shall provide coverage for damages against, but not limited to, bodily injury, third-party liability, clean up, corrective action including assessment, remediation and defense costs. When a self-insured retention or deductible exceeds \$25,000, the Lake Havasu City reserves the right, but not the obligation, to review and request a copy of the CONTRACTOR'S most recent annual report or audited financial statements.
- ii. The pollution liability policy shall be endorsed to include the following additional insured language: **"Lake Havasu City, its departments, agencies, boards, commissions, and its officers, officials, agents, volunteers and employees shall be named as additional insureds with respect to liability arising out of the activities performed by or on behalf of the CONTRACTOR."**
- iii. In the event that the pollution liability insurance required by this CONTRACT is written on a claims-made basis, CONTRACTOR warrants that any retroactive date under the policy shall precede the effective date of this CONTRACT; and that either continuous coverage will be maintained or an extended discovery period will be exercised for a period of seven (7) years beginning at the time work under this CONTRACT is completed.

- D. ADDITIONAL INSURANCE REQUIREMENTS: The policies shall include, or be endorsed to include, the following provisions:
- 1. Lake Havasu City, its departments, agencies, boards, commissions and its officers, officials, agents, volunteers and employees wherever additional insured status is required. Such additional insured shall be covered to the full limits of liability purchased by the CONTRACTOR, even if those limits of liability are in excess of those required by this CONTRACT.
 - 2. The Contractor's insurance coverage shall be primary insurance with respect to all other available sources.
 - 3. Coverage provided by the Contractor shall not be limited to the liability assumed under the indemnification provisions of this CONTRACT.
- E. NOTICE OF CANCELLATION: Each insurance policy required by the insurance provisions of this CONTRACT shall not be suspended, voided, cancelled, reduced in coverage or in limits without ten (10) business days written notice to City. Such notice shall be mailed directly to Lake Havasu City, Community Investment Department, Procurement Division, 2330 McCulloch Blvd. North, Lake Havasu City, AZ, 86403 and shall be sent by certified mail, return receipt requested.

- F. **ACCEPTABILITY OF INSURERS:** Insurance is to be placed with duly licensed or approved non-admitted insurers in the state of Arizona with an "A.M. Best" rating of not less than A-VII. CITY in no way warrants that the above-required minimum insurer rating is sufficient to protect the CONTRACTOR from potential insurer insolvency.
- G. **VERIFICATION OF COVERAGE:**
1. CONTRACTOR shall furnish CITY with certificates of insurance as required by this CONTRACT. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf and the Project/contract number and project description shall be noted on the certificate of insurance.
 2. All certificates and endorsements are to be received and approved by CITY at least ten (10) days before work commences. Each insurance policy required by this CONTRACT must be in effect at or prior to commencement of work under this CONTRACT and remain in effect for the duration of the Project. Failure to maintain the insurance policies as required by this CONTRACT, or to provide evidence of renewal, is a material breach of contract.
 3. All renewal certificates required by this CONTRACT shall be sent directly to Lake Havasu City, Community Investment Department, Procurement Division, 2330 McCulloch Blvd. North, Lake Havasu City, AZ, 86403. The Project/contract number and project description shall be noted on the certificate of insurance. CITY reserves the right to require complete, certified copies of all insurance policies required by this CONTRACT at any time.
- H. **SUBCONTRACTORS:** CONTRACTOR's certificate(s) shall include all subcontractors as insureds under its policies **or** CONTRACTOR shall furnish to CITY separate certificates and endorsements for each subcontractor. All coverages for subcontractors shall be subject to the minimum requirements identified above.
- I. **APPROVAL:** Any modification or variation from the insurance requirements in this CONTRACT must have prior approval from the CITY's Human Resources/Risk Management Division, whose decision shall be final. Such action will not require a formal CONTRACT amendment, but may be made by administrative action.
- J. **EXCEPTIONS:** In the event the CONTRACTOR or sub-contractor(s) is/are a public entity, then the Insurance Requirements shall not apply. Such public entity shall provide a Certificate of Self-Insurance.

SECTION 00500B
CONTRACTOR Claim Handling Procedure

1. Claimant is to submit in writing to the OWNER or their REPRESENTATIVE the details of the claim to include the where, when, and how of the claim, and an estimate of damage, if applicable.
2. OWNER or their REPRESENTATIVE will forward the claim directly to the CONTRACTOR for handling. The CONTRACTOR is to respond to the claimant, in writing, within 30 calendar days of receipt with copies to:

Lake Havasu City Human Resources/Risk Management Division
Lake Havasu City Administrative Services Department
OWNER'S REPRESENTATIVE, if applicable

If the CONTRACTOR denies the claim, the reasons for such denial must be included in the response to the claimant.

SECTION 00510
ARIZONA STATUTORY PERFORMANCE BOND

PURSUANT TO TITLES 28, 34, AND 41, ARIZONA REVISED STATUTES
(Penalty of this bond must be 100% of the Contract amount)

KNOW ALL MEN BY THESE PRESENTS THAT: _____
(hereinafter "Principal"), as Principal, and _____
(hereinafter "Surety"), a corporation organized and existing under the laws of the State of _____
with its principal office in the City of _____, holding a certificate of authority to
transact surety business in Arizona issued by the Director of Insurance pursuant to Title 20,
Chapter 2, Article 1, as Surety, are held and firmly bound unto Lake Havasu City, Arizona
(hereinafter "Obligee") in the amount of **WRITTEN AMOUNT AND 00/100** (Dollars)
(\$#,###,###.##-NUMERIC AMOUNT), for the payment whereof, Principal and Surety bind
themselves, and their heirs, administrators, executors, successors and assigns, jointly and
severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated
the ____ day of _____, _____, to furnish all of the material, supplies, tools,
equipment, labor and other services necessary for the construction and completion of

**North Havasu Additional Tank & Distribution Line, PROJECT NUMBER B26-PW-
108031-500784**

which contract is hereby referred to and made a part hereof as fully and to the same extent as if
copied at length herein.

NOW, THEREFORE, THE CONDITION OF THE OBLIGATION IS SUCH, that if the Principal
faithfully performs and fulfills all of the undertakings, covenants, terms, conditions and
agreements of the contract during the original term of the contract and any extension of the
contract, with or without notice of the Surety, and during the life of any guarantee required under
the contract, and also performs and fulfills all of the undertakings, covenants, terms, conditions
and agreements of all duly authorized modifications of the contract that may hereafter be made,
notice of which modifications to the Surety being hereby waived, the above obligation is void.
Otherwise it remains in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34,
Chapter 2, Article 2, Arizona Revised Statutes, and all liabilities on this bond shall be determined
in accordance with the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, to
the same extent as if it were copied at length in this agreement.

The prevailing party in a suit on this bond shall recover as part of the judgment reasonable
attorney fees that may be fixed by a judge of the court.

Witness our hands this ____ day of _____, _____.

PRINCIPAL SEAL

AGENCY OF RECORD BY: _____

AGENCY ADDRESS SURETY SEAL

BY: _____

**** END OF SECTION ****

SECTION 00520
ARIZONA STATUTORY PAYMENT BOND
PURSUANT TO TITLES 28, 34, AND 41, ARIZONA REVISED STATUTES
(Penalty of this bond must be 100% of the Contract amount)

KNOW ALL MEN BY THESE PRESENTS THAT: _____

(hereinafter "Principal"), as Principal, and _____

(hereinafter Surety), a corporation organized and existing under the laws of the State of _____ with its principal office in the City of _____

_____, holding a certificate of authority to transact surety business in Arizona issued by the Director of the Department of Insurance pursuant to Title 20, Chapter 2, Article 1, as Surety, are held and firmly bound unto Lake Havasu City, Arizona (hereinafter "Obligee") in the amount of **WRITTEN AMOUNT AND 00/100 (Dollars) ((\$#,###,###.##-NUMERIC AMOUNT)** for the payment whereof, Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the _____ of _____, _____, to furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of

North Havasu Additional Tank & Distribution Line, PROJECT NUMBER B26-PW-108031-500784

which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFOR, THE CONDITION OF THE OBLIGATION IS SUCH, that if the Principal promptly pays all monies due to all persons supplying labor or materials to the Principal or the Principal's subcontractors in the prosecution of the work provided for in the contract, this obligation is void. Otherwise it remains in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions, conditions and limitations of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, to the same extent as if it were copied at length in this agreement.

The prevailing party in a suit on this bond shall recover as part of the judgment reasonable attorney fees that may be fixed by a judge of the court.

Witness our hands this ____ day of _____, _____.

PRINCIPAL

SEAL

BY: _____

AGENCY OF RECORD

AGENCY ADDRESS

SURETY

SEAL

BY: _____

** END OF SECTION **

SECTION 00670
NOTICE OF AWARD

TO:

DATE:

PROJECT DESCRIPTION: North Havasu Additional Tank & Distribution Line

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for BIDS dated March 18, 2026, and Information for Bidders.

You are hereby notified that your BID has been accepted for items in the amount of \$, to include: [LIST BID ITEMS AWARDED]

You are required by the Information for Bidders to execute the Contract and furnish the required CONTRACTOR'S Performance Bond, Payment Bond, and Certificates of Liability, Vehicular, and Workmen's Compensation Insurance within ten (10) calendar days from the postmark date when this notice was sent by U.S. Mail.

If you fail to execute said Contract and to furnish said BONDS within ten (10) days from the date of this Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER'S acceptance of your BID as abandoned and as a forfeiture of your BID BOND. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

Dated this [DATE] day of [MONTH], 2026.

Lake Havasu City, Arizona

BY: _____

NAME: Lynette Singleton

TITLE: Procurement Official

Acceptance of Notice

(NOTE: The contractor shall return a signed copy of this notice to the owner.)

Receipt of this NOTICE OF AWARD is hereby acknowledged by:

Contractor

This the ____ day of _____, 2026.

BY: _____

TITLE: _____

** END OF SECTION **

SECTION 00680
NOTICE TO PROCEED

TO: _____ **Date:** _____

RE: B26-PW-108031-500784 North Havasu Additional Tank & Distribution Line

You are hereby notified to commence WORK in accordance with the Contract dated _____ within ten (10) calendar days of the date of this Notice To Proceed, and you are to complete the WORK within **280 Calendar Days** with a completion date of (_____). The period for completion may be extended through the authorized and approved change order process.

OWNER: Lake Havasu City, Arizona

By: _____

Name: _____

Title: _____

ACCEPTANCE OF NOTICE

(NOTE: The Contractor shall return a signed copy of this Notice to the Owner)

Receipt of the above NOTICE TO PROCEED is hereby acknowledged

this the __ day of _____, _____.

By: _____

Name: _____

Title: _____

** END OF SECTION **

**SECTION 00685
CERTIFICATE OF SUBSTANTIAL COMPLETION**

I hereby state that the degree of completion of:

**North Havasu Additional Tank & Distribution Line
Project No. B26-PW-108031-500784**

Provides the full-time use of the project, or defined portion of the project, for the purposes for which it was intended and is the commencement of the Guarantee Period.

"Substantial Completion" shall not be considered as final acceptance.

Lake Havasu City, Arizona

Date: _____

By: _____

Name: _____

Title: _____

ACCEPTANCE OF NOTICE

(NOTE: The Contractor shall return a signed copy of this Notice to the Owner)

Receipt of the above **CERTIFICATE OF SUBSTANTIAL COMPLETION** is hereby acknowledged this the _____ day of _____, _____.

By: _____

Name: _____

Title: _____

E-original: [CONTRACTOR]

E-copy: Procurement (Purchasing@lhcaz.gov)

Lake Havasu City, City Clerk (CityClerk@lhcaz.gov)

CERTIFICATE OF COMPLETION

I hereby state that all goods and services required by:

**North Havasu Additional Tank & Distribution Line
Project No. B26-PW-108031-500784**

have been delivered in conformance with the Contract, and all activities required by the Contractor under the Contract were completed as of _____.
(Date)

Lake Havasu City, Arizona

By: _____

Name: _____

Title: _____

E-original: [CONTRACTOR]

E-copy: Procurement (Purchasing@lhcaz.gov)

City Clerk (CityClerk@lhcaz.gov)

SECTION 00700
GENERAL CONDITIONS

This section of the Contract Documents is pre-printed. Any modifications to the following Articles, as may be required for this Project, are made in the Special Provisions.

1.0 DEFINITIONS

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

1.1 Addenda

Written or graphic instruments issued prior to the opening of Bids which modify or interpret the Contract Documents, Drawings and Specifications, by additions, deletions, clarifications or corrections.

1.2 As Approved

The words "as approved," unless otherwise qualified, shall be understood to be followed by the words "by the Owner."

1.3 As Shown, and as Indicated

The words "as shown" and "as indicated" shall be understood to be followed by the words "on the Drawings" or "in the Specifications."

1.4 Award

The acceptance, by the Owner, of the successful Bidder's proposal.

1.5 Bid

The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

1.6 Bidder

Any individual, firm partnership or corporation, or combination thereof submitting a proposal for the Work contemplated, acting directly or through a duly authorized representative.

1.7 Bonds

Bid, Performance, and Payment Bonds and other instruments of security, furnished by the Contractor and its surety in accordance with the Contract Documents.

1.8 Calendar Day

Every day shown on the calendar, measured from midnight to the next midnight.

1.9 Change Order

A written order to the Contractor, signed by the Owner, covering changes in the Plans, Specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for the Work affected by such changes.

If the Change Order increases the existing Contract Amount, the Builder's Risk Insurance limit must be increased to the adjusted Contract Amount.

1.10 Contract

The "Contract" is the written Contract covering the performance of the Work and the furnishing of labor, materials, incidental services, tools, and equipment in the construction of the Work. It includes Supplemental Contracts amending or extending the Work contemplated in the manner hereinafter described and which may be required to complete the Work in a substantial and acceptable manner to the Owner. The Contract may include Contract Change Orders.

1.11 Contract Documents

The "Contract Documents" consist of the Bidding Requirements, Contract Forms, Conditions of the Contract including General and/or Supplemental General Conditions, Special Provisions, the Technical Specifications, and the Drawings, including all Addenda and modifications thereafter incorporated into the Documents before execution and including all other requirements incorporated by specific reference thereto.

1.12 Contract Price

The total monies payable by Owner to the Contractor under the terms and conditions of the Contract Documents.

1.13 Contract Time

The number of calendar days stated in the Contract Documents for the completion of the Work.

1.14 Contractor

The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the Work contracted for and the payment of all legal debts pertaining to the Work who acts directly or through lawful agents or employees to complete the Contract Work.

1.15 Days

Unless otherwise specifically stated, the term "days" will be understood to mean calendar days.

1.16 Drawings

The term "Drawings," also described as "Plans," refers to the official drawings, profiles, cross sections, elevations, details, and other working drawings, and supplementary drawings, or reproductions thereof, which show the locations, character, dimensions, and details of the Work to be performed. Drawings may either be bound in the same book as the balance of the Contract Documents or bound in separate sets, and are a part of the Contract Documents, regardless of the method of binding.

1.17 Engineer

The individual, partnership, firm, or corporation duly authorized by the Owner (sponsor) to be responsible for the Engineering of the contract Work and acting directly or through an authorized representative.

1.18 Field Order

A written order effecting a change in the Work not involving an adjustment in the Contract Price or an extension of the Contract Time, issued by the Engineer to the Contractor during construction.

1.19 Final Acceptance

Upon due notice from the Contractor of presumptive completion of the entire project, the Owner will make an inspection. If all construction provided for and contemplated by the contract is found completed to the Owner's satisfaction and all requirements of the contract have been met, that inspection shall constitute the final inspection and the Owner will make the final acceptance and issue the Certificate of Completion.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory or that all requirements of the contract have not been met, the Owner will give the Contractor the necessary instructions for correction or completion, and the Contractor shall immediately comply with and execute the instructions. Upon correction of the work, completion of contract requirements, and notification to Owner, another inspection will be made which shall constitute the final inspection provided the work has been satisfactorily completed and all requirements of the contract met. In such event, the Owner will make the final acceptance and issue the Certificate of Completion.

1.20 Inspector

An authorized representative of the Owner assigned to make all necessary inspections and/or tests of the Work performed or being performed, or of the materials furnished or being furnished by the Contractor.

1.21 Methodology and Quality of Workmanship

The manner and sequence of construction which considered to be the acceptable standard in which to perform the Work.

1.22 Notice

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

1.23 Notice of Award

The written notice of the acceptance of the Bid from the Owner to the successful Bidder.

1.24 Notice to Proceed

Written communication issued by the Owner to the Contractor authorizing him to proceed with the Work and establishing the date of commencement of the Work.

1.25 Or Equal

The phrase "or equal" shall be understood to indicate that the "equal" product is the same or better than the product names in function, performance, reliability, quality, and general configuration. Determination of equality in reference to the project design requirements will be made by the Owner.

1.26 Owner

The term "Owner" shall be understood to be Lake Havasu City, Arizona.

1.27 Payment Bond

The approved form of security furnished by the Contractor and its surety as a guaranty that it will pay in full all bills and accounts for materials and labor used in the construction of Work.

1.28 Performance Bond

The approved form of security furnished by the Contractor and its surety as a guarantee that the Contractor will complete the Work in accordance with the terms of the Contract and guarantee the Work for a period of one (1) year after the date of Certificate of Substantial Completion.

1.29 Plans

Plans shall have the same meaning as "Drawings," see Section 1.16.

1.30 Project

The undertaking to be performed as provided in the Contract Documents, see Section 1.11.

1.31 Proposal

The offer of the Bidder for the Work when made out and submitted on the prescribed proposal form, properly signed and guaranteed.

1.32 Proposal Guarantee

The cash, or cashier's check or certified check, or bidder's bond accompanying the Proposal submitted by the Bidder, as a guarantee that the Bidder will enter into a contract with the Owner for the construction or doing of the Work, if it is awarded to it, and will provide the contract bonds and insurance required.

1.33 Shop Drawings

All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, manufacturer, supplier or distributor, which illustrate how specific portions of the Work shall be fabricated or installed.

1.34 Specifications

The directions, provisions and requirements pertaining to the method and manner of performing the Work or to the quantities and qualities of the materials to be furnished under the Contract, together with all other directions, provisions and requirements, plus such amendments, deletions from or additions which may be provided for by Supplemental Contract or Change Orders.

1.35 Subcontractor

A Subcontractor is a person or entity who has a direct or indirect contract with a Contractor to perform any of the Work at the site. For convenience, the term Subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender but includes the plural and feminine gender and includes a Sub-Subcontractor or an authorized representative thereof. The term Subcontractor does not include any separate Contractor or its Subcontractors.

1.36 Substantial Completion

"Substantial Completion" shall be that degree of completion of the project or a defined portion of

the project, sufficient to provide the Owner, at its discretion, the full-time use of the project or defined portion of the project for the purposes for which it was intended. "Substantial Completion" shall not be considered as final acceptance.

1.37 Supplemental General Conditions

Modifications to General Conditions required by a Federal Agency for participation in the Project and approved by the agency for participation in the Project and approved by the agency in writing prior to inclusion in the Contract Documents and such requirements that may be imposed by applicable state laws. The term also includes modifications or additions to the General Conditions required by the Owner or Engineer.

1.38 Supplier

Any person or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

1.39 Surety

The corporation, partnership, or individual, other than the Contractor, executing Payment, or Performance Bonds which are furnished to the Owner by the Contractor.

1.40 Work

The word "Work" within these Contract Documents shall include all material, labor, tools, utilities, and all appliances, machinery, transportation, and appurtenances necessary to perform and complete the Contract, and such additional items not specifically indicated or described which can be reasonably inferred as belonging to the item described or indicated and as required by good practice to provide a complete and satisfactory system or structure.

1.41 Working Day

A working day shall be any day, other than a legal holiday, Saturday or Sunday, on which the normal working forces of the Contractor may proceed with regular work.

2.0 **NOTICE TO PROCEED**

2.1 After the Owner has issued the Notice Of Award, the Contractor shall provide the Performance Bond, the Payment Bond, the Certificate Of Insurance, the Work Schedule, the monthly cash flow, and a signed Contract within ten (10) calendar days. The Owner's attorney will review each document and, if they are found to be acceptable, the Owner will sign and execute the Contract. Within a period of sixty (60) calendar days after executing the Contract, the Owner will issue the Notice To Proceed. Within ten (10) calendar days of the postmark date of the Notice To Proceed, the Work shall commence. The Contractor shall not commence any Work until such time that the Notice To Proceed has been issued.

3.0 ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

3.1 The Engineer may furnish additional instructions to the Contractor by means of Drawings or otherwise, during the progress of the Work as necessary to make clear or to define in greater detail the intent of the Specifications and Contract Drawings.

The additional drawings and instruction thus supplied will become a part of the Contract Documents. The Contractor shall carry out the Work in accordance with the additional detail drawings and instructions.

4.0 SCHEDULES, REPORTS AND RECORDS

4.1 The Contractor shall submit to the Owner payrolls, reports, estimates, records and other data where applicable as are required by the Contract Documents for the Work to be performed.

4.2 The Contractor, after the Contract award and prior to the Pre-Construction Conference, shall prepare for submittal to the Engineer for review, a detailed progress schedule. The progress schedule shall be brought up to date and submitted to the Engineer prior to each progress payment request, and at such other time intervals as the Engineer may request.

A. Progress Schedule

The schedule shall be a time-scaled critical path progress schedule showing in detail the proposed sequence of activity. The critical path analysis shall consist of a graphic network diagram and shall clearly show start and completion dates and percentage of work completed.

4.3 The Contractor shall also forward to the Engineer, prior to each progress payment request, an itemized report of the delivery status of major and critical items of purchased equipment and material, including Shop Drawings and the status of shop and field fabricated work. These progress reports shall indicate the date of the purchase order, the current percentage of completion, estimated delivery, and cause of delay, if any.

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

4.5 The Owner shall have the right to withhold progress payments for the Work if the Contractor fails to update and submit the progress schedule and reports as specified, and such withholding shall not constitute grounds for additional claims by the Contractor against the Owner.

4.6 The Contractor shall submit an estimated monthly cash flow, based upon the progress schedule with the bonds, schedules, and Certificate Of Insurance.

5.0 DRAWINGS AND SPECIFICATONS

5.1 The intent of the Drawings and Specifications is that the Contractor shall furnish all labor, materials, tools, equipment, utilities, and transportation necessary for the proper execution of the Work in accordance with the Contract Documents and all incidental work necessary to complete the Project in an acceptable quality and manner, ready for use, occupancy or operation by the Owner.

5.2 In case of conflict between the Drawings and Specifications, the Specifications shall govern. Figure dimensions on Drawings shall govern over scale dimensions, and detailed Drawings shall govern over general Drawings.

5.3 Any discrepancies found between the Drawings and Specifications and site conditions or any inconsistencies or ambiguities in the Drawings or Specifications shall be immediately reported verbally and within 24 hours of such a discovery, in writing to the Engineer, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the Contractor after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor's risk, and the Contractor shall assume full responsibility therefor and shall bear all costs attributable thereto, if not acceptable to the Owner.

6.0 SHOP DRAWINGS

6.1 The Contractor shall provide seven (7) copies of the Shop Drawings as specified or as may be necessary for the prosecution of the Work as required by the Contract Documents. All drawings and schedules shall be submitted sufficiently in advance to allow the Engineer not less than 20 regular working days for checking the submittal. The Engineer's approval of any Shop Drawings shall not release the Contractor from responsibility for deviations from the Contract Documents.

6.2 When submitted for the Engineer's review, Shop Drawings shall bear the Contractor's certification by means of a signed Stamp, that he has reviewed, checked and approved the Shop Drawings and that they are in conformance with the requirements of the Contract Documents. Shop Drawings, which in the opinion of the Engineer are incomplete or unchecked by the Contractor, will be returned to the Contractor for resubmission in the proper form.

If Shop Drawings or submittals are rejected by the Engineer, all costs incurred by the Engineer Or The Owner for reviewing the resubmittals shall be charged to the Contractor, and the Owner has the right to deduct such costs from any monies owed the Contractor by the Owner.

6.3 When Shop Drawings have been reviewed by the Engineer, two sets of submittals will be returned to the Contractor appropriately stamped. If major changes or corrections are necessary, the Shop Drawing may be rejected and one set will be returned to the Contractor with such changes or corrections indicated, and the Contractor shall correct and resubmit the Shop Drawings. No changes shall be made by the Contractor to resubmitted Shop Drawings other than those changes indicated by the Engineer, unless such changes are clearly described in a letter

accompanying the resubmitted Shop Drawings.

6.4 The review of such Shop Drawings and catalog cuts by the Engineer shall not relieve the Contractor from responsibility for corrections of dimensions, fabrication details, 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. When the Contractor does call such deviations to the attention of the Engineer, the Contractor shall state in his letter whether or not such deviations involve any deduction or extra cost adjustment.

6.5 Portions of the Work requiring a Shop Drawing or sample submission shall not begin until the Shop Drawing or submission has been approved by the Engineer. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.

7.0 RECORD DRAWINGS

7.1 During construction, the Contractor shall keep an accurate record of the following:

- A. Deviations between the Work as shown on the Plans and the Work as actually installed.
- B. The specific locations of piping, valves, electric conduits, duct work, equipment, and other such work which was not located on the Plans. The Record Drawings shall show distances to these locations from known points on the Plans.
- C. Equipment schedules indicating manufacturer's names and model numbers. When all revisions showing work as installed are made, the corrected set of plans shall be delivered to the Engineer before the final pay request is processed. These plans shall be clearly marked "Record Drawings."

7.2 Nothing contained in this section shall be construed as authorizing any deviation in the Work as shown on the Contract Drawings without a written Change Order or written authority to the Contractor from the Engineer.

8.0 MATERIALS, SERVICES, AND FACILITIES

8.1 It is understood that, except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the Work within the specified time.

8.2 The Contractor shall furnish the Owner a list of materials and the source of supply of each

of the materials on the list. The source of supply of each of the materials shall be approved by the Owner before the delivery of said materials is started. Only materials conforming to these Specifications and approved by the Owner shall be used in the Work. All materials proposed for use may be inspected or tested at any time during their preparation and use. After trial, if it is found that sources of supply which have been approved do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the Contractor shall furnish approved material from other approved sources. No material which, after approval, has in any way become unfit for use shall be used in the Work.

8.3 The Contractor warrants to the Owner and Engineer that the materials and equipment furnished under the Contract will be new and of a quality equal to that specified or approved and, that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. Mechanical and electrical equipment shall be the products of manufacturers of established good reputations and regularly engaged in the fabrication of such equipment. Unless otherwise noted, any equipment offered shall be current models which have been in successful regular operation under comparable conditions for a period of at least two years. This time requirement, however, does not apply to minor details nor to thoroughly demonstrated improvements in design or in material of construction. Work shall be done and completed in a thorough and workmanlike manner and if required by Engineer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment used.

8.4 All materials which the Engineer or its authorized Inspector has determined do not conform to the requirements of the Plans and Specifications will be rejected. They shall be removed immediately from the vicinity of the Work by the Contractor at his own expense, unless otherwise permitted by the Engineer. No rejected material, the defects of which have been subsequently corrected, shall be used in the Work, unless approval in writing has been given by the Engineer. Upon failure of the Contractor to comply promptly with any order of the Engineer made under the provisions in this section, the Engineer shall have authority to cause the removal and replacement of rejected material and to deduct the cost thereof from any monies due or to become due the Contractor.

8.5 If any part or portions of the Work done or material furnished under this Contract shall prove defective or non-conforming with the Drawings and Specifications, and if the imperfection in the same shall not be of sufficient magnitude or importance as to make the Work dangerous or unsuitable, or if the removal of such Work will create conditions which are dangerous or undesirable, the Engineer shall have the right and authority to retain such Work but shall make such deductions in the final payment therefor as may be just and reasonable. Such adjustment shall be effected whether or not final payment has been made.

8.6 Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work shall be located so as to facilitate prompt inspection.

8.7 Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

8.8 Materials, supplies or equipment to be incorporated into the Work shall not be purchased by the Contractor or the Subcontractor subject to a chattel mortgage or under a conditional sale contract or other Contract by which an interest is retained by the seller.

9.0 INSPECTION AND TESTING

9.1 All material and equipment used in the construction of the Project shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the Contract Documents.

9.2 The Owner shall provide all inspection and testing services not required by the Contract Documents.

9.3 The Contractor shall provide at its expense the testing and inspection services required by the Contract Documents.

9.4 If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested, or approved by someone other than the Contractor, the Contractor will give the Engineer timely notice of readiness, the minimum of which shall be forty-eight (48) hours. The Contractor will then furnish the Engineer the required certificates of inspection, testing or approval.

9.5 Inspections, tests or approvals by the Engineer or others shall not relieve the Contractor from its obligations to perform the Work in accordance with the requirements of the Contract Documents.

9.6 The Engineer and its representatives will at all times have access to the Work. In addition, authorized representatives and agents of any participating Federal or State agency shall be permitted to inspect all Work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and also for any inspection, or testing thereof.

9.7 If any Work is covered contrary to the written instructions of the Engineer or prior to inspection, if must, if requested by the Engineer, be uncovered for his observation and replaced at the Contractor's expense.

9.8 If the Engineer considers it necessary or advisable that Work that has already been approved be inspected or tested by the Engineer or others, the Contractor, at the Engineer's request, will uncover, expose or otherwise make available for observation, inspection or testing as the Engineer may require, that portion of the Work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such Work is defective, the Contractor will bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction. If, however, such Work is not found to be defective, the Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both,

directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate Change Order shall be issued.

10.0 SUBSTITUTIONS

10.1 Whenever a material, article or piece of equipment is identified on the Drawings or Specifications by reference to brand name or catalogue number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. The Contractor may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the Contract Documents by reference to brand name or catalogue number, and if, in the opinion of the Engineer, such material, article, or piece of equipment is of equal substance and function to that specified, the Engineer may approve its substitution and use by the Contractor. Any cost differential shall be deductible from the Contract Price and the Contract Documents shall be appropriately modified by Change Order. The Contractor warrants that if substitutes are approved, no major changes in the function or general design of the Project will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the Contract Price or Contract Time. Any substitutions not properly approved and authorized by the Engineer may be considered defective and the Engineer may require the Contractor to remove the substituted material, article or piece of equipment and the Contractor shall bear any and all costs associated with the removal of the substituted item, including all engineering, inspection, testing or surveying costs incurred by the Owner or the Engineer.

10.2 Determination of equality in reference to the project design requirements will be made by the Owner. "Equal" products shall not be purchased or installed by the Contractor without the Owner's written approval. Contractor shall have fourteen (14) days after issuance of Notice to Proceed for submission of data substantiating a request for substitution of an "or equal" item.

11.0 PATENTS

11.1 The Contractor shall pay all applicable royalties and license fees. The Contractor shall defend all suits or claims for infringement of any patent rights and indemnify and hold the Owner and Engineer harmless from loss on account thereof, except that the Owner shall be responsible for any such loss when a particular process, design, or the product of a particular manufacturer or manufacturers is specified, however if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, it shall be responsible for such loss unless it promptly gives such information to the Engineer.

12.0 SURVEYS, PERMITS, REGULATIONS

12.1 The Owner shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the Work together with a suitable number of bench marks adjacent to the Work as shown in the Contract Documents. The Contractor shall satisfy itself as to the accuracy of all measurements before constructing any permanent structure and shall not take

advantage of any errors which may have been made in laying out the Work. From the information provided by the Owner, unless otherwise specified in the Contract Documents, the Contractor shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pile locations and other working points, lines, elevations and cut sheets.

12.2 Such stakes and markings as the Engineer may set for either its own or the Contractor's guidance shall be scrupulously preserved by the Contractor. In the event the Contractor, or its employees, destroy or otherwise remove or obliterate such stakes or markings, an amount equal to the cost of replacing the same may be deducted from subsequent estimates due the Contractor at the discretion of the Owner.

12.3 Permits and licenses of a temporary nature necessary for the prosecution of the Work shall be secured and paid for by the Contractor unless otherwise stated in the Supplemental General Conditions. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Owner, unless otherwise specified. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified. If the Contractor perceives that the Contract Documents are at variance therewith, he shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as provided in Section 16. Changes In The Work. If the Contractor performs and works knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer, he shall assume full responsibility therefore and shall bear all costs attributable thereto.

13.0 PROTECTION OF WORK, PROPERTY AND PERSONS

13.1 The Contractor shall have sole responsibility for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to, all employees on the Work and other persons who may be affected thereby, all the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and other items not designated for removal, relocation or replacement in the course of construction.

13.2 The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. The Contractor shall erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. The Contractor shall notify Owners of adjacent utilities when prosecution of the Work may affect them. The Contractor shall remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by the Contractor, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them be liable, except damage or loss attributable to the fault of the Contract Documents or to the acts or omissions of the Owner or the Engineer or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the Contractor.

13.3 In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or Owner, shall act to prevent threatened damage, injury or loss. He shall give the Engineer prompt Written Notice of any significant changes in the Work or deviations from the Contract Documents caused thereby, and a Change Order shall thereupon be negotiated and issued covering the changes and deviations involved, as provided in Section 16.0, Changes in the Work.

13.4 The Contractor shall designate a responsible member of its organization at the site whose duty shall be the prevention of accidents and the safety of all those at the site. The person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and the Engineer. The Engineer will not be responsible for safety precautions and programs in connection with the Work or for the Contractor's failure to properly perform its responsibilities with respect to initiating, maintaining and supervising all safety precautions and programs.

14.0 PUBLIC SAFETY

14.1 Whenever the Contractor's operations create a condition hazardous to traffic or to the public, it shall furnish at its own expense, and without cost to the Owner, such flagmen and guards as are necessary to give adequate warning to the public of any dangerous conditions to be encountered and he shall furnish, erect, and maintain such fences, barricades, lights, signs, and other devices as are necessary to prevent accidents and avoid damage or injury to the public.

14.2 Should the Contractor appear to be neglectful or negligent in furnishing warning and protective measures as above provided, the Engineer may direct attention to the existence of a hazard and the necessary warning and protective measures shall be furnished and installed by the Contractor at its own expense without cost to the Owner. Should the Engineer point out the inadequacy of warning and protective measures, such action on the part of the Engineer shall not relieve the Contractor from responsibility for public safety or abrogate his obligation to furnish and pay for these devices.

14.3 Should the Contractor fail to, be neglectful, or be negligent in furnishing or maintaining warning and protective facilities as required herein, the Owner may furnish or maintain such facilities and charge Contractor therefor by deducting the cost thereof from periodic progress payments due the Contractor as such costs are incurred by Owner.

14.4 No material or equipment shall be stored where it will interfere with the free and safe passage of public traffic, and at the end of each day's Work and at other times when construction operations are suspended for any reason, the Contractor shall remove all equipment and other obstructions from that portion of the right-of-way open for use by public traffic.

15.0 SUPERVISION BY CONTRACTOR

15.1 The Contractor shall supervise and direct the Work, using its best skill and attention. The

Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor shall employ and maintain on the Work a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site, and who shall have been approved by the Engineer, which approval shall not be unreasonably withheld. The supervisor shall have full authority to act on behalf of the Contractor and all communications given to and by the supervisor shall be as binding as if given to and by the Contractor. The supervisor shall be present on the site at all times. The Contractor shall be responsible to the Owner for the acts and omissions of the employees, subcontractors, and the agents and employees, and other persons performing any other Work under the Contract with the Contractor.

16.0 CHANGES IN THE WORK

16.1 The Owner may at any time, as the need arises, order changes within the scope of the Work without invalidating the Contract. If such changes increase or decrease the amount due under the Contract Documents, or in the time required for performance of the Work, an equitable adjustment shall be authorized by Change Order.

16.2 The Engineer, also, may at any time, by issuing a Field Order, make changes in the details of the Work. The Contractor shall proceed with the performance of any changes in the Work so ordered by the Engineer unless the Contractor believes that such Field Order entitles him to a change in Contract Price or Time, or both, in which event he shall give the Engineer Written Notice thereof within seven (7) days after the receipt of the ordered change. Thereafter the Contractor shall document the basis for the change in Contract Price or Time within fourteen (14) days. The Contractor shall not execute such changes pending the receipt of an executed Change Order or further instruction from the Owner.

16.3 If the Contractor wishes to make a claim for an increase in the Contract sum, it shall give the Engineer written notice thereof within fourteen (14) days after the occurrence of the event giving rise to such claim. This notice shall be given by the Contractor before proceeding to execute the Work, except in an emergency endangering life or property, in which case Contractor shall proceed in accordance with the provisions of the Contract. No such claim shall be valid unless so made. If the Owner and Contractor cannot agree on the amount of adjustment in the Contract sum, it shall be determined by the Engineer. Any change in the Contract sum resulting from such claim shall be authorized in a Change Order.

16.4 The value of any Work covered by a Change Order shall be determined by one or more of the following methods in the order of precedence listed below:

- A. Unit prices previously approved.
- B. An agreed lump sum.
- C. Cost plus percentage.

17.0 TIME FOR COMPLETION AND LIQUIDATED DAMAGES

17.1 The date of beginning and the time for completion of the Work are essential conditions of the Contract Documents and the Work embraced shall be commenced on a date specified in the Notice To Proceed.

17.2 The Contractor shall proceed with the Work at such rate of progress to insure full completion within the Contract Time. It is expressly understood and agreed, by and between the Contractor and the Owner, that the Contract Time for the completion of the Work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Work.

17.3 The Contractor shall only work an eight (8) hour day consisting of Monday through Friday, between 6:00 a.m. to 6:00 p.m., and do not include local municipal holidays. If the Contractor desires to carry on Work more than eight (8) hours each day, or work at night or outside the regular hours, it shall give timely notice (72 hours) to the Engineer and receive the Owner's written approval to allow satisfactory arrangements to be made for inspecting the Work in progress. Should the prosecution of the Work be discontinued for any reason, the Contractor shall notify the Engineer at least 24 hours in advance of resuming operations. The Contractor shall be responsible for any extra compensation due or costs incurred as a result of Contractor's desire to carry out Work beyond an eight (8) hour day, or at night or outside regular hours, including but not limited to, any additional costs or compensation due the Engineer And Owner or its employees or agents as a result of having to be present at the site. The costs or extra compensation necessitated by the Contractor's Work beyond an eight (8) hour day, or at night or outside regular business hours may be deducted or withheld from progress payment or any other payments due to Contractor.

17.4 If for any reason a suspension of the work should occur; the Contractor, at its own expense, shall do all the Work necessary to provide a safe, smooth and unobstructed passageway through construction for use by public traffic or to provide for the proper and efficient operation of sewer, drainage and other facilities within the site of the Work, during the period of such suspension. In the event that the Contractor fails to perform the Work specified in this Subsection, the Owner will perform such Work and the cost thereof will be deducted from periodic progress payments due the Contractor.

17.5 During inclement weather and other conditions, the Contractor shall pursue only such portions of the Work as shall not be damaged thereby. No portions of the Work which satisfactory quality or efficiency will be affected by an unfavorable condition shall be constructed while these conditions remain, unless by special means or precautions, approved by the Engineer, the Contractor is able to overcome them.

17.6 Delays in delivery of equipment or material purchased by the Contractor or its Subcontractor, including Engineer-selected equipment, shall not be considered as a just cause for delay as this is not beyond the control of the Contractor. The Contractor shall be fully responsible for the timely ordering, scheduling, expediting, delivery, and installation of all equipment and

materials.

17.7 In case of failure on the part of the Contractor to complete the Work within the time affixed in the Contract, or such extension thereof as may be allowed by Engineer or Owner, the Contract shall by that fact be terminated by written notice. The Owner shall not thereafter pay or allow the Contractor any further compensation for any Work done by it under said Contract, and the Contractor and its sureties shall be liable to the Owner for all loss or damage which it may suffer by reason of his failure to complete the Contract within such time. Failure to prosecute the Work diligently shall be grounds for termination by the Owner pursuant to this paragraph.

In the event the Contract should be terminated, the Owner shall have the right to take over the Work and to proceed with the same until it is completed, either by performing said Work itself directly or by contracting it out to some other person or persons, and in such event the Owner may take possession of and utilize, in completing the Work, such materials, appliances and plant as may be on the site of the Work and necessary for its completion. Nothing herein contained shall be deemed to limit the right of the Owner in the event of any breach of Contract by the Contractor; but all rights herein given to the Owner are and shall be deemed to be additional to any other rights or remedies which the Owner shall have under any provision of law.

17.8 Should the Contractor fail to complete the Work, or any part thereof, in the time agreed upon in the Contract or within such extra time as may have been allowed for delays by extensions granted as provided in the Contract, the Contractor shall reimburse the Owner for the additional expense and damage for each calendar day that the Contract remains uncompleted after the Contract completion date. It is agreed that the amount of such additional expense and damage incurred by reason of failure to complete the Work is the per diem rate, as stipulated in Section 15, Information For Bidders, plus any costs incurred by the Engineer including, but not limited to: the Engineer's costs for additional inspection, testing or surveying as a result of the Contractor's failure to complete the Work in the time agreed upon. The said amounts are agreed upon as liquidated damages for the loss to the Owner on account of expense due to the employment of Engineers, inspectors, and other employees after the expiration of the time of completion, and on account of the value of the operation of the Works dependent thereon. It is expressly understood and agreed that this amount is not to be considered in the nature of a penalty, but as liquidated damages which have accrued against the Contractor. The Owner shall have the right to deduct such damages from any amount due, or that may become due the Contractor, or the amount of such damages shall be due and collectible from the Contractor or its Surety.

17.9 The Contractor shall not be charged with liquidated damages or any excess costs when the delay in completion of the Work is due to any of the reasons set forth below provided the Contractor has given Written Notice of the delay within three (3) days of the occurrence of the cause of the delay to the Owner or Engineer. In the event notice is not given as provided, liquidated damages may be assessed.

A. To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to: acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a separate contract with the Owner, fires, floods,

epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather.

18.0 CORRECTION OF WORK

18.1 The Contractor shall promptly correct all work rejected by the engineer as defective or as failing to conform to the contract documents, whether observed before or after substantial completion and whether or not fabricated, installed or completed. Contractor shall bear all costs of correcting such rejected work, including compensation for the engineer's additional services made necessary thereby. Contractor shall also bear the costs of making good all work of the Owner or separate Contractor destroyed or damaged by such correction or removal.

18.2 All removal and replacement work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected work within ten (10) days after receipt of Written Notice, the Owner may remove such work and store the materials at the expense of the Contractor, including compensation for the engineer's additional services made necessary thereby.

19.0 SUBSURFACE CONDITIONS

19.1 The Contractor shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the Owner by Written Notice of:

- A. Subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents; or
- B. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in Work of the character provided for in the Contract Documents.

19.2 The Owner shall promptly investigate the conditions, and if it finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the Work, an equitable adjustment shall be made and the Contract Documents shall be modified by a Change Order. Any claim of the Contractor for adjustment hereunder shall not be allowed unless he has given the required Written Notice; provided that the Owner may, if he determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

20.0 SUSPENSION OF WORK, TERMINATION AND DELAY

20.1 The Owner may suspend the Work or any portion thereof for a period of not more than ninety (90) days or such further time as agreed upon by the Contractor, by Written Notice to the Contractor and the Engineer which notice shall fix the date on which Work shall be resumed. The Contractor shall resume that Work on the date so fixed. The Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable

to any suspension.

20.2 In addition to any other reasons for termination provided in the Contract, the Contractor shall be considered in default of the Contract and such default will be considered as cause for the Owner to terminate the Contract for any of the following reasons if the Contractor:

- A. Fails to begin the Work under the Contract within the time specified in the "Notice To Proceed," or
- B. Fails to perform the Work or fails to provide sufficient workers, equipment or materials to assure completion of Work in accordance with the terms of the Contract, or
- C. Performs the Work unsuitably or neglects or refuses to remove materials or to perform such new Work as may be rejected as unacceptable and unsuitable, or
- D. Discontinues the prosecution of the Work, or
- E. Fails to resume Work which has been discontinued within a reasonable time after notice to do so, or
- F. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or
- G. Allows any final judgment to stand against him unsatisfied for a period of 10 days, or
- H. Makes an assignment for the benefit of creditors, or acceptable manner, or
- I. Is otherwise in breach of the Contract and has failed to remedy the breach within ten (10) days of written notice of the existence of such breach, or
- J. Fails to provide safe conditions for its workers and/or the general public.

Should the Owner consider the Contractor in default of the Contract for any reason above, he shall immediately give Written Notice to the Contractor and the Contractor's surety as to the reasons for considering the Contractor in default and the Owner's intentions to terminate the Contract.

If the Contractor or Surety, within a period of 10 days after Written Notice, does not proceed in accordance therewith, then the Owner shall have, upon written notification of the facts of such delay or neglect, the power and authority without violating the Contract, to take the prosecution of the Work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the Work and are acceptable and may enter into an Contract for the completion of said Contract according to the terms and

provisions thereof, or use such other methods as in the opinion of the Owner will be required for the completion of said Contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the Work under Contract, will be deducted from any monies due or which may come due the Contractor. If such expense exceeds the sum which would have been payable under the Contract, then the Contractor and the Surety shall pay to the Owner the amount of such excess.

20.3 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. Any retention or payment of monies due Contractor by Owner will not release Contractor from liability.

20.4 Upon seven days Written Notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, elect to terminate the Contract. In such case, Contractor shall be paid (without duplication of any items):

20.4.1 for 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;

20.4.2 for 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 on such expenses;

20.4.3 for reasonable costs incurred in settlement of terminated contracts with Subcontractors, Suppliers and others; and

20.4.4 for reasonable expenses directly attributable to termination.

Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

20.5 If the Work should be stopped under an order of any court or other public authority for a period of more than ninety (90) days, through no act or fault of the Contractor or of anyone employed by him, or if the Owner should fail to pay the Contractor within 45 days after the time specified in the Payments To Contractor, Section 22.0, then the Contractor may, upon 15 days Written Notice to the Owner, stop Work until payment of the amount owing has been received.

20.6 The Owner may terminate the Contract or a portion thereof if conditions encountered during the progress of the Work make it impossible or impracticable to proceed with the Work or a local or national emergency exists.

When Contracts, or any portion thereof, are terminated before completion of all Work in the Contract, adjustments in the amount bid for the pay items will be made on the actual quantity of

Work performed and accepted, or as mutually agreed for pay items of Work partially completed or not started. No claim for loss of anticipated profits will be considered.

Termination of the Contract or any portion thereof shall not relieve the Contractor of its responsibilities for the completed work nor the surety of its obligation for and concerning any just claims arising out of the Work performed.

21.0 ISSUANCE OF NOTICE OF COMPLETION AND FINAL ACCEPTANCE BY OWNER

21.1 Upon completion of the Project, a Final Inspection shall be requested by the Contractor in writing and the Owner will make an inspection within seven (7) days. If all construction provided for and contemplated by the contract is found completed to his satisfaction, that inspection shall constitute the final inspection and the Owner will make the final acceptance and issue a Certificate Of Completion to the Contractor.

If, however, the inspection discloses any Work, in whole or in part, as being unsatisfactory, the Owner will give the Contractor the necessary instructions for correction of same, and the Contractor shall immediately comply with and execute such instructions. Upon correction of the Work, another inspection will be made which shall constitute the final inspection provided the Work has been satisfactorily completed. In such event, the Owner will make the final acceptance and issue a Certificate Of Completion to the Contractor.

22.0 PAYMENTS TO CONTRACTOR

22.1 In addition to any documents required by the Engineer to be submitted to Engineer at the time a partial pay estimate is submitted, including partial lien released as specified in Section 22.9 of the General Conditions, the Contractor shall, at least ten (10) days before each progress payment falls due (but not more often than once a month), submit to the Engineer a partial payment estimate filled out and signed by the Contractor covering the Work performed during the period covered by the partial payment estimate and supported by such data as the Engineer may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the Work, title to such materials and equipment shall vest in the Owner, and Contractor shall supply, at the time of submission of payment estimate, supporting documents satisfactory to the Owner, to establish and protect Owner's interest in the materials and equipment, and Contractor shall maintain appropriate insurance on same until such time as actual possession by the Owner of the materials and equipment shall occur. The Engineer will, within seven (7) days after receipt of each partial payment estimate, either indicate in writing his approval of payment and present the partial payment estimate to the Owner or return the partial payment estimate to the Contractor indicating in writing his reasons for refusing to approve payment. In the latter case, the Contractor may make the necessary corrections and resubmit the partial payment estimate. The Owner will, within fourteen (14) days of presentation to him of an approved partial payment estimate, pay the Contractor a progress payment on the basis of the approved partial payment estimate. The Owner shall retain ten (10) percent of the amount of each payment until final completion and acceptance of all Work covered by the Contract Documents. When the Contract is fifty percent completed, one-half of the amount retained shall

be paid to the Contractor provided the Contractor makes a written request for the payment and the Contractor is making satisfactory progress on the Contract and there is no specific cause or claim requiring a greater amount to be retained. After the Contract is fifty per cent completed, no more than five per cent of the amount of any subsequent progress payments made under the Contract may be retained providing the Contractor is making satisfactory progress on the project, except that if at any time the Owner determines satisfactory progress is not being made, ten per cent retention shall be reinstated for all progress payments made under the Contract subsequent to the determination.

22.2 In lieu of ten percent (10%) retention provided for in paragraph 22.1, of this Article, the Owner shall, at the Contractor's option, accept as a substitute an assignment of any of the following:

- A. Time certificates of deposit of banks licensed by the State of Arizona; or
- B. Securities of or guaranteed by the United States of America; or
- C. Securities of the State of Arizona, or any county, municipality or school district thereof; or
- D. Shares of savings and loan institutions authorized to transact business in the State of Arizona.

Such assigned instruments shall have a face value in an amount equal to ten percent (10%) of the progress payment for which such instruments are tendered and shall be retained by the Owner as a guarantee for complete performance of the Contract.

In the event the Owner accepts substitute security as provided herein for the ten percent (10%) retention, the Contractor shall be entitled to all interest or income earned by such security, and all such security in lieu of retention shall be returned to the Contractor within sixty (60) days after final completion and acceptance of all material, equipment and work covered by the contract if the Contractor has furnished the Owner satisfactory receipts for all labor and material billed and waivers of liens from any and all persons holding claims against the work.

In no event shall the Owner accept a time certificate of deposit of a bank or shares of a savings and loan institution in lieu of the retention specified in paragraph 22.1 of this Article unless accompanied by a signed and acknowledged waiver of the bank or savings and loan institution of any right or power to set off against either the Owner or the Contractor in relationship to the certificates or shares assigned.

22.3 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner out of the amount paid to the Contractor on account of such Subcontractors' Work, the amount to which said Subcontractor is entitled, reflecting the percentage actually retained, if any, from payments to the Contractor on account of such Subcontractors' Work. The Contractor shall, by an appropriate Contract with each Subcontractor, require each Subcontractor to make

payments to his Sub-subcontractors in similar manner.

22.4 Prior to Substantial Completion, the Owner, with the approval of the Engineer and with the concurrence of the Contractor, may use any completed or substantially completed portions of the Work. Such use shall not constitute an acceptance of such portions of the Work.

22.5 The Owner shall have the right to enter the premises for the purpose of doing Work not covered by the Contract Documents. This provision shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the Work, or the restoration of any damaged Work except such as may be caused by agents or employees of the Owner.

22.6 Upon final completion and acceptance of the Work, the Engineer shall issue a certificate attached to the final payment request that the Work has been accepted under the conditions of the Contract Documents. No retention of payments may be delayed or retained without a specific written finding by the Engineer or Owner of the reasons justifying the delay in payment. The entire balance found to be due the Contractor, including the retained percentages, except the amount necessary to pay the expenses the Owner reasonably expected to incur in order to pay or discharge the expenses determined by the Engineer or Owner in the finding justifying the retention or delay, shall be paid to the Contractor, within sixty (60) days of completion or proper filing of the Notice of Completion.

22.7 The Contractor shall indemnify and save the Owner or the Owner's agents harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the Work. The Contractor shall, at the Owner's request, furnish satisfactory evidence, in the form of lien releases or other documents deemed appropriate by the Owner, that all obligations of the nature designated above have been paid, discharged, or waived. If the Contractor fails to do so the Owner may, after having notified the Contractor, either pay unpaid bills or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of the Contract Documents, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor, his Surety, or any third party. In paying any unpaid bills of the Contractor, any payment so made by the Owner shall be considered as a payment made under the Contract Documents by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.

22.8 If any payment to Contractor is delayed after the date due, interest shall be paid at the rate of one percent per month or fraction of a month on such unpaid balance as may be due. If the Owner fails to make payment sixty (60) days after final completion and acceptance, in addition to other remedies available to the Contractor, interest shall be paid at the rate of one per cent per month or fraction of the month on such unpaid balance as may be due, except for that amount necessary to pay the expenses the Owner reasonably expects to incur in order to pay or discharge the expense determined by the Engineer or Owner in the finding justifying the retention or delay.

22.9 The Owner may require the Contractor to furnish partial releases or liens executed by all persons, firms and corporations who have furnished labor services or materials incorporated into the Work during the period of time for which the progress payment is due, releasing such lien rights as these persons, firms or corporations may have for that period.

23.0 ACCEPTANCE OF FINAL PAYMENT AS RELEASE

23.1 Following the Owner's acceptance of the Work, the Owner will issue a Notice of Completion to the Contractor. Sixty days after the issuing of the Notice of Completion, and upon receipt of the necessary Unconditional lien releases executed by all persons, firms and corporations who have furnished labor services or materials incorporated into the work evidencing that all liabilities have been fully discharged, the Owner will pay to the Contractor the entire sum so found to be due after deducting therefrom all previous payments and all amounts to be kept and all amounts to be retained under the provisions of the Contract. All previous prior partial estimates and payments shall be subject to correction in the final estimate and payment.

23.2 The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor other than claims in stated amounts as may be specifically excepted by the Contractor for all things done or furnished in connection with this Work and for every act and neglect of the Owner and others relating to or arising out of this Work. Any payment, however, final or otherwise, shall not release the Contractor or his sureties from any obligations under the Contract Documents or the Performance Bond and Payment Bonds.

24.0 INSURANCE

24.1 The Contractor shall give special attention to Section 00500-A of the Bid Documents when preparing a bid, which outline the insurance requirements of Owner and the Contractor shall consider these insurance requirements part of the Bid/Contract documents.

The Contractor shall purchase and maintain such insurance as will protect him from claims set forth below which may arise out of or result from the Contractor's execution of the Work, whether such execution be by itself or by any Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- A. Claims under worker's compensation, disability benefit and other similar employee benefit acts;
- B. Claims for damages because of bodily injury, occupational sickness or disease, or death of his employees;
- C. Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;

- D. Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person; and
- E. Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom.

The Contractor is responsible to respond to claims arising as a result of its work. See Section 500-B for specific procedures.

24.2 Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These Certificates shall contain a provision that coverages afforded under the policies will not be canceled unless at least ten (10) days prior Written Notice has been given to the Owner, "Attention: Contract Administrator, 2330 McCulloch Boulevard North, Lake Havasu City, AZ, 86403".

24.3 The Contractor shall procure and maintain, at its own expense, during the Contract Time, liability insurance as specified in Section 500-A, incorporated herein.

25.0 CONTRACT SECURITY

25.1 The Contractor shall within ten (10) days after the receipt of the Notice Of Award furnish the Owner with a Performance Bond and a Payment Bond in sums equal to the amount of the Contract PRICE, conditioned upon the performance by the Contractor of all undertakings, covenants, terms, conditions and Contracts of the Contract Documents, and upon the prompt payment by the Contractor to all persons supplying labor and materials in the prosecution of the Work provided by the Contract Documents. Such Bonds shall be executed by the Contractor and a corporate bonding company licensed to transact such business in the state in which the Work is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these Bonds shall be borne by the Contractor. If at any time a surety on any such Bond is declared a bankrupt or loses its right to do business in the state in which the Work is to be performed or is removed from the list of Surety Companies accepted on Federal Bonds, Contractor shall within ten (10) days after notice from the Owner to do so, substitute an acceptable Bond (or Bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such Bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable Bond to the Owner.

26.0 ASSIGNMENTS

26.1 Neither the Contractor nor the Owner shall sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of his right, title or interest therein, or his obligations thereunder, without written consent of the other party. Nor shall the Contractor assign any monies due or to become due to him hereunder without the previous written consent of the

Owner.

26.2 The Owner and Contractor each bind itself, its partners, successors and assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party in respect to all covenants, Contracts and obligations contained in the Contract Documents.

27.0 INDEMNIFICATION

27.1 Contractor shall indemnify and hold harmless City, its officers and employees from and against any and all liabilities, damages, losses, and costs, including reasonable attorney's fees, but only to the extent caused by the negligence, recklessness, or intentional wrongful conduct of Contractor or other persons employed or used by the Contractor in the performance of this Contract. It is agreed that Contractor will be responsible for primary loss investigation, defense, and judgment costs where this indemnification is applicable.

27.2 In any and all claims against the Owner or the Engineer, or any of their agents or employees, by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation of benefits payable by or for the Contractor or any Subcontractor under worker's compensation acts, disability benefit acts or other employee benefits acts.

27.3 The obligation of the Contractor under this paragraph shall not extend to the liability of the Engineer, his agents or employees arising out of the preparation or approval of maps, DRAWINGS, opinions, reports, surveys, Change Orders, designs or Specifications.

28.0 SEPARATE CONTRACTS

28.1 The Owner reserves the right to let other contracts in connection with this Project. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work, and shall properly connect and coordinate its Work with theirs. If the proper execution or results of any part of the Contractor's Work depends upon the Work of any other Contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such Work that render it unsuitable for such proper execution and results.

28.2 The Owner may perform additional Work related to the Project by itself, or it may let other contracts containing provisions similar to these. The Contractor shall afford the other Contractors who are parties to such Contracts (or the Owner, if he is performing the additional Work himself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of Work, and shall properly connect and coordinate his Work with theirs.

28.3 If the performance of additional Work by other Contractors or the Owner is not noted in

the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to the Contractor prior to starting any such additional Work. If the Contractor believes that the performance of such additional Work by the Owner or others involves it in additional expense or entitles him to an extension of the Contract Time, it may make a claim therefore as provided in Sections 16 and 17.

29.0 SUBCONTRACTING

29.1 The Contractor may utilize the services of specialty Subcontractors on those parts of the Work which come under normal contracting practices or are typically performed by specialty Subcontractors, provided the Contractor, simultaneously with the delivery of the executed Contract, shall furnish to the Owner and the Engineer in writing the names of the persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each of the principal portions of the Work. The engineer will promptly reply to the Contractor in writing stating whether or not the Owner or the Engineer, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Engineer to promptly reply shall constitute notice of no reasonable objection. The Contractor shall not contract with any such proposed person or entity to whom the Owner or Engineer has made reasonable objection and the Contractor shall not be required to contract with anyone to whom he has a reasonable objection. If the Owner or Engineer has a reasonable objection to any proposed person or entity, the Contractor shall submit a substitute to whom the Owner or the Engineer has no reasonable objection. The Contractor shall make no substitution for any Subcontractor, person or entity previously selected if the Owner or Engineer makes reasonable objection to such substitution.

29.2 The Contractor shall not award Work to Subcontractor(s), in excess of forty-nine (49%) percent of the Contract Price, without prior written approval of the Owner.

29.3 The Contractor shall be fully responsible to the Owner for the acts and omissions of its Subcontractors, and of persons either directly or indirectly employed by them, as it is for the acts and omissions of persons directly employed by it.

29.4 The Contractor shall not employ any Subcontractors that are not properly licensed with Lake Havasu City and the State of Arizona. Changes of Subcontractors listed with the Proposal shall be made only with the approval of the Owner.

29.5 Nothing contained in these Contract Documents shall be construed as creating any contractual relationship between any Subcontractor and the Owner; the Contractor shall be as fully responsible to the Owner for the acts and omissions of Subcontractors, and of persons employed by them, as he is for the acts and omissions of persons directly employed by him.

29.6 The Contractor shall, without additional expense to the Owner, utilize the services of specialty Subcontractors on those parts of the Work which are specified or required by State or local laws to be performed by specialty Subcontractors.

29.7 The Contractor shall be responsible for the coordination of all trades, Subcontractors, material and people engaged upon this Work. The Owner will not undertake to settle any differences between the Contractor and his Subcontractors or between Subcontractors.

29.8 The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind Subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the Work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.

29.9 Nothing contained in this Contract shall create any contractual relation between any Subcontractor and the Owner.

30.0 ENGINEER'S AUTHORITY

30.1 The Engineer shall act as the Owner's representative during the construction period. The Engineer shall decide questions which may arise as to quality and acceptability of materials furnished and Work performed and shall interpret the intent of the Contract Documents in a fair and unbiased manner. The Engineer will make periodic visits to the site and determine if the Work is proceeding in accordance with the Contract Documents.

30.2 The Contractor will be held strictly to the intent of the Contract Documents in regard to the quality of materials, workmanship and execution of the Work. Inspections may be made at the factory or fabrication plant of the source of material supply.

30.3 The Engineer shall not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety precautions and programs in connection with the Work and will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Engineer shall not be responsible or have control or charge over the acts or omissions of the Subcontractors, or any of their agents or employees, or any other person performing any of the Work.

30.4 The Engineer shall promptly make decisions relative to interpretation of the Contract Documents.

30.5 The Engineer will have the authority to reject Work which does not conform to the Contract Documents. Whenever, in its opinion, it is considered necessary or advisable for the implementation of the intent of the Contract Documents, the Engineer will have authority to require special inspection or testing of the Work in accordance with the other terms of this Contract whether or not such Work be then fabricated, installed or completed.

31.0 LAND AND RIGHTS-OF-WAY

31.1 Prior to issuance of Notice To Proceed, the Owner shall obtain all land and rights-of-way necessary for carrying out and for the completion of the Work to be performed pursuant to the

Contract Documents, unless otherwise mutually agreed.

31.2 The Owner shall provide to the Contractor information which delineates and describes the lands owned and rights-of-way acquired.

31.3 The Contractor shall provide at its own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

32.0 GUARANTEE

32.1 Except as otherwise specified, all Work shall be guaranteed by the Contractor against defects resulting from the use of inferior materials, equipment, or workmanship for a period of one (1) year from the date the Certificate of Substantial Completion is issued by the Owner, or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents.

32.2 If, within any guarantee period, repairs or changes are required in connection with guaranteed Work, which, in the opinion of the Owner, is rendered necessary as the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall, promptly upon receipt of notice from the Owner, and without expense, (1) place in satisfactory condition in every particular all of such guaranteed Work, correcting all defects therein; (2) make good all damage to the building, site or Work, or equipment or contents thereof, which in the opinion of the Owner, is the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the contract; and (3) make good any Work or material, or the equipment and contents of said building, site or Work disturbed in fulfilling any such guarantee. If the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee, the Owner may have the defects corrected and the Contractor and his surety shall be liable for all expense incurred. The Performance Bond shall remain in full force and effect through the guarantee period.

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GUARANTEE

The Contractor agrees to execute, and to cause each Subcontractor to execute, a written guarantee to the Owner, in substantially the following form:

GUARANTEE FOR:

We hereby guarantee, both jointly and severally, that the improvement which we have installed for the Owner of Project, specifically described as:

North Havasu Additional Tank & Distribution Line, PROJECT NO. B26-PW-108031-500784

has been done in accordance with the Contract Drawings and Specifications.

We agree, both jointly and severally, to repair and replace any or all Work included in said improvement, together with any other adjacent work which may be displaced or damaged by so doing, that may prove to be defective in its workmanship or material within a period of one year from date of the Certificate of Substantial Completion, ordinary wear and tear and unusual abuse or neglect accepted.

In the event of our failure to comply with the above mentioned conditions within a reasonable period of time (as determined by the Owner) after being notified in writing by the Owner, we both jointly and severally, do hereby authorize the Owner to proceed to have said defects repaired and made good at our expense, and we will honor and pay the costs and charges therefore upon demand.

Signed _____

Countersigned _____

Local Representative to be contacted for service:

Name _____

Address _____

Phone No. _____

FAX _____

The guarantee form(s) shall be completed and returned with the acknowledgement of the Certificate of Completion.

The failure of the Contractor or any Subcontractor to execute, such guarantee shall not affect the right of the Owner to rely on and enforce the guarantee and the obligations respectively assumed by the Contractor and each Subcontractor under Subparagraph 32.1 and 32.2 hereof.

33.0 ARBITRATION

33.1 Provided both parties mutually agree, all claims, disputes and other matters in question arising out of, or relating to, the Contract Documents or the breach thereof, except for claims which have been waived by the making and acceptance of final payment as provided by Section 23, may be decided by arbitration in accordance with the American Arbitration Association or any other similar body. The foregoing Contract to arbitrate shall be specifically enforceable under the prevailing arbitration law (Arizona Revised Statutes Sections 12-1501, *et seq.*) of the State of Arizona. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.

33.2 Notice of the demand for arbitration shall be filed in writing with the other party to the Contract Documents and with the American Arbitration Association and a copy shall be filed with the Engineer. The party filing for arbitration may select which arbitration service to use. Demand for arbitration shall in no event be made on any claim, dispute or other matter in question which would be barred by the applicable statute of limitations.

33.3 The Contractor shall carry on the Work and maintain the progress schedule during any arbitration proceedings, unless otherwise mutually agreed in writing.

33.4 The provisions of the Contract pertaining to arbitration are not binding upon Engineer and Engineer cannot be compelled to participate against his will in an arbitration arising out of a dispute over the Contract or Contract Documents unless Engineer so consents in writing to be a party to the arbitration.

34.0 TAXES AND CHARGES

34.1 The Contractor shall pay all State and local sales and use taxes on items, and in a manner as required by the laws and statutes of the State of Arizona and its political subdivisions. The Contractor shall withhold and pay any and all withholding taxes, whether State or Federal, and pay all Social Security charges, State Unemployment Compensation charges, industrial insurance, workers' compensation charges, and pay or cause to be withheld, as the case may be, any and all taxes, charges, or fees, or sums whatsoever, which are now or may hereafter be required to be paid or withheld under any laws.

35.0 MISCELLANEOUS CONDITIONS

35.1 In the event that either party to the Contract is required to institute arbitration or litigation to enforce its rights under the terms of the Contract, then the prevailing party in the arbitration or litigation shall be entitled to recover all costs and attorney's fees incurred.

35.2 In the event that any provision contained in the Contract is found to be contrary to the applicable law, then it shall be severed and the remaining provisions of the Contract shall remain in full force and effect.

35.3 The Contract shall be governed by the laws of the State of Arizona.

36.0 CONFLICTS WITHIN THE PLANS OR SPECIFICATIONS

36.1 In the event that a conflict is discovered between sections of the Specifications or between the Plans and the Specifications, the following list of priority shall be used to resolve the conflict:

- A. Executed Change Orders
- B. Addenda
- C. Contract
- D. Special Provisions
- E. General Conditions
- F. Instructions to Bidders
- G. Technical Specifications
- H. Plans
- I. Referenced Standard Specifications or Other Documents

37.0 NONDISCRIMINATION

37.1 The Contractor, with regard to the work performed pursuant to this contract, shall not discriminate on the grounds of race, color, sex, religion, creed, age, physical or mental disability, or national origin or ancestry in any contracts with the public and in the selection and retention of employees or subcontractors, nor in the procurement of materials and leases of equipment.

38.0 INTEGRATION

38.1 This Contract represents the entire Contract between the parties hereto and supersedes any and all prior negotiations or representations, either written or oral.

38.2 Amendments or modifications to the Contract shall be in writing, signed by both parties, or by Change Orders.

38.3 The Contract Documents shall not be construed to create any contractual relationship of any kind between the Engineer and the Contractor, but the Engineer shall be entitled to

performance of obligations intended for his benefit, and to the enforcement thereof.

39.0 HAZARD COMMUNICATION PROGRAM

39.1 All contractors working on City projects shall submit a copy of their hazard communication plan to the Fire Prevention Office prior to commencement of work on any project. This will ensure that other individuals on the job site are not unknowingly exposed to a hazardous substance or chemical.

The Fire Prevention Office shall be provided a list of the hazardous substances and the material safety data sheets that are applicable to the work areas of those contract employees.

All contract labor within City facilities will be treated the same as regular employees with regard to this hazard communication standard.

**** END OF SECTION ****

LAKE HAVASU CITY

SPECIAL PROVISIONS

AND

TECHNICAL SPECIFICATIONS

**North Havasu Additional Tank &
Distribution Line**

B26-PW-108031-500784

SECTION 00800
SPECIAL PROVISIONS

1.0 SCOPE

These Special Provisions supplement and modify the General Conditions, Technical Specifications, and Plans. All requirements and provisions of the General Conditions, Technical Specifications and Plans apply except where modified by these Special Provisions.

2.0 DEFINITION OF TERMS

Wherever in these documents the word "Engineer" appears, it shall be understood to mean Lake Havasu City Public Works Department, Engineering Division.

3.0 PRECONSTRUCTION CONFERENCE

Within ten (10) days after the Contract has been awarded, but before the start of construction, the Engineer will schedule a conference to be held at the site of the Project for the purpose of discussing such matters as Project supervision, onsite inspections, progress schedules and reports, payrolls, payments to Contractors, equal employment opportunity, contract change orders, insurance, safety, and any other items pertinent to the Project. The Contractor shall arrange to have all supervisory personnel connected with the Project on hand to meet with the representatives of the Owner and the Engineer.

4.0 DRAWINGS OF RECORD

Two sets of the Contract Documents are to be kept at the job site, maintained in good condition, and marked daily by the Contractor as the Work proceeds. The Contract Documents shall be kept available for inspection by the Owner at all times, and shall be kept up to date.

5.0 SURVEYS

The CONTRACTOR shall layout the WORK, in accordance with the drawings, shall establish all necessary lines, etc., required to complete the Work in accordance with the Contract Documents. The CONTRACTOR shall employ an experienced and competent Arizona Registered Land Surveyor (R.L.S.) satisfactory to the Owner to layout the WORK and to verify lines and elevations as the WORK progresses.

6.0 WEATHER CONDITIONS

In the event of temporary suspension of Work, or during inclement weather, or whenever the Owner shall direct, the Contractor will and will cause its Subcontractors to protect

carefully their Work and materials against damage or injury from the weather. If, in the opinion of the Owner, any Work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any of its Subcontractors to so protect its work, such materials shall be removed and replaced at the expense of the Contractor.

7.0 SUBMITTALS

Prior to construction and as soon as possible, the Contractor shall supply all submittals required by the Technical Specifications or as requested by the Owner.

8.0 INSPECTION OF THE WORK

The Owner intends to provide a full-time resident inspector for the Project. The resident inspector will be available for a forty (40) hour period during the week from Monday through Friday during the period of the Contract. In the event the Contractor elects to work outside the forty (40) hour week that occurs between Monday through Friday, such as Saturday, Sunday or legal holidays, in accordance with Article 17.0 of the General Conditions the Contractor will be responsible for all inspection, engineering, and testing costs incurred during that period. For any inspection work performed on Saturday, Sunday, or local municipal holidays the minimum chargeable time shall be four (4) hours. The Owner reserves the right to deduct these additional inspection, engineering, and testing costs directly from the Contractor's payments.

9.0 WATER AND POWER

A. WATER

Water is available from the Water Division at no cost to the Contractor. The Contractor shall make application and obtain a hydrant meter from the Water Division for the purpose of metering the use of water on the Project. The Contractor shall adhere to all conditions stated in the Meter Application, including payment of a deposit for the meter, return of the meter to the Water Division each month during the Project for reading, and notification to the Water Division prior to any change in the location of the hydrant meter. The maximum water to be drawn off a hydrant at any time is 200 gpm (water drawn from 4" hydrant whenever available). Water shall only be drawn off hydrants approved by the Lake Havasu City Water Superintendent or authorized representative.

B. POWER

All power for lighting, operation of Contractor's plant or equipment or for any other use as may be required for proper completion of the Work to be performed under the provisions of these Contract Documents, shall be provided by the Contractor at its sole cost and expense.

10.0 BURNING OF VEGETATION

No burning of vegetation will be allowed.

11.0 MATERIALS TESTING

A. CONSTRUCTION TESTING

All quality control testing must be provided by Contractor. The material and workmanship provided during construction will be tested on a regular basis by the Contractor. It shall be the responsibility of the Contractor, at no additional cost, to provide material samples for testing at the **Owner's** request.

The Contractor shall be responsible for charges resulting from failed tests, costs for retesting shall be based upon hourly and/or individual test rates. In the event any portion of the Project is rejected because of substandard work, all materials testing, engineering, and inspection costs associated with corrective measures shall be chargeable to the Contractor at the current respective rates.

B. PRELIMINARY MATERIALS TESTING

All preliminary materials testing and mix design testing required by the Specifications to ensure materials and mix designs are suitable for Project use will be the responsibility of the Contractor at no additional cost to the Owner.

12.0 CLEANUP AND POLLUTION CONTROL

A. GENERAL

The Contractor shall be responsible for the removal of all debris, litter and waste from the job site(s) and/or equipment maintenance area and the restoration of any and all areas affected, directly or indirectly by the construction, transportation of equipment or materials and/or by the acts of neglect or omission by its employees.

All debris, litter, etc., shall be disposed of in accordance with prevailing ordinance or law. Open burning of trash, debris, etc., will not be permitted.

Such clean-up operations shall be on a daily basis. All pavement, concrete, brush, rocks, excess materials, etc. accumulated or removed during the course of construction must be disposed of in those areas designated by the Engineer or authorized representative, including but not limited to the Lake Havasu City Landfill. All costs for disposal, including gate or tipping fees, etc. are the responsibility of the Contractor. This material must be disposed of within ten (10)

days of time of removal. If the areas in question are not cleaned up to the satisfaction of the Engineer, progress payments will be withheld until clean-up is completed and approved by the Engineer, or, in the case of private projects, other legal action will be taken.

B. TEMPORARY FACILITIES

The Contractor shall provide temporary mailboxes and traffic control signs where necessary until completion of backfilling and clean-up.

C. SOLID WASTES

All solid wastes shall be removed and disposed of in accordance with prevailing ordinance or law. Clean-up shall be completed on a daily basis. All costs for disposal shall be the responsibility of the Contractor, and shall be considered incidental to the costs of the various bid items.

All spilled paving material shall be removed and disposed of prior to final acceptance and payment.

D. MAINTENANCE AREAS

Maintenance areas shall be kept clean during construction and shall be free of litter at all times. All empty containers, debris, waste, etc., shall be removed and disposed of prior to final acceptance. Upon inspection by the Engineer, the Contractor may be required to dress the surface of the ground, dependent upon the extent of spillage of petroleum products on the surface. If so directed, such dressing shall consist of scarifying the surface to a depth of six (6) inches and moving and compacting the soil in such a way as to blend the spill areas into clean soil and restore the surface by partial compaction.

E. POLLUTION

The Contractor shall be held responsible for acts leading to pollution of water, air or land by any means.

Open burning of trash, debris, etc., will not be permitted anywhere in the City limits.

The discharge of any pollutants upon the surface of the ground, or into any stream, ravine, wash or body of water which may result in pollution of the public water supply, or of groundwater contributory thereto, will not be permitted.

Violation of these conditions will be cause for the termination of Work, and possible

legal action.

F. REMOVAL AND REPLACEMENT OF SIGNS, MAILBOXES, ETC.

It is the responsibility of the Contractor to remove all poles, etc. which are located within the construction area and replace at the time of backfilling and clean-up in the locations determined by the Street Superintendent. In the case of landscaping or other private items located in the construction area, the Contractor shall hand-deliver a written notice to all residences in that area stating its intentions to perform construction activities and shall do so at least five (5) working days prior to Work commencing. If, at the time of construction these items are still in the construction area, the Contractor is to remove and dispose of them properly. All signs and mailboxes shall be permanently installed within forty-eight (48) hours of completion of construction activities.

G. NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)GENERAL PERMIT

At the time of the preconstruction conference, the contractor shall submit, for the Engineer's approval, a program which includes all the measures which the contractor proposes to take for the construction of permanent erosion control work specified in the Contract and all the temporary control measures to prevent erosion and pollution of streams, lakes and reservoirs.

Permanent erosion control work and pollution prevention measures shall be performed at the earliest practicable time consistent with good construction practices. Temporary work and measures are not meant to be performed in lieu of permanent work specified in the Contract.

Construction of drainage facilities as well as the performance of other contract work which will contribute to the control of erosion and sedimentation shall be carried out in conjunction with earthwork operations or as soon thereafter as possible.

Except for that approved in writing by the Engineer, the contractor shall perform no clearing and grubbing or earthwork until the contractor's program has been approved.

If in the opinion of the Engineer, clearing and grubbing, excavation, or other construction operations are likely to create an erosion problem because of the exposure of erodible earth material, the Engineer may limit the surface area to be disturbed until satisfactory control measures have been accomplished. Unless otherwise permitted by the Engineer, the contractor shall not expose an area of erodible earth material greater than 217,800 square feet at any one location.

The Engineer may order the contractor to provide immediate measures to control erosion and prevent pollution. Such measures may involve the construction of temporary berms, dikes, dams, sediment basins and slope drains; the use of temporary mulches, mats and seeds and the use of other devices, methods, items, etc., as necessary.

At any time the contractor proposes to change its schedule of operations, the contractor shall review and update its erosion and pollution control program and submit it to the Engineer for approval.

The contractor shall not be entitled to additional compensation or an extension of contract time for any delays to the Work because of the contractor's failure to submit an acceptable erosion and pollution control program.

Erosion control and pollution prevention work specified in the Contract which is to be accomplished under any of the various contract items will be paid for by the bid item. Any additional Work required by the Owner will be paid for by the Force Account set up for this Work.

The cost of any erosion control and pollution prevention work which may be proposed by the contractor in its program, in addition to that specified in the Contract, will be considered as included in the prices bid for contract items.

13.0 DUST CONTROL

It shall be the Contractor's responsibility to provide adequate water for dust control. It is imperative that the air quality standards are maintained. In addition, dust could be quite hazardous in the everyday operations. It shall be the Contractor's responsibility to ensure that all regulations for air quality and safety are met.

14.0 SUPERVISORY PERSONNEL

It is the intent of these Special Provisions to provide a completed Project which will in every way reflect the work of competent journeyman mechanics in the various trades represented. The Contractor shall ensure that each portion of the work is supervised by a qualified person, well versed in the operation of the various tools required for the trade, the method in which the work is to be done, and a knowledge of the general requirements of the construction work. All work is to be done in accordance with the latest methods devised for such work to ensure the highest quality product.

15.0 SAFETY REQUIREMENTS

The Contractor shall comply with all pertinent provisions of the Department of Labor

"Safety and Health Regulations for Construction" (29 CFR Part 1518, 36 CFR 7340), with additions or modifications thereto, in effect during construction of this Project.

THE FOLLOWING MEASURES OR PROVISIONS ARE TO BE ADHERED TO AT ALL TIMES DURING THE CONSTRUCTION OF THIS PROJECT:

- A.** All heavy construction machinery to include trenching machines, bulldozers, backhoes, etc., must be equipped with a roll bar meeting the requirements of the above regulation.
- B.** Safety helmets will be worn by all personnel working at the site. In addition, all spectators and inspectors will be required to wear safety helmets in construction zone.
- C.** Steel toe safety shoes or boots will be worn by all personnel working at the site.

16.0 PRESERVATION OF BENCH MARKS AND MONUMENTS

The Contractor shall exercise caution to ensure that permanent benchmarks, monuments, established property corners, survey lines, and points are not damaged or disturbed by this Work. If any survey monuments, property corners, survey lines or points are damaged or disturbed, the Contractor's representative shall immediately notify the inspector. All centerline survey monumentation located in pavement removal areas shall be replaced by an Arizona Registered Land Surveyor (R.L.S.) after completion of the pavement removal and replacement operations. All costs incurred to re-establish such points shall be borne by the Contractor.

17.0 DISPOSAL OF EXCESS MATERIAL

Excess soil and unsuitable materials shall be removed from the site by the Contractor at its own expense and disposed of in accordance with the Contract Documents unless otherwise permitted herein. In the event the Contractor chooses to utilize local private lots to dispose of excess material, the Contractor must provide the Engineer with written permission from the lot owner prior to utilizing the lot. Placing material suitable for fill on vacant lots will require a Grading Permit in advance of placing the material.

18.0 REFERENCE STANDARD SPECIFICATIONS

Where standard specifications or testing methods have been referred to, such as ASTM or AASHTO, the intent is to refer to the latest applicable issue or revision of such specifications or testing methods. The following abbreviations are used in these Special Provisions.

AWWA American Waterworks Association

00800-7

Revised 01.16.2020

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AI	Asphalt Institute
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute (formerly the USA Standards Institute)
ASTM	American Society for Testing and Materials
NSF	National Sanitation Foundation
S.P.W.C.	Standard Specifications for Public Works Construction. (Wherever written herein shall mean "Maricopa Association of Governments, Arizona Specification for Public Works Construction".) The "Sample Forms" and "Part 100 – General Conditions" of these Standard Specifications for Public Works Construction are excluded from the documents for this Project.

19.0 CODES, ORDINANCES AND LOCAL SPECIFICATIONS

All Work under this Project shall be performed in strict accordance with these Special Provisions and the Standard Specifications for Public Works Construction (SPWC). Where any conflict occurs between these plans and specifications and the local codes and ordinances in effect at the time, such codes and ordinances shall take precedence over these plans and specifications only if these plans and specifications are inferior as to materials and workmanship called for by such codes and ordinances.

20.0 INTERFERING STRUCTURES AND UTILITIES

The Contractor shall notify Arizona 811 (formerly Blue Stake) (1-800-782-5348) at least three (3) working days prior to any excavations.

The Contractor shall exercise all possible caution to prevent damage to existing structures and utilities, whether above ground or underground. The Contractor shall notify all utility offices concerned at least seventy-two (72) hours in advance of construction operations in which a utility's facilities may be involved.

Any structure or utility damage caused by the work shall be repaired or replaced in a

condition equal to or better than the condition prior to the damage. Such repair or replacement shall be accomplished at the Contractor's expense without additional compensation from the Owner.

If interfering structures or installations such as vaults, manholes, valves, utility poles, guy wires, or anchors are encountered, the Contractor shall notify the Engineer and contact the appropriate utility or structure owner at least seven (7) days in advance of construction to arrange for protection or relocation of the structure.

The Contractor shall remove, protect and/or replace all existing structures, utilities or other improvements and similar items within the proposed improvements at its own expense without additional compensation from the Owner unless specifically provided for as a pay item of Work by the Specifications or as otherwise provided for on the Plans. Replacement shall be in a manner and in a condition at least equivalent to, or better than, the original condition.

If the Contractor encounters existing facilities which will prevent the construction of any facility and which are not properly shown on the Plans, Contractor shall notify the Owner before continuing with the construction in order that the Owner may make such field revisions as necessary to avoid conflict with the existing structure. The cost of waiting or "down" time during such field revision shall be borne by the Contractor without additional cost to the Owner. If the Contractor fails to notify the Owner when an existing structure is encountered, but proceeds with the construction despite this interference, Contractor does so at its own risk. In particular, when the location of the new construction will prohibit the restoration of existing structures to their original condition; the Contractor shall notify the Engineer and contact the utility or structure owner so a field relocation may be made if possible to avoid the conflict.

In the event of interruption to any utility service as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authority. Contractor shall cooperate with the said authority in restoration of service as promptly as possible and shall bear all costs of repair. In no case shall interruption of any utility service be allowed to exist outside working hours unless prior approval of the Owner is received.

Neither the Owner nor its officers or agents shall be responsible for damages to the Contractor as a result of the locations of the water and sewer lines or utilities being other than those shown on the Plans or for the existence of water, sewer lines or utilities not shown on the Plans.

21.0 AIR QUALITY - OPERATING PERMITS

The Contractor may be required to obtain registration certificates and/or operating permits for sources of air pollution.

Information concerning these certificates and permits may be obtained from:

The Office of Air Quality
Arizona Department of Environmental Quality
P.O. Box 600
Phoenix, AZ 85001-0600
(602) 207-2300

22.0 ADJUST UTILITIES TO FINISHED GRADE

The Contractor shall be responsible for locating all manhole rims, valve boxes, meter boxes, utility vaults, etc., and setting them to finished grade. The Contractor shall adjust sewer and water facilities to finished grade in accordance with the specifications within seven (7) days after street surfacing has been completed on each street. All valves and/or manholes will be made visible and accessible for emergency use within 24 hours. It shall be the responsibility of the Contractor to coordinate with the various private utility companies so that they can adjust their facilities to finished grade at an appropriate time. Adjust all facilities in accordance with these specifications and the MAG Standard Details, as modified by Lake Havasu City.

23.0 SAFETY, HEALTH AND SANITATION PROVISIONS

The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of its employees as may be necessary to comply with the requirements and regulations of the Arizona State Department of Health.

The Contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions, on its own responsibility or as the Owner may determine, reasonably necessary to protect the life and health of employees on the job, the safety of the public and to protect property in connection with the performance of the Work covered by the Contract.

Precaution shall be exercised by the Contractor at all times for the protection of persons (including employees) and property. The Contractor shall comply with the provisions of all applicable laws, pertaining to such protection including all Federal and State occupational safety and health acts, and standards and regulations promulgated thereunder.

24.0 PUBLIC SAFETY AND TRAFFIC CONTROL

Every attempt shall be made to provide public safety during the construction of the Project. Traffic control shall be performed in accordance with Section 2650, Traffic Control, of the Technical Specifications.

During all construction operations, the Contractor shall construct and maintain such facilities as may be required to provide access for all property owners to their property. No person shall be cut off from access to their residence or place of business for a period exceeding two (2) hours, unless the Contractor has made a special arrangement with the affected persons. It shall be the Contractor's responsibility to notify all adjacent property owners of the construction activity and the schedule of such activities.

The Contractor shall submit for approval a traffic control and barricade plan within ten (10) days of receipt of Notification of Award of Contract. There shall be no deviations from the approved barricade plan unless a revised barricade plan is submitted and approved. The Contractor shall issue a news release once a week for duration of the Project. The release will be published in Sunday's newspaper and shall indicate the area in which the Contractor will be performing work for that week.

Businesses must be notified forty-eight (48) hours prior to any restrictions on normal parking areas used by their employees or patrons.

The Contractor shall contact, cooperate with, and give notice to each resident, homeowner, business or school that will be affected by any part of the construction process, particularly concerning temporary interruptions to vehicular access.

Written notice of the approximate schedule and explanation of work shall be given to each resident, homeowner, business or school at least five (5) days prior to commencement of work in the area. Verbal door-to-door communication shall be made at least twenty-four (24) hours prior to construction to remind all affected parties of the construction to take place.

The Owner shall receive a copy of all notifications to residents. In the event of complaints by residents, the Owner may require the Contractor to provide documentation (i.e., check list) showing the date and time of the verbal door-to-door communication.

In addition, the Contractor is responsible to answer and resolve any conflicts that may arise between a homeowner or business owner and himself during the construction process.

The Contractor shall provide and station competent flaggers whose sole purpose shall be to direct the movement of public traffic through or around the work. Proper advanced warning signs shall be in place when flaggers are working and removed when work requiring flaggers is completed. Flaggers must be used to assist trucks for safe ingress and egress whenever truck movements may interfere with safe passage through the work zone.

All traffic control devices that are not in use or will not be used for a period greater than

72 hours or that are determined by the Engineer to be unnecessary, confusing, or causing an unsafe condition, shall be removed by the Contractor from the public right-of-way immediately upon notification by the Engineer.

Every attempt shall be made to provide public safety during the construction of the Project. Traffic control shall be performed in accordance with Section 2650, Traffic Control, of the Technical Specifications. No person shall be cut off from access to their residence or place of business for a period exceeding six (6) hours, unless the Contractor has made a special arrangement with the affected persons. In addition, no work will be scheduled which will interrupt regular trash pickup to either residential or commercial properties. It will be the Contractor's responsibility to coordinate its activities with the local trash haulers.

No streets, avenues, boulevards or cul-de-sacs will be closed to traffic unless prior arrangements have been made and approval has been obtained from the Engineer.

25.0 TEMPORARY FACILITIES ON SITE

A. General

Except as otherwise provided, the Owner shall bear no costs of temporary facilities and their removal.

B. Temporary Utility Services

The Contractor shall provide temporary electric power as necessary for the execution of the Work, including that required by all Subcontractors. Contractor shall make the necessary arrangements with Owner, shall bear all costs for these temporary services and shall furnish and install all necessary transformers, metering facilities and distribution centers from branch circuits as Contractor may require.

The Contractor shall provide lighting and outlets in temporary structures throughout the Project as may be required for safety, proper performance and inspection of the Work. If operations are performed during hours of darkness, or if natural lighting is deemed insufficient by Owner, the Contractor shall provide adequate floodlights, clusters and spot illumination. The use of permanently installed lighting fixtures, lamps and tubes for work will not be permitted except by special permission of Owner. The Contractor shall make arrangements with Subcontractors for electrical services and lighting as may be necessary in the performance of their work.

Temporary water service lines, if required, shall be installed and removed by the Contractor, who shall pay all charges for making the connections, running the

temporary lines, removing the temporary lines at the completion of the Work and disconnecting the services. All relocations required to clear the work of others shall be performed by the Contractor when requested by the Owner.

C. Temporary Structures

Prior to starting Work, the Contractor shall, as directed by Owner, provide and maintain suitable temporary office facilities for the duration of the Project as required for the Contractor's project administration; and all necessary sheds and facilities for the proper storage of tools, materials and equipment employed in the performance of the Work.

D. Toilet Facilities

The Contractor shall provide and maintain temporary toilet facilities for the duration of operations, which shall be maintained in a clean and sanitary condition acceptable to Owner and in full compliance with applicable regulations of any public authority.

E. Telephones

The Contractor shall provide, maintain and pay for telephone services for the duration of the Work as required for the Contractor's operation.

F. Fence and Barricades

The Contractor shall provide such protective fences and barricades as Contractor may deem necessary for public safety and to protect Contractor's storage areas and the Work in place. The location and appearance of all fences shall be subject to the approval of the Owner.

G. Contractor Parking

The Contractor shall not park its equipment, nor allow its personnel to park, in any area except those specifically designated by the Owner.

H. Temporary Living Quarters

Temporary living quarters shall not be allowed on the job site or on publicly owned properties. In addition, all Lake Havasu City Zoning Codes for the area in question shall be strictly adhered to.

I. Removal of Temporary Construction

The Contractor shall remove temporary office facilities, toilets, storage sheds and other temporary construction from the site as soon as, in Owner's opinion, the progress of Work permits. Contractor shall recondition and restore those portions of the site occupied by the same to a condition equal to or better than it was prior to construction.

26.0 ACCESS TO WASHES

- A.** Unless otherwise mentioned herein, the Contractor must obtain written permission from the Owner prior to gaining access or utilizing washes or City parcels for any purpose. Request for access to washes and City parcels will be reviewed on a case by case basis. The Contractor shall have access to washes and City parcels via public streets and/or private easements only. For the purposes of this paragraph, "private easement" means a contract by and between the Contractor and a property owner, in writing, authorizing the Contractor to travel across the property owner's real property in order to have ingress or egress to washes, parcels or any portion thereof. Such contracts, if any, shall be filed with the City before the Contractor may exercise the rights thereunder granted. Access to any wash, parcels, or portion thereof by any means not in compliance with the terms of this paragraph shall be deemed a trespass and a breach of the terms of the Contract.
- B.** Violations of the provisions of subparagraph (A.) hereof, shall entitle the City to deduct the sum of One Thousand Dollars (\$1,000.00) from the monies due to Contractor as and for liquidated damages for each such violation. For the purposes of this paragraph, each entry by a vehicle upon land for which Contractor has not received permission to enter shall be deemed a separate violation of subparagraph (A.) hereof.

27.0 COORDINATION AND COOPERATION WITH UTILITY COMPANIES AND OTHER TRADES

A. Coordination/Interruption

The Contractor is responsible to coordinate work with all utility companies and other trades, on or affecting the Project, for an efficient and effective execution of the complete Project. The Contractor shall carefully examine all work that may conflict, and plan removal and/or installation details in advance of the construction to avoid any such conflict. Failure on the Contractor's part to coordinate with any and all utilities, public or private, shall preclude the City's consideration for additional time or cost.

B. Permission Required

Utility mains and utility service to buildings shall not be cut off or otherwise

interrupted without the Contractor obtaining permission from the Owner in each and every instance.

C. Scheduling of Interruptions

Where utilities serve facilities or buildings in use, interruptions in service shall be scheduled during the hours when the facility is not in operation. Any overtime costs occasioned thereby shall be regarded as incidental to, and included within, the Contract Price.

D. General Requirements

Prior to interrupting any utility service, the Contractor shall ascertain that it has the proper materials, together with adequate workmen and equipment, to complete the Work with a minimum of delay.

E. Project Electrical Service

The Contractor is responsible to coordinate with Unisource, Electric Division, to determine the extent of work to be performed by Unisource and by the Contractor to provide electric service for the finished product. The Contractor is also responsible to contact Unisource to determine the hardware required by Unisource to provide service to the final product. Unisource does not provide service to delta connections.

SECTION 01210
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 Description

The outline of measurement and payment in this section is intended to provide a general guideline to the CONTRACTOR in preparing bids and submitting pay requests. Listing of work included in each bid item is not intended to include all work, but is to provide general guidance to the CONTRACTOR for allocating costs. All work will be paid for on a unit price basis with payment made for the quantity of each item completed.

All materials required for construction shall be furnished by the CONTRACTOR unless specifically stated. Items not specifically measured and paid for shall be considered as subsidiary items required to complete the installation in accordance with the intent of the contract documents. The CONTRACTOR shall include in the unit price bid items, all costs associated with subsidiary items not being measured for payment.

1.2 Authority

Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section governs.

Take all measurements and compute quantities. The ENGINEER will verify measurements and quantities.

1.3 Unit Quantities

Quantities indicated in the Bid Form are for bidding and contract purpose only. Quantities and measurements supplied or placed in the Work and verified by the ENGINEER shall determine payment.

If the actual Work requires more or fewer quantities than indicated, actual quantities will be paid at the contract unit prices. Additional quantities must be approved prior to the work being initiated.

PART 2 – PRODUCTS – Not Used

PART 3 – CONSTRUCTION – Not Used

PART 4 - METHODS OF MEASUREMENT

4.1 General

All items that are included in the bid for measurement and payment are included herein. All other items of work shall be considered subsidiary to construction and will not be measured for payment.

4.2 Measurement and Payment

1. Mobilization/Demobilization, Bonds, and Insurance

The quantity of "Mobilization/Demobilization, Bonds, and Insurance" measured for payment shall be lump sum.

The CONTRACT lump sum bid price for "Mobilization/Demobilization, Bonds, and Insurance" shall be full compensation for furnishing all materials, labor, equipment and tools for all required bonds, insurance, mobilization of staff and equipment, environmental control measures and documentation, and any other costs associated with complying with the contract administrative requirements and commencing WORK at the project site. This item also includes all work and materials necessary to complete the work and to demobilize and perform project closeout as described in the PLANS and SPECIFICATIONS. **Payment for this item shall not be requested until at least thirty days from the notice to proceed has elapsed.**

Payment for this item shall be made in accordance with Table A.

TABLE A

Payment for Mobilization on First Partial Payment	Not to exceed 2.5% of the Lump Sum Base Bid
Subsequent payments for Mobilization	Not to exceed 2.5% of the Lump Sum Base Bid
Payment For Mobilization on Final Partial Payment	Any remaining Mobilization in excess of 5% of the Lump Sum Base Bid

2. Demolition of Existing Pavement and Manhole

The quantity of "Traffic Control Plan & Implementation" measured for payment shall be lump sum.

The CONTRACT Lump Sum Price for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools

required for the demolition and removal of existing pavement and existing manhole structures. This item includes saw cutting, removal, loading, hauling, legal disposal of all demolished materials, protection of adjacent improvements, and all work and materials necessary to complete the work as described in the Plans and Specifications. Payment for this item shall be lump sum.

3. 20-Inch Inlet Piping and Vault

The Contract Unit Price per linear foot for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for the installation of 20-inch inlet piping. This item includes all preparation of the site, saw cutting, removal, excavation, hauling of materials, bedding, piping, valves, vaults, altitude valves, access doors shading, concrete collars, bollards, valve supports, restraints, duckbill valve, combination air release/vacuum valves, appurtenances, fittings, connections, backfill, compaction, testing, and all work and materials necessary to complete the work as described in the Plans and Specifications. Payment for this item shall be made on the basis of linear feet installed.

4. 12-Inch Interconnect Piping

The Contract Unit Price per linear foot for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for the installation of 12-inch interconnect piping. This item includes all preparation of the site, saw cutting, removal, excavation, hauling of materials, bedding, piping, valves, shading, concrete collars, bollards, valve supports, restraints, appurtenances, fittings, connections, backfill, compaction, testing, and all work and materials necessary to complete the work as described in the Plans and Specifications. Payment for this item shall be made on the basis of linear feet installed.

5. 24-Inch Outlet Piping

The Contract Unit Price per linear foot for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for the installation of 24-inch outlet piping. This item includes all preparation of the site, saw cutting, removal, excavation, hauling of materials, bedding, piping, valves, shading, concrete collars, bollards, valve supports, restraints, combination air release/vacuum valves, appurtenances, fittings, connections, backfill, compaction, testing, and all work and materials necessary to complete the work as described in the Plans and Specifications. Payment for this item shall be made on the basis of linear feet installed

6. 12-Inch Overflow Piping

The Contract Unit Price per linear foot for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for the installation of 12-inch overflow piping. This item includes all appurtenances, fittings, connections, excavation, bedding, backfill, compaction, testing, and all work and materials necessary to complete the work as described in the Plans and Specifications. Payment for this item shall be made on the basis of linear feet installed.

7. Site Grading

The Contract Lump Sum Price for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for site grading. This item includes clearing, grubbing, excavation, hauling, embankments, placement moisture conditioning, compaction, rough and finish grading, riprap, testing, disposal of unsuitable material, and all work and materials necessary to complete the work as described in the Plans and Specifications. All grading work shall be performed in accordance with Lake Havasu City Engineering Standards and applicable sections of the Maricopa Association of Governments (MAG) Uniform Standard Specifications and Details. Payment for this item shall be lump sum.

8. Chain Link Fence Installation

The Contract Unit Price per linear foot for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for the installation of chain-link fence. This item includes clearing and grubbing along the fence line; excavation and concrete footings; furnishing and installation of posts, rails, fabric, gates, fittings, anchoring, and all associated appurtenances; alignment, bracing, and adjustment; restoration of disturbed areas; and all work and materials necessary to complete the work as shown on the Plans and Specifications. Payment for this item shall be made on the basis of linear feet installed.

9. Tank Foundation

The furnishing and installation of the foundation for the new 750,000 gallon ground storage tank, including associated site work in Lake Havasu City, Arizona in accordance with the Specifications and Drawings. The CONTRACTOR'S bid shall include a sketch of the foundation for the tank. The foundation sketch for the tank shall show the dimensions of the foundation, the number of cubic yards of concrete in the foundation, and the number of pounds of reinforcing steel in the foundation.

10. Tank 6" Oil Impregnated Sand Base

The furnishing and installation of the top 6 in. of fill inside the concrete ringwall which is to be compacted oil impregnated sand.

11. 750,000 Gallon Welded Steel Tank With Aluminum Dome Roof

The fabrication and erection of one 750,000 gallon welded steel ground storage tank, including aluminum dome roof, piping, and accessories in Lake Havasu City, Arizona in accordance with the Specifications and Drawings. The CONTRACTOR'S bid shall include a sketch of the tank indicating the shell diameter, the height of the overflow, and the actual capacity. The roof shall be a self-supporting aluminum dome roof. Thicknesses and sizes of each plate and structural member shall also be shown.

12. Tank Interior and Exterior Coatings

The surface preparation and painting of the interior and exterior surfaces of the new 750,000 gallon welded steel ground storage tank, including piping and accessories in Lake Havasu City, Arizona in accordance with the Specifications and Drawings.

13. Tank Electrical, Instrumentation, and Controls

The furnishing and installation of the electrical, instrumentation, and controls for the new 750,000 gallon ground storage tank in Lake Havasu City, Arizona in accordance with the Specifications and Drawings.

14. Cathodic Protection System for Welded Steel Tank

The furnishing and installation of the cathodic protection system for the new 750,000 gallon welded steel ground storage tank in Lake Havasu City, Arizona in accordance with the Specifications and Drawings.

15. Additional Reinforced Concrete

It is felt that the specifications adequately describe the work to be performed; however, in the event that during the course of the construction, it is found that additional reinforced concrete is required and it is authorized in writing by the OWNER and ENGINEER, this work shall be paid for by the unit price bid per cubic yard of installed reinforced concrete, including all concrete, reinforcement, formwork, labor, finishing, curing, overhead, profit, etc.

16. Additional Excavation

It is felt that the specifications adequately describe the work to be performed; however, in the event that during the course of the construction, it is found that additional excavation is required and it is authorized in writing by the OWNER and ENGINEER, this work shall be paid for by the unit price bid per cubic yard of additional excavation, including backfilling, labor, overhead, profit, etc. The quantities of excavation shall be determined as follows and shall be calculated based on vertical walls. However, proper angle of repose or shoring shall be accomplished.

circular footing = additional depth of excavation x modified area of footing (incl. 2 ft on each edge of footing pad) i.e. Volume = [(out. radius + 2 ft)² - (ins. radius - 2 ft)²] x π x additional depth

17. Additional Compacted Structural Backfill (under footing)

It is felt that the specifications adequately describe the work to be performed; however, in the event that during the course of the construction, it is found that additional compacted structural backfill is required and it is authorized in writing by the OWNER and ENGINEER, this work shall be paid for by the unit price bid per cubic yard of compacted structural backfill including labor, overhead, profit, etc.

18. Force Account

The lump sum quantity shown in the "Force Account" shall be included in the Bid. Only the OWNER shall determine the use of monies in the "Force Account".

4.3 Progress Payments

- 1.** CONTRACT provides for payment of 90% for completed WORK until final payment. Completed WORK includes placement of all equipment and piping, testing, clean-up and inspection.
- 2.** Partial pay estimates must be submitted to the ENGINEER no later than the 25th of each month. Pay estimates may only include WORK that has been completed at that time.
- 3.** No materials will be considered for stored material partial payment. No payment will be made until after the materials have been installed, inspected, tested, and approved by ENGINEER to be placed in service.

4.4 Final Payment

Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities accepted by the ENGINEER multiplied by the unit sum/price for work which is incorporated in or made necessary by the Work.

PART 5 – DEFECT ASSESSMENT

- 5.1** Replace the Work, or portions of the work, not conforming to specified requirements.
- 5.2** If, in the opinion of the ENGINEER, it is not practical to remove and replace the Work, the ENGINEER will direct one of the following remedies:
 - A.** The defective Work may remain, but the unit price will be adjusted to a new price at the discretion of the ENGINEER.
 - B.** The defective Work will be partially repaired to the instructions of the ENGINEER, and the unit price will be adjusted to a new price at the discretion of the ENGINEER.
- 5.3** The individual specification sections may modify these options or may identify a specific formula or percentage sum/price reduction.
- 5.4** The authority of the ENGINEER to assess the defect and identify payment adjustment is final.

PART 6 – NON-PAYMENT FOR REJECTED PRODUCTS

- 6.1** Payment will not be made for any of the following:
 - A.** Products wasted or disposed of in a manner that is not acceptable.
 - B.** Products determined as unacceptable before or after placement.
 - C.** Products not completely unloaded from the transportation vehicle.
 - D.** Products placed beyond the lines and levels of the required Work.
 - E.** Products remaining on hand after completion of the Work.
 - F.** Loading, hauling and disposing of rejected products.

****END OF SECTION 01210****

SECTION 01210
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 Description

The outline of measurement and payment in this section is intended to provide a general guideline to the CONTRACTOR in preparing bids and submitting pay requests. Listing of work included in each bid item is not intended to include all work, but is to provide general guidance to the CONTRACTOR for allocating costs. All work will be paid for on a unit price basis with payment made for the quantity of each item completed.

All materials required for construction shall be furnished by the CONTRACTOR unless specifically stated. Items not specifically measured and paid for shall be considered as subsidiary items required to complete the installation in accordance with the intent of the contract documents. The CONTRACTOR shall include in the unit price bid items, all costs associated with subsidiary items not being measured for payment.

1.2 Authority

Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section governs.

Take all measurements and compute quantities. The ENGINEER will verify measurements and quantities.

1.3 Unit Quantities

Quantities indicated in the Bid Form are for bidding and contract purpose only. Quantities and measurements supplied or placed in the Work and verified by the ENGINEER shall determine payment.

If the actual Work requires more or fewer quantities than indicated, actual quantities will be paid at the contract unit prices. Additional quantities must be approved prior to the work being initiated.

PART 2 – PRODUCTS – Not Used

PART 3 – CONSTRUCTION – Not Used

PART 4 - METHODS OF MEASUREMENT

4.1 General

All items that are included in the bid for measurement and payment are included herein. All other items of work shall be considered subsidiary to construction and will not be measured for payment.

4.2 Measurement and Payment

1. Mobilization/Demobilization, Bonds, and Insurance

The quantity of "Mobilization/Demobilization, Bonds, and Insurance" measured for payment shall be lump sum.

The CONTRACT lump sum bid price for "Mobilization/Demobilization, Bonds, and Insurance" shall be full compensation for furnishing all materials, labor, equipment and tools for all required bonds, insurance, mobilization of staff and equipment, environmental control measures and documentation, and any other costs associated with complying with the contract administrative requirements and commencing WORK at the project site. This item also includes all work and materials necessary to complete the work and to demobilize and perform project closeout as described in the PLANS and SPECIFICATIONS. **Payment for this item shall not be requested until at least thirty days from the notice to proceed has elapsed.**

Payment for this item shall be made in accordance with Table A.

TABLE A

Payment for Mobilization on First Partial Payment	Not to exceed 2.5% of the Lump Sum Base Bid
Subsequent payments for Mobilization	Not to exceed 2.5% of the Lump Sum Base Bid
Payment For Mobilization on Final Partial Payment	Any remaining Mobilization in excess of 5% of the Lump Sum Base Bid

2. Demolition of Existing Pavement and Manhole

The quantity of "Traffic Control Plan & Implementation" measured for payment shall be lump sum.

The CONTRACT Lump Sum Price for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for the demolition and removal of existing pavement and existing manhole structures. This item includes saw cutting, removal, loading, hauling, legal disposal of all demolished materials, protection of adjacent improvements, and all work and materials necessary to complete the work as described in the Plans and Specifications. Payment for this item shall be lump sum.

3. 20-Inch Inlet Piping and Vault

The Contract Unit Price per linear foot for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for the installation of 20-inch inlet piping. This item includes all preparation of the site, saw cutting, removal, excavation, hauling of materials, bedding, piping, valves, vaults, altitude valves, access doors shading, concrete collars, bollards, valve supports, restraints, duckbill valve, combination air release/vacuum valves, appurtenances, fittings, connections, backfill, compaction, testing, and all work and materials necessary to complete the work as described in the Plans and Specifications. Payment for this item shall be made on the basis of linear feet installed.

4. 12-Inch Interconnect Piping

The Contract Unit Price per linear foot for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for the installation of 12-inch interconnect piping. This item includes all preparation of the site, saw cutting, removal, excavation, hauling of materials, bedding, piping, valves, shading, concrete collars, bollards, valve supports, restraints, appurtenances, fittings, connections, backfill, compaction, testing, and all work and materials necessary to complete the work as described in the Plans and Specifications. Payment for this item shall be made on the basis of linear feet installed.

5. 24-Inch Outlet Piping

The Contract Unit Price per linear foot for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for the installation of 24-inch outlet piping. This item includes all preparation of the site, saw cutting, removal, excavation, hauling of materials, bedding, piping, valves, shading, concrete collars, bollards, valve supports, restraints, combination air release/vacuum valves, appurtenances, fittings, connections, backfill, compaction, testing, and all work and materials necessary to

complete the work as described in the Plans and Specifications. Payment for this item shall be made on the basis of linear feet installed

6. 12-Inch Overflow Piping

The Contract Unit Price per linear foot for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for the installation of 12-inch overflow piping. This item includes all appurtenances, fittings, connections, excavation, bedding, backfill, compaction, testing, and all work and materials necessary to complete the work as described in the Plans and Specifications. Payment for this item shall be made on the basis of linear feet installed.

7. Site Grading

The Contract Lump Sum Price for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for site grading. This item includes clearing, grubbing, excavation, hauling, embankments, placement moisture conditioning, compaction, rough and finish grading, riprap, testing, disposal of unsuitable material, and all work and materials necessary to complete the work as described in the Plans and Specifications. All grading work shall be performed in accordance with Lake Havasu City Engineering Standards and applicable sections of the Maricopa Association of Governments (MAG) Uniform Standard Specifications and Details. Payment for this item shall be lump sum.

8. Chain Link Fence Installation

The Contract Unit Price per linear foot for this item shall constitute full compensation for furnishing all materials, labor, equipment, and tools required for the installation of chain-link fence. This item includes clearing and grubbing along the fence line; excavation and concrete footings; furnishing and installation of posts, rails, fabric, gates, fittings, anchoring, and all associated appurtenances; alignment, bracing, and adjustment; restoration of disturbed areas; and all work and materials necessary to complete the work as shown on the Plans and Specifications. Payment for this item shall be made on the basis of linear feet installed.

9. Tank Foundation

The furnishing and installation of the foundation for the new 750,000 gallon ground storage tank, including associated site work in Lake Havasu City, Arizona in accordance with the Specifications and Drawings. The CONTRACTOR'S bid shall include a sketch of the foundation for the tank. The foundation sketch for the tank shall show the dimensions of the foundation, the number of cubic yards of concrete in the foundation, and the number of pounds of reinforcing steel in the foundation.

10. Tank 6" Oil Impregnated Sand Base

The furnishing and installation of the top 6 in. of fill inside the concrete ringwall which is to be compacted oil impregnated sand.

11. 750,000 Gallon Welded Steel Tank With Aluminum Dome Roof

The fabrication and erection of one 750,000 gallon welded steel ground storage tank, including aluminum dome roof, piping, and accessories in Lake Havasu City, Arizona in accordance with the Specifications and Drawings. The CONTRACTOR'S bid shall include a sketch of the tank indicating the shell diameter, the height of the overflow, and the actual capacity. The roof shall be a self-supporting aluminum dome roof. Thicknesses and sizes of each plate and structural member shall also be shown.

12. Tank Interior and Exterior Coatings

The surface preparation and painting of the interior and exterior surfaces of the new 750,000 gallon welded steel ground storage tank, including piping and accessories in Lake Havasu City, Arizona in accordance with the Specifications and Drawings.

13. Tank Electrical, Instrumentation, and Controls

The furnishing and installation of the electrical, instrumentation, and controls for the new 750,000 gallon ground storage tank in Lake Havasu City, Arizona in accordance with the Specifications and Drawings.

14. Cathodic Protection System for Welded Steel Tank

The furnishing and installation of the cathodic protection system for the new 750,000 gallon welded steel ground storage tank in Lake Havasu City, Arizona in accordance with the Specifications and Drawings.

15. Additional Reinforced Concrete

It is felt that the specifications adequately describe the work to be performed; however, in the event that during the course of the construction, it is found that additional reinforced concrete is required and it is authorized in writing by the OWNER and ENGINEER, this work shall be paid for by the unit price bid per cubic yard of installed reinforced concrete, including all concrete, reinforcement, formwork, labor, finishing, curing, overhead, profit, etc.

16. Additional Excavation

It is felt that the specifications adequately describe the work to be performed; however, in the event that during the course of the construction, it is found that additional excavation is required and it is authorized in writing by the OWNER and ENGINEER, this work shall be paid for by the unit price bid per cubic yard of additional excavation, including backfilling, labor, overhead, profit, etc. The quantities of excavation shall be determined as follows and shall be calculated based on vertical walls. However, proper angle of repose or shoring shall be accomplished.

circular footing = additional depth of excavation x modified area of footing (incl. 2 ft on each edge of footing pad) i.e. Volume = [(out. radius + 2 ft)² - (ins. radius - 2 ft)²] x π x additional depth

17. Additional Compacted Structural Backfill (under footing)

It is felt that the specifications adequately describe the work to be performed; however, in the event that during the course of the construction, it is found that additional compacted structural backfill is required and it is authorized in writing by the OWNER and ENGINEER, this work shall be paid for by the unit price bid per cubic yard of compacted structural backfill including labor, overhead, profit, etc.

18. Force Account

The lump sum quantity shown in the "Force Account" shall be included in the Bid. Only the OWNER shall determine the use of monies in the "Force Account".

4.3 Progress Payments

- 1.** CONTRACT provides for payment of 90% for completed WORK until final payment. Completed WORK includes placement of all equipment and piping, testing, clean-up and inspection.
- 2.** Partial pay estimates must be submitted to the ENGINEER no later than the 25th of each month. Pay estimates may only include WORK that has been completed at that time.
- 3.** No materials will be considered for stored material partial payment. No payment will be made until after the materials have been installed, inspected, tested, and approved by ENGINEER to be placed in service.

4.4 Final Payment

Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities accepted by the ENGINEER multiplied by the unit sum/price for work which is incorporated in or made necessary by the Work.

PART 5 – DEFECT ASSESSMENT

- 5.1** Replace the Work, or portions of the work, not conforming to specified requirements.
- 5.2** If, in the opinion of the ENGINEER, it is not practical to remove and replace the Work, the ENGINEER will direct one of the following remedies:
 - A.** The defective Work may remain, but the unit price will be adjusted to a new price at the discretion of the ENGINEER.
 - B.** The defective Work will be partially repaired to the instructions of the ENGINEER, and the unit price will be adjusted to a new price at the discretion of the ENGINEER.
- 5.3** The individual specification sections may modify these options or may identify a specific formula or percentage sum/price reduction.

- 5.4** The authority of the ENGINEER to assess the defect and identify payment adjustment is final.

PART 6 – NON-PAYMENT FOR REJECTED PRODUCTS

- 6.1** Payment will not be made for any of the following:
- A.** Products wasted or disposed of in a manner that is not acceptable.
 - B.** Products determined as unacceptable before or after placement.
 - C.** Products not completely unloaded from the transportation vehicle.
 - D.** Products placed beyond the lines and levels of the required Work.
 - E.** Products remaining on hand after completion of the Work.
 - F.** Loading, hauling and disposing of rejected products.

****END OF SECTION 01210****

SPECIFICATIONS

for the

Fabrication and Erection of

One 750,000 Gallon Welded Steel Ground Storage Tank

Including Aluminum Dome Roof, Foundation, Painting,

Piping, Site Work, and Accessories

Lake Havasu City, Arizona

for

Lake Havasu City, Arizona

Prepared by

TANK INDUSTRY CONSULTANTS

Headquarters:

**7740 West New York Street
Indianapolis, Indiana 46214**

TIC 24.125.S1803.002

February 12, 2026

SPECIFICATIONS

for the

Fabrication and Erection of

One 750,000 Gallon Welded Steel Ground Storage Tank

Including Aluminum Dome Roof, Foundation, Painting,

Piping, Site Work, and Accessories

Lake Havasu City, Arizona

for

Lake Havasu City, Arizona

900 London Bridge Road

Lake Havasu City, Arizona 86403

February 12, 2026

Engineer

TANK INDUSTRY CONSULTANTS

Headquarters:

**7740 West New York Street
Indianapolis, Indiana 46214**

Certified by:



**Gregory R. "Chip" Stein, P.E.
Registered Professional Engineer, No. 31328
State of Arizona**

TIC 24.125.S1803.002

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SECTION 00840

SUPPLEMENTARY REQUIREMENTS - NEW TANK CONSTRUCTION

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1. **CONSTRUCTION STAKING:** The construction staking to be provided by the OWNER shall consist of the placement of stakes as determined necessary by the ENGINEER. Stakes will indicate the horizontal control point of the water tank, drain locations, and an elevation benchmark at the tank. Stakes will be provided once. The OWNER will furnish a Temporary Bench Mark (TBM) as shown in the Drawings. The CONTRACTOR will be responsible for preserving stakes and any replacement or additional stakes required will be paid for by the CONTRACTOR.
2. **ROADWAY CLEAN-UP:** Construction traffic from the tank site shall not be allowed to deposit detrimental amounts of construction mud or any other debris on the public roadways. The OWNER or the Department of Transportation may request that the local and state maintained or surrounding roadways be immediately cleaned. If no action is taken within two hours after notification, the OWNER or the Department of Transportation may clean up surrounding roadways concerned and the OWNER may deduct the amount of cleanup costs from the total contract.
3. **NUISANCE CONTROLS:** The CONTRACTOR is required to minimize noise, dust, pests, debris, pollution and erosion at the construction site. Erosion shall be controlled by temporary cover, silt fencing, etc., as appropriate. Water shall be applied to dusty areas as necessary. Debris shall be promptly removed from the site. Storage areas shall be such that pests and rodents can be controlled.
4. **MATERIAL STORAGE:** All materials and equipment stored at the site shall be protected from the elements where such exposure would be detrimental, and shall be adequately supported to prevent bending, warping, damage to painted surfaces, and other degradation of material properties.
5. **NOTIFICATION OF OWNER:** If during construction, materials produced by man or culture (arrowheads, axes, pottery, etc.), or evidence of human remains are located, the OWNER shall be notified immediately and the CONTRACTOR shall cease all operations until instructed otherwise by the OWNER.
6. **PROTECTION OF PROPERTY:** The CONTRACTOR shall protect, shore, brace, support and maintain all underground pipes, conduits, drains and all other underground construction uncovered or otherwise affected by the construction work performed by him/her. All pavements, driveways, surfacing, curbs, walks, buildings, utility poles, guy wires and other surface structures affected by construction operations in connection with performance of the contract, together with all shrubs in yards, and markings on or adjacent to the construction site, shall be maintained, and if removed or otherwise damaged, shall be restored to the original condition. All replacements of such underground structures and/or surface structures or parts thereof shall be made with new materials as approved in writing by the ENGINEER.

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7. BARRICADES AND LIGHTS: All open trenches or other excavations shall be provided with suitable barriers, signs and lights to the extent that adequate protection is provided to the public against accident by reason of such open construction. Obstructions such as material piles and equipment shall be provided with similar warning signs and lights.
 - 7.1. All barricades and obstructions shall be illuminated by means of acceptable warning lights at night and all lights used for this purpose shall be kept burning from sunset to sunrise. Materials stored upon or alongside public streets, roads and highways shall be so placed and the work at all times shall be so conducted as to cause the minimum obstruction and inconvenience to the traveling public.
 - 7.2. All barricades, signs, warning lights and other protective devices shall be installed and maintained in conformance with applicable statutory requirements and where within highway right-of-ways as required by the authority having jurisdiction thereof.
 - 7.3. In case the CONTRACTOR fails or neglects to take such precautions, the OWNER may have such lights and barricades installed and charge the cost of this work to the CONTRACTOR. Such action by the OWNER does not relieve the CONTRACTOR of any liability incurred under these specifications or contract.
8. CONTRACTOR DUTIES:
 - 8.1. Except as specifically noted, provide and pay:
 - A. Labor, materials and equipment.
 - B. Tools, construction equipment and machinery.
 - C. Water, heat and utilities.
 - D. Other facilities and services necessary for proper execution and completion of the work.
 - E. All applicable taxes and fees.
 - 8.2. Secure and pay for, as necessary for proper execution and completion of Work, and as applicable at time of receipt of bids.
 - A. Building Permits
 - B. Licenses
 - 8.3. Give required notices.
 - 8.4. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which relate to the performance of the work.
 - A. Promptly submit written notice to ENGINEER of observed variance of Contract Documents, Specifications or Drawings from Legal requirements.

- B. Assume responsibility for Work known to be contrary to legal requirements if notice is not submitted.
 - C. Necessary changes to the Contract Documents, Specifications or Drawings will be accomplished by Change Order if the Contract price or completion time are affected.
- 8.5. Enforce strict discipline and good order among employees. Do not employ on Work:
- A. Unfit persons.
 - B. Persons not skilled in assigned tasks.
9. CONTRACTOR USE OF PREMISES:
- 9.1. Confine operations at site to areas permitted by:
- A. Law.
 - B. Ordinances.
 - C. Permits.
 - D. Contract Documents and Specifications.
 - E. Drawings.
 - F. Easements.
- 9.2. Do not unreasonably encumber site with materials or equipment.
- 9.3. Do not load any structure with weight that will endanger structure.
- 9.4. Assume full responsibility for protection and safekeeping of products stored on premises.
- 9.5. Move any stored products which interfere with operations of OWNER or other CONTRACTOR.

END OF SECTION

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SECTION 01010

SUMMARY OF WORK

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PART 1 -- GENERAL

1.1. GENERAL

- A. The General Conditions, Supplementary Conditions, Supplementary Requirements, and applicable portions of Division 1 are part of this Section.

1.2. WORK UNDER THIS CONTRACT

- A. The Work covered under this Contract shall consist of all excavation, foundation construction, backfill, construction access roadway construction, fabrication, erection, painting, disinfection, site work, site clean-up and rough grading shown on the plans and specified in these Specifications for the fabrication and erection of a 750,000 gallon welded steel ground storage tank including aluminum dome roof, foundation, painting, and accessories. The above description shall serve as general information only and shall not be construed to limit the contractor's responsibility or obligation to comply with the Contract Documents and Detailed Technical Specifications.

1.3. ADDITIONAL INSURED

- A. The CONTRACTOR shall list a) Lake Havasu City; b) Tank Industry Consultants; and each of their officers, agents, and employees as additional insured on all insurance policies (except worker's compensation and employers' liability) and coverage which are required by the OWNER as specified in the Contract Documents.

PART 2 -- PRODUCTS

- A. All products incorporated into the work area shall be new, unused, and first quality unless otherwise specifically noted.

PART 3 -- EXECUTION

3.1. QUALITY OF WORK

- A. All work shall be performed in a workmanlike manner by properly trained and qualified personnel under supervision of the CONTRACTOR'S Representative.

END OF SECTION

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SECTION 01040

COORDINATION

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PART 1 -- GENERAL

1.1. GENERAL

- A. Coordination of the Project, and each portion of the Work on this Project shall be performed by the CONTRACTOR to achieve a quality product in an expedient manner in general accordance with this Section.

PART 2 -- PRODUCTS

NOT USED

PART 3 -- EXECUTION

3.1. QUALITY ASSURANCE

- A. CONTRACTOR'S Personnel: The CONTRACTOR shall have a full complement of personnel, for the proper coordination and expedition of the work, on a continuous basis until the work is completed.
- B. Notification: The CONTRACTOR shall notify the OWNER and the ENGINEER at least seven (7) days before starting the Work at the site. The CONTRACTOR shall reconfirm the commencement of Work with the OWNER and ENGINEER twenty-four (24) hours prior to starting work at the site.
- C. Emergency Information: The CONTRACTOR shall post information concerning emergency medical, fire, rescue and hazardous waste phone numbers from which personnel on the site can obtain information if needed. The CONTRACTOR shall also list the name and number of a representative of the CONTRACTOR who can be reached in case of an emergency. The emergency information shall be in a central position, located so it is visible and accessible 24 hours a day. The emergency information shall be posted the entire length of time that the CONTRACTOR is performing Work at the tank site.
- D. Contractor Supervision: Except where the CONTRACTOR is an individual and gives his personal superintendence to the work, the CONTRACTOR shall provide a competent superintendent, satisfactory to the OWNER, for the work at all times during working hours with full authority to act for him. The on-site superintendent shall not be replaced without prior written notification and written approval of the ENGINEER. The CONTRACTOR shall also provide an adequate staff for the proper coordination and expedition of his work. Should, in the opinion of the OWNER, any language barrier exist between the on-site superintendent and the OWNER or FIELD OBSERVER, the

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CONTRACTOR shall employ a qualified full-time interpreter or provide a new on-site superintendent at no additional cost to the OWNER. The on-site superintendent shall be bi-lingual if any workers are not proficient in English.

- E. Authority of CONTRACTOR'S COMPETENT PERSON(S): The CONTRACTOR'S COMPETENT PERSON(S) shall have the complete support of top management and written authority to ensure these operations are carried out in accordance with compliance plans and governmental regulations, independent of production pressures. To ensure independence, CONTRACTOR'S COMPETENT PERSON(S) shall report directly to the headquarters office and not to the site foreman. The CONTRACTOR'S COMPETENT PERSON(S) may have additional responsibilities and carry out other work assignments, but shall not routinely be a member of the crew that actually performs surface preparation work.
- F. Responsibility of CONTRACTOR'S COMPETENT PERSON(S): CONTRACTOR'S COMPETENT PERSON(S) shall be responsible for overseeing surface preparation operations without supervision of the OWNER, ENGINEER, and/or FIELD OBSERVER. Responsibilities shall include:
1. Monitoring effectiveness and ensuring the continued integrity of environmental controls.
 2. Supervising worker exposure monitoring.
 3. Ensuring that a hazard communication program has been conducted for the CONTRACTOR'S personnel on site.
 4. Ensuring that employees are wearing personal protective equipment and are trained in the use of such equipment and in the use of exposure control methods, personal hygiene facilities, respiratory protection, and decontamination practices.
 5. Ensuring that the engineering controls in use are in operating condition and functioning properly.
 6. Ensuring that fugitive emissions to air, water, or soil are minimized and that handling of all waste streams is in compliance with applicable regulations and contract specifications.
 7. Controlling access to the work site and ensuring that contaminated control boundaries are marked off.
 8. Maintaining project documentation.
- G. Work Schedule: The Work shall be accomplished in such a way as to minimize the number of days required for observing the Work. **The CONTRACTOR'S attention is directed to the Agreement concerning Contract Time.**
- H. Times for Work: No on-site work is to be done in the night period between sunset and sunrise. The times for Work shall also comply with local, state and federal regulations and laws regarding days of week, noise and interference with activities of surrounding

occupants and property owners. Should temperatures be excessive for personnel welfare during daylight hours or should other job conditions make nighttime Work beneficial to the CONTRACTOR and OWNER, written permission may be granted by the ENGINEER and OWNER to conduct Work at night. This permission shall only be granted if the CONTRACTOR provides the proper lighting and safety equipment and informs the neighboring occupants and property owners.

- I. Observation: The OWNER plans to engage Tank Industry Consultants or another designated representative of the OWNER, to perform intermittent observations of the fabrication, shop painting, and erection. The OWNER plans to engage Tank Industry Consultants or another designated representative of the OWNER, to perform full-time observation of the field cleaning and painting
- J. Accessibility for Observation: All Work shall be made accessible to the FIELD OBSERVER using the CONTRACTOR'S rigging and equipment. If assistance is required for the FIELD OBSERVER to safely access the work, the CONTRACTOR shall furnish labor to assist the FIELD OBSERVER. The cost of this labor shall be included in the base contract amount.
- K. Attractive Nuisances and Cleanup: The job site shall be kept in a clean and safe condition at all times. Hazards or attractive nuisances shall be protected at all times. Upon completion of the Work, the job site and all nearby sites impacted by the Work activities shall be left clean of all debris or any other items resulting from the operations of the CONTRACTOR. Impervious barriers (i.e. plastic, metal drip pans, etc.) shall be placed under any compressors, generators, paint pumps, mixers, welding machines, etc. to prevent oils, solvents, organic compounds, or other contaminants from leaching into the soil. **Any oils, solvents, organic compounds, or contaminants spilled on the site during the process of the Work shall be immediately removed and cleaned up by the CONTRACTOR. Any earth contaminated by a spill shall also be removed and replaced with new certified clean material to the satisfaction of the OWNER and the ENGINEER.**
- L. Welding or Cutting Operations: No welding or cutting through the existing coating system shall be permitted, unless adequate worker protection is provided and proper personal hygiene practices are followed in accordance with the instructions in ANSI Z49.1, "*Safety in Welding and Cutting.*"
- M. Operation of Valves and Equipment: All operations which would include operating valves, switching, starting, stopping, or removal from service of any equipment shall be done by the OWNER'S personnel. If the CONTRACTOR desires the OWNER to close valves, operate switches, start, stop, or remove any equipment from service, the CONTRACTOR shall submit a written request to the OWNER, and if the OWNER determines that such action will not adversely affect the operations of the OWNER to provide water, then the OWNER may close valves, operate switches, start, stop, or remove the equipment from service. Such requests shall be directed to the PROJECT REPRESENTATIVE so interruptions, if any, of the OWNER'S operations or systems will be no longer than necessary. The CONTRACTOR shall have a full complement of personnel working on a continuous basis until the Work causing the interruption is

completed. All Work performed under this Agreement shall be performed in close cooperation with the OWNER.

- N. Site Security: The site is located at the airport and as such CONTRACTOR shall comply with the security requirements of the airport and shall submit procedure for keeping the outer perimeter gate closed. When not working on the tank or site (such as during the evening, weekends, holidays, or rain days), the CONTRACTOR shall secure all openings in the tank (greater than 8 in.), the exterior ladder, and access or rigging devices. The CONTRACTOR shall lock the site fence to prevent unauthorized personnel from gaining access to the site, the interior of the tank, and the CONTRACTOR'S equipment and supplies. The CONTRACTOR shall be solely responsible for the security of the site, tank, equipment, and supplies during both working and non-working hours.
- O. OWNER Performed Work: The CONTRACTOR shall cooperate with the OWNER who may be conducting other operations on or near the tank. The CONTRACTOR shall clean and paint all areas added or disturbed by the OWNER on the tank and attached accessories.

END OF SECTION

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SECTION 01060

REGULATORY REQUIREMENTS

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PART 1 -- GENERAL

1.1. REGULATORY REQUIREMENTS

- A. It is consistent with the intent of these Specifications to describe those performance standards, often broad and general in nature, required to provide a complete and operating system. It shall be the responsibility of the CONTRACTOR to familiarize himself fully regarding the detailed needs and requirements of any and all regulatory agencies having jurisdiction over this work. These detailed needs and requirements shall be accommodated, as part of the Work, in every manner just as if they were prescribed in these Contract Documents and Specifications.
- B. Confined Space Entry: The CONTRACTOR shall comply with and have documented Confined Entry Space Procedures available at the tank site at all times as required by OSHA 29 CFR 1926 Subpart AA. The CONTRACTOR shall also comply with any state and/or local requirements which are more restrictive than the federal requirements.
- C. Compliance with Environmental Regulations: Compliance with local, state and federal regulations concerning emissions or disposal of solid, particulate, liquid, or gaseous matter as a result of the cleaning, painting, or other operations under this Agreement shall be the responsibility of the CONTRACTOR. This compliance shall be accomplished without supervision from the OWNER, ENGINEER, FIELD OBSERVER, or other direct or indirect agents of the OWNER. No additional compensations for changes in the laws, regulations, or the interpretation thereof shall be granted by the OWNER. No burning of trash (including abrasive bags or other paper or wood products) on the site shall be permitted. All shielding, abrasive retrieval, or other methods of using precautions required by the regulating agencies shall also be accomplished at no additional cost to the OWNER unless otherwise provided herein. **Any fines imposed on the OWNER, ENGINEER, or FIELD OBSERVER by any regulatory agency as a result of the CONTRACTOR'S noncompliance with environmental regulations shall be paid or reimbursed by the CONTRACTOR.**
- D. Safety and Health: The CONTRACTOR shall comply with safe working practices for abrasive blasting, cleaning, burning, welding, and handling lead-based and nonlead-based coated steel, and all health and safety regulations and requirements of Federal, state and local health regulatory agencies, Safety Data Sheets (SDS), and the paint and abrasive manufacturers. This compliance shall be accomplished without supervision from the OWNER, ENGINEER, FIELD OBSERVER, or other direct or indirect agents of the OWNER. The CONTRACTOR shall provide portable sanitary toilet and wash-up facilities at the Work site.

- E. Rigging Attachments: All rigging attachments installed on the tank (by the erection or painting CONTRACTOR) shall be carefully inspected by the CONTRACTOR immediately prior to use. The CONTRACTOR assumes all responsibility for use of any added attachments.

1.2. REQUIREMENTS

- A. Provide required personnel, equipment, and materials, to construct project according to applicable codes and standards.

1.3. APPLICABLE CODES AND STANDARDS

- A. All design and work shall be in accordance with the local building code and requirements. As a minimum standard of quality and workmanship, construction Work is to comply with the latest edition of the following codes and standards insofar as they are applicable:

1. American Water Works Association (AWWA) Standards
2. American Welding Society (AWS) Standards
3. American Petroleum Institute (API) Standards
4. American Institute of Steel Construction (AISC)
5. American Society for Testing and Materials (ASTM) Standards
6. American Concrete Institute (ACI) Standards
7. Concrete Reinforcing Steel Institute (CRSI) Standards
8. AMPP, The Association for Materials Protection and Performance (formerly SSPC, The Society for Protective Coatings and NACE, National Association of Corrosion Engineers)
9. Occupational Safety and Health Administration (OSHA) Standards
10. American National Standards Institute (ANSI) Standards
11. United States Environmental Protection Agency (USEPA)
12. United States Resource Conservation and Recovery Act (US RCRA)
13. National Electric Code (NEC)
14. NSF International (NSF) {formerly National Sanitation Foundation}
15. Underwriter's Laboratories (UL)
16. American Society of Civil Engineers (ASCE)
17. International Building Code (IBC)

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- B. The above codes and standards are hereinafter referred to as "Reference Specifications."

PART 2 -- PRODUCTS

NOT USED

PART 3 -- EXECUTION

3.1. PROCEDURES

- A. CONTRACTOR shall comply with all regulations and requirements listed or inferred by this Section. CONTRACTOR shall pay all fees, obtain necessary permits as may be required for the prosecution of his work.

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SECTION 01070

ABBREVIATIONS AND SYMBOLS

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PART 1 -- GENERAL

1.1. SECTION INCLUDES

- A. Definitions used throughout the specifications.

1.2. DEFINITION OF PARTIES

- A. **OWNER** shall mean Lake Havasu City, Arizona, 900 London Bridge Road, Lake Havasu City, Arizona 86403.
- B. **PROJECT REPRESENTATIVE** shall mean Mr. Jason C. Hart, Capital Program Manager, Public Works Department, 900 London Bridge Road, Lake Havasu City, Arizona 86403, telephone 928/854-0789.
- C. **ENGINEER** shall mean Tank Industry Consultants - Headquarters: 7740 West New York Street, Indianapolis, Indiana 46214, telephone 317/271-3100, FAX 317/271-3300.
- D. **FIELD OBSERVER** shall mean Tank Industry Consultants - Headquarters: 7740 West New York Street, Indianapolis, Indiana 46214, telephone 317/271-3100, FAX 317/271-3300.
- E. **SOIL CONSULTANT** shall mean Western Technologies, 2400 East Huntington Drive, Flagstaff, Arizona 86004, telephone 928/774-8700.
- F. The term **CONTRACTOR'S COMPETENT PERSON(S)** in this specification shall mean a representative of the CONTRACTOR who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. The name(s) of the CONTRACTOR'S COMPETENT PERSON(S) shall be submitted to the ENGINEER prior to performing any Work.

PART 2 -- PRODUCTS

NOT USED

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PART 3 -- EXECUTION

NOT USED

END OF SECTION

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SECTION 01300

SUBMITTALS

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PART 1 -- GENERAL

1.1. SECTION INCLUDES

- A. Procedure for submitting drawings, data, design calculations, etc. for steel water storage tank, piping, valves, and accessories.

PART 2 -- PRODUCTS

NOT USED

PART 3 – EXECUTION

- A. Certification: All drawings and calculations prepared by the CONTRACTOR for submittal (one set of initial submittals, and all final submittals) shall be signed and sealed by a Professional Engineer registered in the State of Arizona.
- B. Compliance: All drawings, catalog cuts, or other descriptive information submitted to the ENGINEER for review shall bear a signed approval by the CONTRACTOR that the submitted material meets these specifications prior to submittal to the ENGINEER for review.
- C. Procedures:
 - 1. Initial Submittals: The CONTRACTOR shall submit five (5) sets of all initial submittals to the ENGINEER. One (1) set of ENGINEER reviewed initial submittals shall be forwarded to the OWNER. One (1) set of ENGINEER reviewed initial submittals shall be returned to the CONTRACTOR. Only one (1) set of initial submittals shall need to be signed and sealed by a Professional Engineer registered in the State of Arizona. (If the initial submittals are on 11 in. x 17 in. paper or smaller, then only one (1) set of initial submittals (signed and sealed by a P.E.) shall be sent to the ENGINEER. The ENGINEER shall make the appropriate copies and distribute them as mentioned above).

2. Final Submittals: After all submittals for a particular section of Work (i.e. foundation drawings, shop drawings, etc.) have been favorably reviewed by the ENGINEER, the CONTRACTOR shall submit five (5) sets of all final submittals to the ENGINEER. Two (2) sets of ENGINEER reviewed final submittals shall be forwarded to the OWNER. One (1) set of ENGINEER reviewed final submittals shall be returned to the CONTRACTOR. All sets of final submittals shall be signed and sealed by a Professional Engineer registered in the State of Arizona.
- D. Review: Drawings, data, etc. shall be reviewed by the ENGINEER within approximately two (2) weeks after receipt. Review of these drawings shall not relieve the CONTRACTOR from responsibility for compliance with the specifications or for the adequacy of the demolition methods. The CONTRACTOR shall incorporate the submittal review process time and make the necessary scheduling adjustments so that the completion of the Work within the Contract Time is not affected.

END OF SECTION

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SECTION 01560

TEMPORARY EROSION AND SEDIMENT CONTROL

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PART 1 -- GENERAL

1.1. SECTION INCLUDES

- A. All labor, materials, equipment and related services necessary to furnish and install temporary erosion and sediment control indicated on the Drawings or specified herein. The erosion and sediment control shall be provided from the initial site disturbance by the CONTRACTOR through final site stabilization.

1.2. GENERAL DESCRIPTION OF WORK

- A. Furnish and install temporary erosion and sediment control indicated on the Drawings or specified herein and protect the integrity of the erosion control measures installed. The erosion control measures shall be provided until such times as the temporary ground cover is sufficiently developed. The cost of providing the erosion and sediment control shall be included in the Base Bid. The CONTRACTOR shall comply with all local, state and federal laws, ordinances, and regulations pertaining to erosion, sediment and pollution control, including those promulgated by the State of Arizona, and shall indemnify and hold harmless the OWNER and ENGINEER from and against all claims, damages, losses and expenses resulting from such Work.

1.3. SUBMITTALS

- A. Submit to the ENGINEER the erosion control plan for the site.

1.4. EROSION AND SEDIMENT CONTROL MEASURES

- A. CONTRACTOR shall take all measures to control erosion and sedimentation at the construction site, including borrow and waste areas and temporary access roads, and at off-site areas especially vulnerable to damage from erosion and sedimentation. All erosion and sediment control measures will be subject to approval by the ENGINEER. All erosion and sediment control measures shall be implemented prior to any construction occurring. All temporary erosion and sediment control measures shall be removed within 30 days after completion of construction and establishment of permanent erosion control.

- 1. Critical Areas: Critical areas to be protected from damage due to severe erosion and sedimentation are as follows:
 - a. Exposed and disturbed areas.
 - b. Steep cuts and fills.
 - c. Open piles of unstable excavated material.

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- d. Stream and creek crossings.
 - e. Existing slopes.
2. Exposed Areas: Work shall be scheduled so that areas subject to erosion are exposed for the shortest possible time. Only those trees, shrubs and grasses shall be removed that are necessary for construction; those remaining shall be protected to preserve their aesthetic and erosion control values. Temporary on-site structures and buildings shall be located to preserve the existing landscape and to minimize erosion, including that from construction traffic. If practicable, work shall be scheduled in seasons when erosion is less of a hazard, particularly for sites with steep slopes and erodible soils.
 3. Disturbed Areas: Temporary protection shall be required for disturbed areas until final grading is completed and permanent vegetation is established, and shall consist of planting temporary grass cover or other vegetation when feasible. Other short term protection shall include covering disturbed areas and topsoil piles with a mulch of hay, straw or wood chips, stabilizing with netting, or covering with plastic sheets. Graded slopes and fills shall be limited to an angle and to lengths that will maintain stability and allow easy maintenance. Construction equipment shall not be operated in a way to make the land more susceptible to erosion, such as leaving tracks up and down slopes. Access roads shall be located and constructed so as to prevent erosion.
 4. Surface Water Runoff: Controls for surface water runoff shall be constructed as early as possible to prevent the formation of gullies or rills. These controls shall be maintained during the entire construction period or until permanent storm drains are completed. Runoff shall be controlled by diversion channels or berms, slope drains, flow barriers, dikes or other structures that retard or spread its flow. Compacted embankments, straw bales, ditches, furrows or temporary diversions across slopes shall be provided to intercept runoff before it reaches erodible areas. Diversions and drains shall be directed into stabilized areas where the discharge can be spread out and dissipated.
 5. Sediment: Barriers and settling basins shall be constructed to trap sediment before disturbing the land that drains into these barriers and settling basins. Dams, earth embankments, or temporary barriers such as small dikes consisting of semipermeable materials or quickly compacted soils, shall be provided to trap sediment. Semipermeable materials shall be hay bales, sand or gravel, and shall act as a filter, allowing water to flow through but retaining most of the sediment. Sediment basins shall be cleaned out periodically as required to maintain their capacity.
 6. Streams and Creeks: Construction in streams, creeks and other waterways shall be scheduled so as to minimize the extent and duration of disturbance of the channels. Where relocation of a waterway is required, it shall be planned and executed so that changes in stream flow characteristics are minimized.

7. Protection of Slopes: Within 15 working days of the completion of any phase of grading, all slopes left exposed shall be provided with temporary grass cover or other suitable ground cover, devices or structures sufficient to control erosion.

PART 2 -- PRODUCTS

2.1. SILT FENCE

- A. Silt fences shall consist of a specifically manufactured non-woven drainage and filtration fabric, attached to a support system of wire mesh and posts. The height of the fabric shall be 2 feet above grade. Fabric toe shall be buried to secure the bottom edge of the fabric. The fabric shall be attached to the support system with suitable staples or wire rings. Wire mesh size and post spacing shall be in accordance with the fabric manufacturer's recommendations.

PART 3 – EXECUTION

3.1. INSTALLATION OF SILT FENCES

A. Installation:

1. As far as practicable, fences shall be located on uniform contours and arranged at right angles to the runoff direction. Fence ends shall be turned to go up the contour for a short distance to prevent bypass of silt.
2. Silt fences shall be removed as soon as disturbed areas and slopes have been stabilized to the satisfaction of the ENGINEER.

B. Maintenance:

1. Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to 1/2 the design volume of the trap. Sediment removed from the basin shall be deposited in a suitable area in such a manner that it will not erode.
2. The structure should be checked daily to insure that it is structurally sound and has not been damaged by erosion or construction equipment. The height of the outlet should be checked to insure that its center is at least one foot below the top of the embankment.

3.2. EMERGENCY CONDITION

- A. If unusually intense storms cause planned control measures to fail, prompt restoration and cleanup of sediment deposits shall be made, including damage to adjacent property. If construction is delayed or shut down, temporary cover of exposed and disturbed areas shall be provided.

3.3. POLLUTION CONTROL MEASURES

- A. General: The CONTRACTOR shall not discharge or permit discharge into the waters, canals, ditches, or drainage system any fuels, oils, bitumens, garbage, sewage or other materials which may be harmful to fish, wildlife or vegetation or that may be detrimental to outdoor recreation. The CONTRACTOR shall be responsible for investigation and complying with all applicable federal, state and local laws and regulations governing pollution of water. All work under this Contract shall be performed in such a manner that objectionable conditions will not be created in waters through or adjacent to the project areas.
- B. Protection of Fish and Other Marine Life: The CONTRACTOR shall at all times, perform all work and take such steps required to prevent any interference or disturbance to fish and other marine life. CONTRACTOR will not be permitted to alter water flows or otherwise disturb native habitats adjacent to the project area that is critical to fish or wildlife.

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SECTION 01700

PROJECT CLOSEOUT

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PART 1 -- GENERAL

1.1. CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been evaluated, and that Work is complete in accordance with Contract Documents and ready for ENGINEER'S observation. Provide submittals to ENGINEER that are required by governing or other authorities. Submit Application for Final Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.2. RESTORATION

- A. The CONTRACTOR shall restore and/or replace paving, curbing, sidewalks, gutters, shrubbery, fences, sod, or other disturbed surfaces and structures to a condition equal to that before the Work began and to the satisfaction of the ENGINEER and shall furnish all labor and materials incidental thereto.

1.3. DOCUMENTATION

- A. The CONTRACTOR shall submit all documentation to OWNER and ENGINEER necessary for proper completion of the Project. This documentation shall include, but not be limited to, the written report (as specified in AWWA D100-21, Section 11.2 including a roll-out drawing), "As-Built" drawings, O&M manuals, etc.

PART 2 -- PRODUCTS

NOT USED

PART 3 -- EXECUTION

NOT USED

END OF SECTION

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SECTION 02200

EARTHWORK

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PART 1 -- GENERAL

1.1. SECTION INCLUDES

- A. All labor, materials, equipment and related services necessary to excavate, backfill, and compact the soil indicated on the Drawings or specified herein.

1.2. GENERAL DESCRIPTION OF WORK

- A. General excavation, preparation of sub-grade and foundation, general backfill around foundation, and clean-up necessary to complete Project.

1.3. EXCAVATION SAFETY STANDARDS

- A. The CONTRACTOR shall, at a minimum, comply with all applicable excavation and trench safety standards identified in OSHA's Excavation, Trenching and Shoring Safety Standards, 29 CFR 1926.650-652, Subpart P, during the progress of the Work. In addition, the CONTRACTOR shall comply with all applicable state and local excavation and trench safety requirements. The more stringent of these requirements shall be adhered to by the CONTRACTOR.

PART 2 -- PRODUCTS

2.1. GENERAL FILL MATERIAL

- A. A suitable non-organic soil shall be used as fill for the foundation backfill above the foundation ring pad.
- B. Material shall be capable of being compacted to 90% of maximum dry density, as determined by the Modified Proctor test, ASTM D-1557.

2.2. STRUCTURAL FILL MATERIAL

- A. CONTRACTOR shall submit a geotechnical assessment of any proposed structural backfill.

2.3. SAND MATERIAL

- A. The top 6 in. of fill inside the concrete ringwall shall be compacted oil impregnated sand. The sand shall have a pH greater than 10.5, the chloride content shall be less than 100 parts per million, and the sulfate content shall be less than 200 parts per million.

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PART 3 – EXECUTION

3.1. STRIPPING AND STORAGE OF TOP SOIL

- A. Remove existing topsoil, vegetation, roots, grass, or other perishable material from areas which are to be excavated or receive fill.
- B. Strip materials to full depth of topsoil unless directed otherwise by the ENGINEER.
- C. Stockpile topsoil on site where directed by ENGINEER or OWNER.
- D. Stripping and stockpiling operations shall be completed before starting excavation operations.
- E. Approved topsoil removed from the areas will be used by the OWNER.

3.2. EXCAVATING

- A. Excavate to the depths required for fittings, foundation walls, or other improvements. The bottom of the tank foundation shall be founded at a minimum depth of 3 ft below existing grade or to the strata designated by the Soil Consultant. Excavate to the depth of subsoil deposits of deleterious material such as brick, stone, wood, vegetation, silt, etc. where same interferes with new construction. The bottom of the foundations shall bear on soil with a net allowable bearing pressure of 2,500 psf. For spread foundations or for deep foundations the CONTRACTOR shall pay for the soils laboratory to verify the allowable soil bearing pressure. Additional observations by the Soil Consultant will be paid for by the OWNER if determined necessary by the ENGINEER and Soil Consultant. If the excavations need to be extended, as recommended by the Soil Consultant and approved by the ENGINEER and OWNER, then the additional excavation shall be paid for by the unit price for Additional Excavation listed in the Bid Form. Any additional backfilling required as a result of extending the excavations deeper shall be paid for by the unit price for Additional Backfilling listed in the Bid Form.
- B. Excavate outside of the walls as required to permit placing and removal of forms, observation of work and installation of damp proofing, drain tile, and other below grade work.
- C. Excavate to the exact size of footings, trenches, and other work where forms are not used. Trim and level excavations to proper elevations and clear them of debris and rubbish.
- D. Wherever soft or unsuitable soils are encountered during the excavation of the foundation, these areas shall be undercut to an elevation of adequate bearing materials and backfilled and compacted with suitable approved fill material.
- E. At the completion of the foundation excavations, a 3 in. thick minimum concrete mud mat shall be installed to protect the exposed subgrade during construction of the concrete formwork and placement of the reinforcement and concrete and to aid in any dewatering that may be required. All loose material shall be removed prior to the placement of the concrete mud mat.

- F. If excavations for the foundations are through error of the CONTRACTOR, carried beyond the elevation indicated or other approved depth, the CONTRACTOR shall backfill and compact the excavations with approved material at CONTRACTOR'S expense.
- G. If rock is encountered which can not be removed by the equipment being used to move soil, the removing of rock shall be classed as extra work. The extra work order must be approved in writing by the ENGINEER and OWNER before the rock is removed.
- H. Rock Excavation: Rock excavation shall consist of igneous, metamorphic, and sedimentary rock which cannot be excavated without blasting; or the use of a modern power shovel of no less than one cubic yard capacity, properly used, having adequate power and in good running condition; or the use of other equivalent power equipment. It shall also include all boulders or detached stones each having a volume of 1/2 cubic yard or more.
- I. Excess material from the foundation excavation shall be disposed of by the CONTRACTOR.
- J. Dewatering:
 - 1. Furnish, install, operate, and remove dewatering equipment necessary to drain and keep excavations free of water under all circumstances.
 - 2. Obtain ENGINEER'S written approval of proposed method of dewatering.
 - 3. Prevent surface water from flowing into excavation; promptly remove any water accumulated.
 - 4. No pumping will be permitted during the placing of concrete or for a period of at least 24 hours thereafter unless satisfactory precautions are taken to prevent the removal of cement from the in-place concrete.

3.3. BACKFILLING

- A. Use materials specified in Part 2.
- B. Placing:
 - 1. Remove all organic and loose material from the excavation and compact subgrade thoroughly prior to placing.
 - 2. Do not place frozen material or material on frozen or wet ground or where there is standing water.
 - 3. Backfill shall not be placed adjacent to concrete structure until the concrete has developed sufficient strength to support the backfill without damage to structure. The backfill shall be placed and compacted in such a way as to prevent damage to the structure. CONTRACTOR shall backfill at own risk.

4. Place backfill materials in layers not exceeding 8 in. Material shall be thoroughly compacted to at least 90% of the maximum dry unit weight as determined by ASTM D-1557 prior to placing next layer. No puddling or jetting of the backfill material shall be allowed as a compaction method, as these methods will not achieve the specified compaction.
5. Deposit fill on each side of walls and free-standing structures simultaneously to approximately the same elevation. Use only granular fill material for backfill against walls except that the top 12 in. shall be compacted clayey soil.
6. Heavy equipment for spreading and compacting backfill shall not be operated closer to any wall than a distance equal to the height of the backfill above the top of the footings. Backfill adjacent to walls shall be compacted to the same density as the adjacent fill with small vibratory or hand tamping equipment.

C. Trench Backfilling:

1. Backfill material approved by the ENGINEER shall be unfrozen and free from rock, large stones, boulders, or other unsuitable substances. The material shall be deposited in the trench uniformly on both sides of the pipe for the full width of the trench and to the elevation that is the horizontal diameter of the pipe. This backfill material shall be tamped in 4 in. layers and shall be sufficiently damp to permit thorough compaction under and on each side of the pipe to provide support free from voids. Additional approved backfill material shall then be deposited over the pipe and compacted to an average depth of 12 in. over the top of 8 in. and smaller pipes, and 24 in. over larger pipe. Approved granular fill shall be used on all pipelines under roadways, parking lots or pipelines within 5 ft of any roadway.
2. Any deficiency in the quantity of material for backfilling the trenches or for filling depressions caused by settlement shall be provided by the CONTRACTOR.

D. Compaction:

1. Compact backfill within drives and parking areas to a density of at least 95% of Modified Proctor Density, ASTM D-1557. A minimum of two compaction tests shall be taken by an approved soils laboratory at designated locations noted by the ENGINEER or OWNER, and the costs shall be paid by the CONTRACTOR. Additional tests required by the ENGINEER and/or the OWNER will be taken and paid for by the OWNER.
2. Compact any backfill under the foundation to a density of at least 95% of Modified Proctor Density, ASTM D-1557. The soils laboratory shall take a minimum of three readings, or as many as necessitated to confirm the compaction result. The OWNER is to pay for the cost of the compaction tests. The CONTRACTOR shall pay for all costs necessitated to obtain the necessary compaction.
3. Compact other backfill to density of at least 90% of Modified Proctor Density, ASTM D-1557.

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4. Use appropriate compaction methods as necessary to obtain densities specified. Generally, compact cohesive material by rolling and/or mechanically tamping and granular material by mechanically vibrating. Obtain ENGINEER'S written approval of proposed method.

3.4. SITE ROUGH GRADING

- A. Do all cutting, filling, and grading necessary to bring the tank site soil within ± 4 in. of the design finish grade leaving the site free of ruts, construction debris including weld rod stubs, and rocks over 2 in. diameter. The design finish grade shall be as shown on the drawings.
- B. Cooperate with other SUBCONTRACTORS and/or OWNER for installation of paving, finish grading, seeding, sodding, or other site work indicated or specified.
- C. Grades not otherwise indicated shall be uniform levels of slopes between points where elevations are given or between such points and existing grades.

3.5. FINISH GRADING

- A. An approved top soil shall be placed within 1/2 in. of the final grades shown on the site plans.

3.6. EROSION CONTROL

- A. Erosion control measures shall be taken on all disturbed areas and any drainage swales. The ENGINEER or OWNER may direct additional procedures if adequate precautionary methods are not being taken. Any additional erosion controls shall be made at no cost to the OWNER.

END OF SECTION

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SECTION 02610

PIPE AND FITTINGS

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PART 1 -- GENERAL

1.1. COORDINATION OF WORK

- A. Connection to existing pipelines may require shutdown of part of the OWNER'S facilities. Construction work requiring the shutdown of equipment, buildings, or other OWNER'S facilities shall be coordinated with the OWNER'S and ENGINEER'S personnel.

PART 2 -- PRODUCTS

2.1. IRON PIPE

- A. All pipe for pipelines with diameters three (3) in. and larger shall be ductile iron with ductile iron or cast iron fittings, except steel pipe shall be furnished where noted on the Drawings.
- B. Pipe and fittings shall have flanged, mechanical joint, or push-on joint ends as shown on the Contract Drawings and shall conform to the following standards:
 - 1. ANSI/AWWA C104/A21.4 - Cement - Mortar Lining shall be double thickness per Section 4.8.2 of this Standard.
 - 2. ANSI/AWWA C105/A21.5 - Polyethylene Encasement.
 - 3. ANSI/AWWA C110/A21.10 - Fittings & Flanges.
 - 4. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints.
 - 5. ANSI/AWWA C151/A21.51 - Ductile, Centrifugally Cast.
- C. Pipe and fittings shall be provided with waterstops where shown on the Drawings or as required to prevent leakage around the pipe and fittings.

D. Pipe thickness and outside diameter shall be as follows:

<u>Size</u>	<u>Pressure Class</u>	<u>Thickness, In.</u>	<u>O.D.</u>
6	350	0.28	6.90
8	350	0.30	9.05
10	350	0.32	11.10
12	350	0.34	13.20
16	350	0.37	17.40
24	350	0.41	25.80

2.2. STEEL PIPE AND FITTINGS

- A. Pipe up to and including 24 in. diameter shall be mill type pipe conforming to ASTM Specification A53, Grade B seamless, or welded pipe conforming to AWWA Standard C202. Pipe 12 in. diameter and under shall be standard nominal size Schedule "Extra Strong" wall thickness. On pipe over 12 in. diameter, the diameters given shall be O.D. and wall thickness shall be 0.500 in. Overflow pipes may be Schedule 20 (1/4 in. minimum wall thickness).
- B. Fittings shall be butt-welded forged steel fittings. As a minimum, the wall thickness of the fitting must be the same as the pipe or thicker.
- C. Flanges shall be Class D, slip-on type in accordance with AWWA Standard C207. Flanges shall be flat faced with O.D. and drilling in accordance with ASA Standard B16.5 for the appropriate pressure rating.
- D. Interior of all buried steel pipe and fittings shall be cement-mortar lined in accordance with AWWA Standard C205. Field welded joints shall be lined in accordance with the Appendix to AWWA Standard C205.
- E. Pipe and fittings shall be provided with waterstops where shown on the Drawings or as required to prevent leakage around the pipe and fittings.

2.3. PLASTIC PIPE AND FITTINGS

- A. PVC pipe and couplings up to and including 12 in. diameter shall be made from class 12454-A or class 12454-B virgin compounds as defined in ASTM Specification D1784 and conforming to AWWA Standard C900. All PVC pipe have cast-iron-pipe-equivalent (CI) outside diameters and shall conform to the following standards:
 - 1. ANSI/AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
 - 2. ANSI/AWWA C907 - Polyvinyl Chloride (PVC) Pressure Fittings for Water, 4 in. through 8 in.
- B. Pipe shall be homogeneous throughout; free from voids, cracks, inclusions, and other defects; and as uniform as commercially practical in color, density, and other physical properties. Pipe surfaces shall be free from nicks and scratches. Pipe surfaces shall be free from sun damage. The joining surfaces of pipe spigots and of integral-bell and

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sleeve-reinforced bell sockets shall be free from gouges and other imperfections that might cause leakage at joints.

- C. Marking requirements shall be as stipulated in AWWA C900.
- D. All fittings shall be equipped with retainer glands or restrained joints.

2.4. RESTRAINED PUSH-ON JOINT PIPE AND FITTINGS

- A. When joint restraint for a 4 in. through 54 in. push-on joint pipe installation is required and indicated on the plans, restrained push-on joint pipe and fittings utilizing ductile iron components shall be provided.
- B. Restrained joint pipe shall be ductile iron manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. Push-on joints for such pipe shall be in accordance with ANSI/AWWA C150/A21.50, and shall be U.S. Pipe TR FLEX pipe or equal.
- C. Cement-mortar lining and seal coating for pipe and fittings shall be in accordance with ANSI/AWWA C110/A21.10 for fittings.
- D. Restrained push-on joints for pipe and fittings shall be designed for a water working pressure of 350 psi in sizes 4 in. through 24 in. and 250 psi for sizes 30 in. through 54 in.
- E. Restrained push-on joint pipe and fittings shall be capable of being deflected after assembly.

2.5. JOINT MATERIALS

- A. Gaskets: Gaskets shall be 1/16 in. thick rubber full face gaskets provided with holes punched for flanges faced and drilled for American Standard 125 psi.
- B. Bolts and Nuts:
 - 1. Flanged Pipe: Size, length and number of bolts for flanged pipe and fittings shall be as shown in Table 10.14 of the ANSI/AWWA Standard Specification C110.
 - 2. Mechanical Joint Pipe: Size, length and number of bolts for mechanical joint pipe and fittings shall be as shown in Table 10.1 of the ANSI/AWWA Standard Specification C110.
 - 3. Bolts shall conform to ANSI B18.2.1, Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws, and nuts shall conform to ANSI B18.2.2., Square and Hex Nuts. Bolts smaller than 3/4 in. shall have either standard square or heavy hex heads and heavy hex nuts. Bolts 3/4 in. and larger shall have either square or hex heads and either hex or heavy hex nuts. Bolts and nuts to be threaded in accordance with ANSI B1.1, Unified Inch Screw Threads, (UN and UNR Thread Form) class 2A external and class 2B internal. Bolts and nuts shall be made of low-carbon steel and conform to the chemical and mechanical requirements of ASTM A307, Specifications for Carbon Steel

Externally Threaded Standard Fasteners, grade B. The carbon steel bolts should be used where gray-iron flanges are installed with flat ring gaskets that extend only to the bolts. Higher strength bolts may properly be used where gray-iron flanges are installed with full-face gaskets. Higher strength bolts may be used where ductile flanges are installed with either ring or full-face gaskets. All "T" bolts and nuts shall be CorTen or stainless steel or chromium plated.

- C. Tie Rods: All tie rods shall meet the requirements of ASTM Standard A-307 for Low Carbon Steel Externally and Internally Threaded Standard Fasteners.

PART 3 – EXECUTION

3.1. GENERAL INFORMATION

- A. Dimensions shown on Contract Drawings are approximate only. The CONTRACTOR shall verify all piping geometry in the field and shall be responsible for insuring proper alignment and fit of all piping consistent with the intent of the Contract Drawings.
- B. All buried steel bolts, nuts, lugs, rods, brackets, etc., shall be given one (1) coat of Tnemec 46-413 Tneme-Tar coal tar epoxy coating to a minimum DFT of 8.0 mils prior to backfilling. All exposed steel pipe supports and hangers shall be cleaned and painted similar to structural steel items as specified in Section 09800 - General Specifications for Coating Systems.
- C. Temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the work shall be provided or overcome by the CONTRACTOR at his own expense and as approved by the ENGINEER and OWNER.
- D. No deviation shall be made from the required line or grade except with the consent of the ENGINEER.
- E. All pipe shall be laid and maintained to the required lines and grades. Fittings, valves and hydrants shall be at the required locations and with joints centered, spigots home and all valve and hydrant stems plumb unless otherwise specified by the ENGINEER.
- F. Cast iron valve boxes shall be firmly supported and maintained centered and plumb over the wrench nut of the valves with box cover flush with the surface of the finished pavement or at such other levels as may be specified by the ENGINEER.
- G. The CONTRACTOR shall make all necessary cuts on pipe and shall provide all required pipe supports, hangers, brackets, and like items.
- H. When pipe joints are made at the joint of the pipeline with the pump nozzle, all bolts and nuts shall be installed loose until after the entire pipeline has been installed, aligned and checked.
- I. Reaction or thrust blocking shall be constructed where shown on the Drawings or as required. As a general rule, reaction or thrust blocking shall be installed at all bends, tees

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and where pipe diameter changes in size. Blocking shall be constructed against vertical surfaces, either undisturbed earth or sheeting left in place as directed. Blocking shall be of the size and shape indicated, and the actual or projected bearing area perpendicular to the direction of the resultant thrust of the pipeline shall be as shown or required. Blocking shall be installed so that the pipe and fitting joints will be accessible for repairs or future removal. Fittings should be wrapped with a polyethylene material prior to pouring of the thrust block.

- J. All completed pipe systems that are not buried below ground shall be cleaned and painted in accordance with Section 09800 - General Specifications for Coating Systems.
- K. All completed pipe systems shall be encased in polyethylene in accordance with AWWA C105.

3.2. INSTALLATION OF FLANGED PIPING

- A. Flanged piping shall be carefully centered to the indicated position and leveled to the correct elevation with all flanges plumb and level. Flanged faces and bolt holes shall be well cleaned of all foreign matter before assembly. All bolt holes shall straddle vertical center line of flange. When joints are made up, the bolts shall be tightened uniformly and progressively on opposite sides of the flanges so there will be no strain on the flange or piping. Gaskets shall be well cleaned before being installed. When making difficult connections, rubber cement or light string may be used to hold the gasket in place.

3.3. INSTALLATION OF MECHANICAL JOINT PIPING

- A. Both spigot ends and bells of pipe and the rubber gaskets shall be washed thoroughly with soapy water to remove all foreign matter that will damage the gaskets. The gaskets will be either plain rubber, metal tipped, duck tipped, "Thiokol" tipped or other special type. The installation of the pipe and the tightening of the bolts shall be performed in accordance with the manufacturer's directions and the Ductile Iron Pipe Research Association (DIPRA) recommendations.

3.4. INSTALLATION OF PUSH-ON JOINT PIPING

- A. The bell socket, the plain end of the entering pipe, and the gasket must be absolutely clean and free of foreign matter (such as mud, sand, cinders, gravel, frozen materials, etc.) prior to the seating of the gasket. The installation of the pipe shall be performed in accordance with the manufacturer's directions and the DIPRA recommendations. Lubricant other than that furnished with the pipe should not be used.

3.5. INSTALLATION OF STEEL PIPE

- A. Pipe joints shall be where shown on the Drawings except where field conditions dictate changes. The CONTRACTOR shall be responsible for insuring proper alignment and fit of all steel piping.
- B. All required field welding of steel pipe shall be performed in accordance with AWWA Standard C206.

3.6. INSTALLATION OF RESTRAINED PUSH-ON JOINT PIPING

- A. The socket, gasket and plain end (spigot end) of restrained push-on joint pipe and fittings must be cleaned of all dirt, sand, gravel, or other foreign matter. Foreign matter left in the gasket seat may cause a leak. The installation of the pipe shall be performed in accordance with the manufacturer's directions and the DIPRA recommendations. Lubricant other than that furnished with the pipe should not be used.
- B. In subfreezing weather, gaskets should be kept at temperatures above 40°F, to ensure resiliency during installation.
- C. The plain end and (spigot end) of the pipe must be cleaned of foreign matter. Then a thin film of lubricant should be applied onto the exterior surface of the plain end and back to the retainer weldment. This lubrication will ease the insertion of the plain end into the bell socket. Do not allow the plain end to touch the ground or trench sides after lubrication because foreign matter might adhere to the spigot and cause a leak. Lubricant other than that furnished with the pipe should not be used.
- D. Orientation of the segment insertion slots located in the face of the bell is important for ease of assembly; therefore, particular attention should be paid to that portion of the assembly instructions. Methods of assembly may vary with contractors and with pipe size. Regardless of the method used, whether with chain hoists and chokers, assembly tools, leverage, or backhoe, it is imperative that the pipe be kept in alignment during assembly. The plain end should be entered into the socket until the assembly stripe nearest the plain end has disappeared into the socket. The locking segments should then be inserted. The rubber locking segment retainer(s) should then be inserted. The rubber locking segment retainer(s) should be wedged between the inserted locking segmented. The pipe may then be retracted until the locking segments are seated. Lastly, deflection may be set observing the deflection limits in the table.

3.7. PREPARATION OF THE TRENCH BOTTOM

- A. Pipe shall be placed on bedding sand material. The bedding extends from 6 inches below the pipe to 12 inches above the top of the pipe. Pipe shall not be installed in trenches whose bottoms are frozen.
- B. Bedding sand shall consist of non-plastic sandy material conforming to the following requirements:
 - Sand Equivalent (SE), 30 Minimum
 - PH 6.5 – 8.5
 - Resistivity 2,000 – 50,000 ohm-cm
 - Sulfate (optional) 1500 PPM or less
- C. The trench bottom bedding shall be shaped to provide continuous contact with the pipe along the barrel of the pipe but a larger hole may be excavated around the bells to provide working clearance.

3.8. TESTING

- A. After the pipe has been laid and the trench partially backfilled, the pipe shall be subjected to a hydrostatic pressure of 150 percent of the normal operating pressure ([60] psi), with a minimum pressure of 150 psi, but not exceeding the rated pressure of the pipe. Test pressure shall be applied for a minimum of two hours. Allowable leakage shall be no greater than that permitted in AWWA C600-05. Corporation cocks will be furnished and installed by the CONTRACTOR for disinfection. The CONTRACTOR should coordinate disinfection and location of corporation cocks prior to backfilling the pipe.
- B. Tests shall be made only after completion of partial backfill as specified and not until at least 36 hours after the last concrete thrust or reaction blocking has been cast with concrete.
- C. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the ENGINEER. The pump, pipe connection, and all necessary apparatus, including gauges, shall be furnished by the CONTRACTOR. The CONTRACTOR shall furnish all necessary assistance for conducting the test. The duration of the test shall be 30 minutes unless otherwise directed by the ENGINEER. All air must be expelled from the pipeline prior to the test period.
- D. During the test, all pipes, fittings, valves, hydrants, and joints will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the CONTRACTOR with sound material in the manner prescribed. The test shall then be repeated until satisfactory to the ENGINEER and OWNER.

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SECTION 02640

VALVES

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PART 1 -- GENERAL

1.1. SUBMITTALS

- A. Submit to the ENGINEER shop drawings and manufacturer's literature for all valves.
- B. Valve manufacturer shall furnish the following data for each valve applicable: shaft diameter; operator manufacturer and manufacturer's designation; operator gear ratio; spur ratio; output torque rating; turns to open; handwheel diameter; actual maximum input torque or handwheel pull to operate valve.

1.2. ALTERNATIVE EQUIPMENT

- A. The Base Bid price shall include all costs for providing the valves specified under this Section.
- B. Valves manufactured by alternative companies will be considered for incorporation into this project, provided the alternative equipment is approved in writing by the ENGINEER and OWNER

PART 2 -- PRODUCTS

2.1. MATERIALS

A. Valves:

- 1. All valves and stops shall have ends suited or adaptors shall be provided for the proper installation in the lines in which they are located. Valves shall meet the standards of the OWNER, but at a minimum shall meet the following requirements:
 - a. Valves in ductile iron pipe shall be iron body, bronze mounted, resilient wedge gate valve with hand wheel set on 2 in. nut. They shall open in the same direction as those used by the OWNER in the local waterworks system. Valve stems shall terminate with a handwheel.

B. Valve Boxes:

- 1. Valve boxes shall meet the standards of the OWNER, Standard #300 for all valve boxes.

PART 3 – EXECUTION

3.1. EQUIPMENT INSPECTION

A. Factory Representative:

1. After the equipment has been completely installed, the manufacturer shall furnish a factory-trained representative to check the installation, place the equipment in operation, and instruct the operators in its use and maintenance. All costs associated with this inspection by a factory representative shall be paid for by the CONTRACTOR.

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SECTION 02675

DISINFECTION OF WATER DISTRIBUTION SYSTEMS

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PART 1 -- GENERAL

1.1. SECTION INCLUDES

- A. Disinfection of steel water storage tank and all connecting piping under this contract.

1.2. REFERENCES

- A. American Water Works Association (AWWA) Standards
 - 1. C651-23, Disinfecting Water Mains
 - 2. C652-19, Disinfection of Water-Storage Facilities

1.3. SEQUENCING AND SCHEDULING

- A. The interior coating shall be properly cured.
- B. The interior coating shall be washed with potable water.
- C. CONTRACTOR shall flush and disinfect the tank and connecting piping.
- D. The OWNER shall take and send in the samples to the laboratory for testing. The OWNER shall pay for the testing of the initial set of samples. The CONTRACTOR shall pay for all subsequent samples and testing, if required.

PART 2 -- PRODUCTS

2.1. MATERIALS

- A. Materials for disinfection of the tank shall be as listed in Section 3: Forms of Chlorine for Disinfection of AWWA C652-19.
- B. Materials for disinfection of the distribution system shall be as listed in Section 2: Forms of Chlorine for Disinfection of AWWA C651-23.

PART 3 – EXECUTION

3.1. PIPELINES

- A. All pipelines shall be tested and cleaned of debris and dirt prior to disinfection.

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3.2. DISINFECTION OF THE CONNECTING PIPING

- A. It is the CONTRACTOR'S responsibility to flush and disinfect the connecting piping until satisfactory water samples are reported from the OWNER's laboratory. Method 1 (Section 5.1) of AWWA C651-23 shall be used for the disinfection procedure. Samples shall be taken and tested by the OWNER.

3.3. WASHING TANK INTERIOR SURFACES

- A. After proper curing of the interior paint and prior to disinfecting, the CONTRACTOR shall wash the tank interior surfaces with potable water. The CONTRACTOR shall supply an adequate flow of water (20 gpm minimum) with sufficient pressure (60 psi minimum at the nozzle) to wash thoroughly all the interior surfaces, including those surfaces above the high water level. All residue shall be removed from the tank and inlet/outlet pipe.

3.4. DISINFECTION OF THE TANK

- A. Disinfection: It is the CONTRACTOR'S responsibility to flush and disinfect the tank and connecting piping until two or more successive samples taken in a twenty-four hour period show that the samples are satisfactory as reported from the OWNER'S laboratory. Method 3 (Section 4.3.3) or Method 2 (Section 4.3.2) of AWWA C652-19 shall be used for the disinfection procedure. Samples shall be taken and tested by the OWNER.

3.5. SAMPLING AND TESTING

- A. The OWNER shall take and send in the samples to the laboratory, but shall assume no responsibility for the sampling technique or the care of the samples. The stored tank water shall comply with current State and USEPA standards for organic, inorganic, and biological contaminants as influenced by the operations of the CONTRACTOR. One tank of water for the disinfection shall be furnished by the OWNER at no charge to the CONTRACTOR. Additional water shall be furnished at current municipal water rates charged by the OWNER and shall be paid for by the CONTRACTOR.

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SECTION 03100

CONCRETE FORMWORK

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PART 1 -- GENERAL

1.1. SECTION INCLUDES

- A. All labor, materials, equipment and related services necessary to furnish, install, and remove all concrete formwork indicated on the Drawings or specified herein.

1.2. REFERENCES

- A. American Concrete Institute (ACI) Codes
 - 1. ACI 301-20, Standard Specifications for Structural Concrete
 - 2. ACI 318-19, Building Code Requirements for Structural Concrete
 - 3. ACI 347-14, Recommended Practice for Concrete Formwork

1.3. PAYMENT

- A. Concrete formwork is considered Incidental Work with no separate measurement and payment to be made.
- B. All labor, materials, equipment and related services necessary to excavate, backfill, and compact the soil indicated on the Drawings or specified herein.

PART 2 -- PRODUCTS

2.1. MATERIALS

- A. Form ties, anchors, and accessories shall be of standard manufacture, suitable for the intended purpose.
- B. Form sealers shall be a chemical-type, nonstaining, releasing agent that will not affect the bonding of waterproofing, or other materials to the concrete.
- C. Form Materials: Forms for finished concrete shall be constructed with plywood or metal-framed, plywood-faced materials to provide continuous, straight, and smooth surfaces.
 - 1. Plywood forms shall conform to U.S. Product Standard PS 1-74, Exterior Type, Grade BB, Plyform Class I or Class II, 5/8 in. minimum thickness, edge sealed, and mill oiled.

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2. Wood forms shall be constructed using sound, good quality lumber, free from loose knots and otherwise suitable to facilitate finishing concrete surfaces as specified. Boards shall be seasoned and dressed to a uniform thickness.
3. Alternate forming systems may be used subject to advance approval of the ENGINEER.

PART 3 – EXECUTION

3.1. FORMWORK DESIGN

- A. The design, engineering, and construction of formwork shall be the responsibility of the CONTRACTOR.
- B. The formwork shall be designed for the loads, lateral pressures, and allowable stresses as outlined in the referenced Codes and Standards, and for design considerations, wind loads, allowable stresses and other applicable requirements of the controlling local building code.

3.2. CONSTRUCTION OF FORMS

- A. Construct all required forms to be substantial, sufficiently tight to prevent leakage of mortar, and able to withstand excessive deflection when filled with wet concrete.
- B. Layout:
 1. Form all required cast-in-place concrete to the shapes, sizes, lines, and dimensions indicated on the Drawings. The maximum length of any chord segments used in circular forming shall be 4 ft. However, use of chord segments shall not relieve the CONTRACTOR from complying with the dimensional tolerances cited in ACI 301 and ACI 318 and specified in Section 03300 - Concrete.
 2. Exercise particular care in the layout of forms to avoid necessity for cutting of concrete after it is in place.
 3. Make proper provisions of all openings, offsets, recesses, anchorage, blocking, and other features of the work as shown or required.
 4. Perform all forming required for work of other trades and do all cutting and repairing of forms required to permit such installation.
 5. Carefully examine the drawings and specifications and consult with other trades as required relative to provision for openings, reglets, chases, and other items in the forms.
- C. Set all required steel frames, angles, grilles, bolts, inserts, and other such items required to be anchored in the concrete before the concrete is placed.
- D. Bracing:

1. Properly brace and tie the forms together so as to maintain position and shape and to insure safety to personnel.
 2. Construct all bracing, supporting members, and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.
 3. Properly space the forms apart and securely tie them together, using metal spreader ties that give positive tying and accurate spreading.
- E. Construct all forms so as to insure that the concrete surfaces will conform to "Recommended Practice for Concrete Formwork" Publication ACI 347 of the American Concrete Institute.
- F. Keep forms sufficiently wetted to prevent joints opening up before concrete is placed.

3.3. PLYWOOD FORMS

A. Design:

1. The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between structural supports.
 2. When necessary to maintain specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork due to weight and pressure of the fresh concrete and due to construction loads.
- B. Make all panel joints tight. Butt joints with all edges true and square.
- C. Chamfer all corners of beam and wall forms with wood strips 3/4 in. by 3/4 in. Extend terminal edges to required limit and miter chamfer strips at changes in direction.

3.4. FOOTING FORMS

- A. Footing forms shall be required unless specifically approved otherwise by the ENGINEER.

3.5. SHORES AND SUPPORTS

- A. Comply with referenced standards for shoring as specified herein.
- B. Reuse of Forms:
1. Reuse of forms shall be subject to advance approval of the ENGINEER.
 2. Requirements:
 - a. Reuse of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.

- b. Reuse of forms shall in no way impart less structural stability to the forms nor less acceptable appearance to finished concrete.
- C. Removal of Forms:
- 1. General:
 - a. Formwork not supporting concrete, such as sides of footings, grade beams, walls, and similar parts of the work, may be removed 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided that curing and protection operations are maintained. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements may not be removed in less than 10 days, and not until concrete has attained design minimum 28-day compressive strength.
 - 2. Removal:
 - a. Use all means necessary to protect workmen, passersby, the installed work and materials of other trades, and the complete safety of the structure.
 - b. Cut nails, and tie wires or form ties off flush, and leave all surfaces smooth and clean.
 - c. Remove metal spreader ties on exposed concrete by removing or snapping off inside wall surface and pointing up and rubbing the resulting pockets to match the surrounding areas.
 - d. Flush all holes resulting from the use of spreader rods and sleeve nuts, using water, and then solidly pack throughout the wall thickness with cement grout applied under pressure by means of a grouting gun.
 - (1) Grout shall be one part Portland cement to 2-1/2 parts sand.
 - (2) Apply grout immediately after removing forms.

3.6. TOLERANCES

- A. Allowable Variations: Formwork shall be constructed so that concrete surfaces conform to the tolerances cited in ACI 301 and ACI 318 and specified in Section 03300 - Concrete.
- B. Control Points and Bench Marks: The CONTRACTOR shall establish and maintain in an undisturbed condition until substantial completion, sufficient control points and/or elevation benchmarks to be used for reference purposes to check tolerances.

END OF SECTION

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SECTION 03200

CONCRETE REINFORCEMENT

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PART 1 – GENERAL

1.1. SECTION INCLUDES

- A. All labor, materials, equipment and related services necessary to furnish and install all steel reinforcement for the concrete construction indicated on the Drawings or specified herein.

1.2. REFERENCES

- A. American Concrete Institute (ACI) Codes
 - 1. ACI 301-20, Standard Specifications for Structural Concrete
 - 2. ACI Detailing Manual
 - 3. ACI 318-19 (22), Building Code Requirements for Reinforced Concrete
- B. Concrete Reinforcing Steel Institute (CRSI) Standards
 - 1. CRSI, Manual of Standard Practice
 - 2. CRSI, Placing Reinforcing Bars

1.3. PAYMENT

- A. Concrete reinforcement is considered Incidental Work with no separate measurement or payment to be made.

1.4. SUBMITTALS

- A. Mill Test Certifications: Submit mill test certifications of all reinforcing steel used in concrete construction to the ENGINEER in accordance with Section 01300 - Submittals prior to the start of any field work.
- B. Reinforcing Steel Order List: Submit a list of reinforcing steel to be used for the project. Bars shall be marked by number size with weights of each set of bars and total weight of steel shown. Bars shall be notated on an accompanying drawing showing the location of each bar.

PART 2 -- PRODUCTS

2.1. MATERIALS

A. Reinforcing Bars:

1. Conform to ASTM A615, Grade 60/S1, for #3 to #11 bars, ties, and stirrups.

B. Welded Wire Fabric:

1. Welded wire fabric shall conform to the gauge and mesh size of the plain or deformed wire required or shown in the Contract Documents.
2. Welded wire fabric utilizing plain wire shall conform to ASTM A185.

C. All other materials not specifically described but required for a complete and proper installation of concrete reinforcement shall be selected by the CONTRACTOR subject to the approval of the ENGINEER.

PART 3 – EXECUTION

3.1. FABRICATION

A. Shop fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances conforming to ACI 315. In case of fabricating errors, do not rebend or straighten reinforcement in a manner that will injure or weaken the material.

B. All bars shall be bent cold. All bends for stirrups, ties, and hooks shall have a minimum diameter as required by ACI 318.

C. Reinforcement with any of the following defects will not be permitted:

1. Bar lengths, depths, and bends exceeding specified fabrication tolerances.
2. Bends or kinks not indicated on drawings or final shop drawings
3. Bars with reduced cross-section due to excessive rusting or other cause.

3.2. DELIVERY

A. Deliver reinforcement to the project site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

3.3. STORAGE

A. Store concrete reinforcement materials at the site in a manner to prevent damage, accumulation of dirt, or excessive rust.

3.4. PLACEMENT

- A. Prior to the start of concrete placement, accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations.
 - 1. Portions of supports, spacers, chairs, etc., within 1/2 in. of the concrete surface shall be coated with plastic, galvanized, or protected from corrosion.
 - 2. Reinforcement for slabs-on-grade and footings shall be supported on precast concrete units spaced at intervals required by the size of reinforcement used, to provide for minimum clearances specified.
- B. Place reinforcement to obtain the minimum coverages for concrete protection.
 - 1. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations.
 - 2. Set wire ties so that ends are directed away from exposed concrete surfaces.
 - 3. Tack welding of crossing reinforcement for the purpose of proper placement shall not be permitted.
- C. Install welded wire fabric in as long of lengths as practical.
 - 1. Lap adjoining pieces at least one full mesh and lace splices with 16 gauge wires.
 - 2. Do not make end laps midway between supporting beams or directly over beams of continuous structures.
 - 3. Offset end laps in adjacent widths to prevent continuous laps.
- D. Place all required steel dowels and securely anchor them into position before the concrete is placed.

3.5. SPLICES

- A. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Comply with requirements of ACI 318 for minimum lap of spliced bars.
- B. Make only those splices that are indicated on the approved shop drawings.

3.6. FABRICATING AND PLACING TOLERANCES

- A. Allowable Variations: Fabrication and placement of reinforcing steel shall conform to the tolerances cited in ACI 318 and specified in Section 03300 - Concrete.

- B. Concrete Cover: Concrete cover shall be provided for all reinforcement in conformance with ACI 318.

END OF SECTION

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SECTION 03300

CONCRETE

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PART 1 – GENERAL

1.1. SECTION INCLUDES

- A. All labor, materials, equipment and related services necessary to furnish and install all concrete indicated on the Drawings or specified herein.

1.2. REFERENCES

- A. American Concrete Institute (ACI) Codes
 1. ACI 117, Standard Specifications for Tolerances for Concrete Construction and Materials
 2. ACI 301-20, Standard Specifications for Structural Concrete
 3. ACI 305, Recommended Practice for Hot Weather Concreting
 4. ACI 306, Recommended Practice for Cold Weather Concreting
 5. ACI 311, Recommended Practice for Concrete Inspection
 6. ACI 318-19 (22), Building Code Requirements for Structural Concrete

1.3. SYSTEM DESCRIPTION

- A. Design Requirements: The foundation shall be designed based on 3500 psi concrete. However, the concrete construction shall be performed using 4000 psi concrete as specified in this Section.

1.4. NOTIFICATION

- A. CONTRACTOR shall notify ENGINEER, OWNER, and FIELD OBSERVER 48 hours prior to the placement of any concrete. CONTRACTOR shall verify placement of concrete 24 hours prior to scheduled placement.

1.5. TESTING AGENCY

- A. The Certified Independent Testing Agency referred to in this Section and in ACI 301 and ACI 318 shall meet the requirements of ASTM E329, "Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction." The Certified Independent Testing Agency shall have been inspected within the past three

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years by the Cement and Concrete Reference Laboratory of the National Bureau of Standards and shall have corrected any deficiencies. Proof of Certification shall be submitted to the ENGINEER prior to the start of construction.

1.6. PAYMENT

- A. Cast-in-place concrete is considered Incidental Work with no separate measurement or payment to be made.

PART 2 -- PRODUCTS

2.1. CEMENT

- A. Shall conform to ASTM C150.
- B. Provide Type I for all usages.

2.2. FLY ASH

- A. Shall conform to ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.

2.3. AGGREGATES

- A. Shall conform to ASTM C33.
- B. Fine and coarse aggregate shall be regarded as separate ingredients.
- C. Each size of coarse aggregate, as well as the combination of sizes when two or more are used, shall conform to the grading requirements of the publications cited herein.

2.4. WATER

- A. Use clean mixing water free from injurious amounts of oils, acids, alkalis, organic materials, or other deleterious substances.

2.5. CONCRETE ADMIXTURES

- A. Air-Entraining Admixtures: Conform to ASTM C260.
- B. Water-Reducing Admixtures: Conform to ASTM C494, Type A, free of set-accelerating or set-retarding compounds, chlorides, fluorides, or nitrates.
- C. High-Range, Water-Reducing Admixtures (Superplasticizers): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
- D. Silica Fume (Microsilica): Use only with prior review and acceptance of the ENGINEER. Use only in conjunction with high range water reducer.

2.6. CURING COMPOUNDS

- A. Conform to ASTM C309, Type I.
 - 1. Provide materials capable of curing, sealing, hardening, and dust proofing concrete slabs and floors.
 - 2. All curing compounds shall be nontoxic and taste and odor free.

PART 3 – EXECUTION

3.1. PROPORTIONING OF CONCRETE

- A. General: Concrete for all parts of the work shall be of the specified quality capable of being placed without excessive segregation, and when hardened of developing all characteristics required.
- B. Strength and Durability: Concrete proportions, including water-cementitious materials ratio, shall be established on the basis of field experience and/or trial mixtures with materials to be employed in accordance with Section 5.3 of ACI 318-19 (22), except as permitted in Section 5.4 of ACI 318-19 (22).
- C. Slump:
 - 1. Requirements: Concrete shall be proportioned so as to result in slumps at the point of placement as follows:
 - a. Foundation Systems: Not less than 1 inch or more than 3 inches.
 - b. All Other Locations: Not less than 1 inch or more than 4 inches.
 - 2. Tolerances: A tolerance of up to 1 inch above the indicated maximum shall be allowed for individual batches provided the average of the most recent five (5) batches tested does not exceed the maximum limit.
- D. Admixtures:
 - 1. General: Provide admixtures produced by acceptable manufacturers and use in compliance with printed directions. Do not use admixtures which have not been incorporated and tested in the accepted mixes.
 - 2. Calcium Chloride: Do not use calcium chloride in concrete.
 - 3. Coloring admixtures shall not be permitted.

E. Selection of Proportions:

1. General:

- a. The proportions of ingredients shall be such as to produce a mixture which will work readily into corners and angles of the forms and around reinforcement by the methods of placing and consolidation employed on the work, but without permitting the materials to segregate or excessive free water to collect on the surface.
- b. The proportions shall conform to the Strength and Durability subparagraph of this Section.

3.2. PRODUCTION OF CONCRETE

A. Ready-Mixed Concrete:

1. All ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94.
2. Plant equipment and facilities shall conform to the "Checklist for Certification of Ready-Mixed Concrete Production Facilities" of the National Ready-Mixed Concrete Association.

B. Dispatching of Concrete:

1. Dispatch all loads of concrete with a signed dispatch ticket indicating the exact time, to the nearest minute, when the batch was mixed.
2. Failure to show the dispatch tickets properly filled out or any delay that will result in a period of time longer than one hour between the time the batch was mixed and the time the batch is finally placed in form will be considered as a basis for rejection of the entire batch.
3. Dispatch tickets shall record any and all additions incorporated in the batch including any water added after the batch was mixed.

C. Control of Admixtures:

1. Chemical admixtures shall be charged into the mixture as solutions and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that can not be added in solution may be weighed or measured by volume if so recommended by the manufacturer.
2. Two or more admixtures used in the same batch shall be added separately.
3. Retarding admixtures shall be added to a batch in strict accordance with the manufacturer's recommendations.

D. Tempering and Control of Mixing Water:

1. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall not be retempered, but shall be removed from the site and legally disposed of by the CONTRACTOR.
2. Water may be added to a batch at the project site only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. Indiscriminate addition of water to a batch to increase slump beyond specified limits shall be cause for rejection of the entire batch.

3.3. CONCRETE PLACEMENT

A. Preparation Prior to Placing:

1. Remove all wood scraps and debris from the areas in which concrete will be placed.
2. Thoroughly clean the areas to insure proper placement and bonding of concrete.
3. Thoroughly wet the forms (except in freezing weather), or oil them; remove all standing water.
4. Concrete shall not be placed on frozen ground.
5. The concrete for the foundations shall be placed on a 3 in. thick minimum mud mat. (Concrete mud mat may be deleted only if approved by the ENGINEER when ground conditions are dry and only if concrete is placed on the same day of excavation.)

B. Installation of Embedded Items:

1. Coordinate with all trades, the placement of anchors, bolts, reglets, inserts, dovetail slots, and other items furnished under other Sections of the specifications which are to be embedded in the concrete.
2. Do not embed aluminum conduit or accessories in concrete.

C. 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 which will prevent segregation and loss of concrete mix materials.
2. Provide mechanical equipment for conveying concrete to insure 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, snow, ice, and other deleterious materials.

D. Depositing and Compacting:

1. Deposit no concrete in the work that has attained its initial set or has contained its water content for more than one (1) hour. Exercise special care to prevent splashing the forms or reinforcement with concrete in advance of pouring. Place no concrete on concrete that has hardened sufficiently to cause the formation of seams and planes of weakness within the section. Do not allow concrete to drop freely more than five (5) feet in unexposed work nor more than three (3) feet in exposed work. Where greater drops are required, employ a tremie or other method approved by the ENGINEER. Control the discharge of the tremie so that the concrete may be effectively compacted into horizontal layers not exceeding twelve (12) inches in thickness with a minimum of lateral movement.
2. Compact concrete with the aid of mechanical internal vibrating equipment and supplemented by hand spacing and rodding. In no case use vibrators to transport concrete inside of forms. The use of form vibrators is not permitted. Compact no concrete by vibration when the slump is greater than 4 inches. Use internal vibrators that maintain a speed of not less than 5,000 impulses per minute when submerged in the concrete. Maintain at least one spare vibrator as a relief. Limit the duration of vibration to that necessary to produce satisfactory consolidation without causing objectionable segregation and vibrate 5 to 15 seconds at points 18 to 30 inches apart. Do not insert vibrator into lower courses that have begun to set.
3. Coordinate and design foundation to eliminate cold joints from structural foundation pour. In other words, no cold joints shall be permitted, except between foundation pad and pedestal, between walls of vault and bottom pad, and between walls of vault and top slab. Suitable construction joints and dowels shall be provided.

E. Bonding: Before depositing new concrete on or against concrete that has set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles. Retighten forms and slush existing surfaces with a grout coat of neat cement. Place new concrete before the grout has attained initial set. Give horizontal construction joints a brush coat of grout consisting of cement and fine aggregate in same proportions as concrete to be placed. No vertical construction joints shall be permitted in the foundation bottom pad.

3.4. REPAIR OF SURFACE DEFECTS

A. Patching: After forms are removed, the ties shall be removed and the resulting holes along with all other flaws or damaged areas resulting from improper or poor concreting operations, shall be rebuilt or patched as approved by the ENGINEER. Any bugholes or other imperfections over 3/8 in. diameter or over 3/8 in. deep shall be repaired. Any bugholes or other imperfections that cover more than 5% of any square foot shall be repaired regardless of their size. For patched areas, conform to the following:

1. Preparation of Surface: Immediately after stripping formwork, remove defective and honeycombed areas to sound concrete with edges regular and perpendicular

to surface. Wet thoroughly these areas and all tie-holes and then paint with a cement-water paste, followed immediately by the patching mortar.

2. Patching Mortar: Prepare mortar of same material and proportions as used for concrete except remove coarse aggregate and use Type I cement. If gray concrete is to be exposed and unpainted, substitute sufficient quantity of white cement for part of gray cement so that patching mortar, when dry, will match surrounding concrete (approximately one part white cement to one part gray cement). Keep water to a minimum.
3. Patching Operation: Mix patching material occasionally for an hour prior to using. Compact firmly into place by tamping and strike off slightly high. After about two hours, strike off level with a sponge rubber float and cure.

3.5. FINISHING OF FORMED SURFACES

A. As-Cast Finishes:

1. Standard Rough Form Finish: Provide standard rough form finish to all concrete formed surfaces that are to be concealed, unless otherwise shown or specified. Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used, with defective areas repaired and patched as specified, and all fins and other projections exceeding 1/4 inch in height rubbed down with wood blocks.
2. Rubbed Finish: Provide a standard rubbed finish in accordance with ACI 301-20, Chapter 10, Paragraph 10.3, to all exposed concrete to a depth of 12 in. below final grade except areas that are to be covered with grout. A smooth rubbed finish shall be produced on newly hardened concrete no later than the day following form removal. Surfaces shall be wetted and rubbed with carborundum brick or other abrasive until uniform color and texture are produced. No cement grout shall be used other than the cement paste drawn from the concrete itself by the rubbing process.

3.6. CONCRETE JOINTS

A. Monolithic Concrete:

1. Joints:
 - a. Joints shall only be allowed between the pad and the ringwall and between the pad and the walls of the inlet base elbow vault.
 - b. All joints shall have reinforcement continuous through the joint.
 - c. The surface of the concrete at all joints shall be thoroughly cleaned and all laitance removed prior to the placement of adjoining concrete.
 - d. A suitable bonding agent shall be applied to the concrete surfaces to be joined.

3.7. CURING AND PROTECTION

A. Curing:

1. General: Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperatures, and shall be maintained with minimal moisture loss at relatively constant temperatures for the period of time necessary for the hydration of the cement and proper hardening of the concrete.
2. Curing: Initial curing shall immediately follow the finishing operation. One of the following materials or methods shall be used:
 - a. Ponding or continuous sprinkling
 - b. Absorptive mat or fabric kept continuously wet
 - c. Curing Compounds: Such compounds shall be applied in accordance with the recommendations of the manufacturer and shall not be used on any surfaces against which additional concrete, grout, or other cementitious finishing materials are to be bonded, nor on surfaces on which such curing is prohibited by the specifications.
3. Duration of Curing: The curing operation shall continue until the cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the air in contact with the concrete is above 50° F., has totaled seven (7) days.

B. Temperature:

1. Cold Weather: Conform with ACI 306 and the following requirements: Mix and place concrete only when the temperature is at least 40° F and rising. The temperature of the concrete shall be maintained between 50° F and 70° F for the required curing period. When necessary, arrangements for heating, covering, insulating, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature and moisture conditions without injury due to concentration of heat.
2. Hot Weather: Conform with ACI 305 and the following requirements: the maximum temperature of fresh concrete at the time of placement during hot weather is 90° F, to prevent an accelerated setting of the concrete. Use retarding densifier admixture, "Plastiment," by Sika Chemical Corporation, during the months of June, July, August, and September when the high expected atmospheric temperature for the day is 85° F or above. Add "Plastiment" in the proportion of four (4) fluid ounces of liquid per bag of cement.

3.8. TESTING

- A. The required testing services by the Certified Independent Testing Agency shall be arranged and paid for by the CONTRACTOR.

B. Tests to be Performed:

1. Sampling Fresh Concrete: Shall be in accordance with ASTM C172, except modified for slump to comply with ASTM C94.
2. Slump Test: In the field, determine consistence in accordance with ASTM C143. Make one slump test for each set of concrete test cylinders molded.
3. Compression Test Specimens: Prepare test specimens in accordance with ASTM C31. One set of four (4) standard cylinders for each compressive strength test (ASTM C39), unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required. One (1) specimen shall be tested at 7 days and two (2) specimens shall be tested at 28 days. The fourth specimen shall be kept by the testing laboratory until the strength of the structure is determined to meet or exceed the specified strength. Compressive Strength Tests (ASTM C39) are required as follows:
 - a. Minimum: One (1) set (four standard cylinders) for each class of concrete placed each day. When concrete placement exceeds ten (10) cubic yards each day, one set of cylinders shall be made for each additional one hundred (100) cubic yards, or fraction thereof.
 - b. Foundation: A minimum of four (4) sets representative of the separate truckloads and casting volumes.
4. Concrete Temperature: Test concrete temperature hourly during placement when air temperature is 40° F and below, and when 80° F and above; and each time a set of compression test specimens is made.

C. Testing Reporting: Report test results to ENGINEER in writing on the same day that tests are made. To facilitate testing services, the CONTRACTOR shall:

1. Provide and maintain facilities for the safe storage and proper curing of concrete test cylinders at the project site.
2. Maintain a complete record of specimens taken giving detailed location of each pour represented. This record shall be submitted with the 7 day test cylinder results.

3.9. EVALUATION OF CONCRETE

A. General: Concrete work which does not conform to the specified requirements, including but not limited to strength and tolerances, shall be removed and new concrete placed at the CONTRACTOR'S expense, without extension of time therefore.

B. Evaluation of Quality Control Tests:

1. Compressive Strength Tests for Laboratory: Cured cylinders will be considered satisfactory if the averages of all sets of three compressive strength test results

equal or exceed the required compressive strength and no individual strength test falls below the required compressive strength by more than 500 psi.

2. Core Tests: The testing service shall take core samples of in-place concrete when pouring conditions and/or test results are such that there is reasonable doubt that the specified concrete strengths and other characteristics have not been attained in the structure, or as directed by the ENGINEER. The testing service shall conduct tests to determine the strength and characteristics of the in-place concrete by compression test on cored cylinders complying with ASTM C42, or by load testing specified in ACI 318, or others as directed. The CONTRACTOR shall pay for such tests conducted and any other additional testing as may be required.

C. Formed Concrete Tolerances:

1. Plan Dimension: Formed concrete having any dimension 1/2 in. smaller or 2 in. greater than shown on the plans shall be considered deficient and subject to additional testing as herein specified.
2. Thickness: Formed concrete having -5% of the specified thickness dimension shall be considered deficient and subject to additional testing as herein specified.
3. Concrete Cover: Formed concrete having any clear concrete cover 1/2 in. smaller than specified shall be considered deficient and shall be rejected.

D. Strength of Concrete Structures: The strength of the concrete structure in-place will be considered potentially deficient if it fails to comply with any of the requirements which control the strength of structure, including the following conditions:

1. Failure to meet compressive strength test requirements.
2. Concrete which differs from the required dimensions or location in such a manner to reduce strength.
3. Concrete subjected to damaging mechanical disturbances; particularly load stresses, heavy shock, and excessive vibration.
4. Poor workmanship and quality control likely to result in deficient strength.

END OF SECTION

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SECTION 03600

GROUT

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PART 1 – GENERAL

1.1. SECTION INCLUDES

- A. All labor, materials, equipment, and related services necessary to furnish and install all grout.

1.2. PAYMENT

- A. Grout is considered Incidental Work with no separate measurement and payment to be made.

1.3. SEQUENCING AND SCHEDULING

- A. Protect surfaces to be grouted from the application of any curing compounds.

PART 2 -- PRODUCTS

2.1. MANUFACTURERS

A. Acceptable Grout Manufacturers and Materials:

1. Euclid Chemical Company, Cleveland, OH 44110. EUCO, Type NS Nonstaining - Nonshrinking Grout.
2. L&M Construction Chemicals, Inc., Omaha, NE 68152. DURAGROUT.
3. Master Builders, Inc., Cleveland, OH 44122. MASTERFLOW 928 Grout.
4. Sika Corporation, Lyndhurst, NJ 07071. SikaGrout 212.

B. Acceptable Curing Compound Manufacturers and Materials:

1. Euclid Chemical Company, Cleveland, OH 44110. AQUA-CURE.
2. L&M Construction Chemicals, Inc., Omaha, NE 68152. L & M CURE.
3. Master Builders, Inc., Cleveland, OH 44122. MASTERKURE W.
4. Sika Corporation, Lyndhurst, NJ 07071. Sikagard Cure/Hard.

2.2. MATERIALS

- A. Nonshrink, Nonmetallic Grout: Use only materials which will produce no shrinkage cracks, are water stable, noncorrosive, nonferrous and will not deface or stain concrete.

PART 3 – EXECUTION

3.1. GROUT USAGE

- A. Nonshrink grout shall be used for grouting of pipes through walls, structural steel base plates, and steel bottom plates.
- B. Where grouting is not indicated on the drawings or specified herein but is required, the CONTRACTOR shall notify the ENGINEER so as to determine the correct grout to use.

3.2. SURFACE PREPARATION

- A. Clean all surfaces of oil, grease, dirt, laitance, and loose material down to sound concrete. Metal surfaces shall be free of rust or other foreign material.
- B. Nonshrink Grout:
 - 1. Protect surfaces to be grouted from the application of curing compounds.
 - 2. Roughen surfaces to be grouted.
 - 3. Saturate concrete surfaces including bolt holes with water for 24 hours prior to grouting.
 - 4. Remove all standing water prior to grouting.

3.3. MIXING

- A. Nonshrink Grout: Mixing of grout materials shall conform strictly to manufacturer's recommendations. A copy of such recommendations shall be available at the project site.

3.4. PLACEMENT & FINISHING

- A. Nonshrink Grout:
 - 1. Pourable Grout: Pour grout from slanted form surface or center entrance point only. Anchor support elements to prevent movement. Sufficient vent holes shall be used to bleed off entrapped air when placing grout. Avoid adding more water than recommended.
 - 2. Plastic: Use chains, rods, vibrator, or tamping to tightly compact grout and remove voids. Strike off exposed areas in a vertical plane that is formed by the outer edge of the base plate or bottom plate.

- B. Steel Shim Plates: After the grout has attained its 7-day strength as defined by the manufacturer of the grout, all steel shim plates within 3 in. of the edge of the bottom plate shall be removed. Grout shall be placed in the voids left by the removal of the steel shim plates in accordance with this Section.

END OF SECTION

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SECTION 09800

GENERAL SPECIFICATIONS FOR COATING SYSTEMS

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PART 1 – GENERAL

1.1. SECTION INCLUDES

- A. General specifications for coating systems for steel storage tanks.

1.2. REFERENCES

- A. AMPP, The Association for Materials Protection and Performance (formerly SSPC, The Society for Protective Coatings and NACE, National Association of Corrosion Engineers)
 - 1. Steel Structures Painting Manual (Volume 1, 3rd Edition - 1993 and Volume 2, 8th Edition - 2000, including Commentary Sections and Appendices).
 - 2. SSPC-AB 2 “Specification for Cleanliness of Recycled Ferrous Metallic Abrasives”
 - 3. SSPC-AB 3 “Newly Manufactured or Re-Manufactured Steel Abrasives”
 - 4. SSPC-VIS 4-01 "Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting"
 - 5. SSPC-VIS 5-01 "Guide and Reference Photographs for Steel Surfaces Prepared by Wet Abrasive Blast Cleaning"
 - 6. SSPC-Guide 6 (CON) “Guide for Containing Debris Generated During Paint Removal Operations”
 - 7. SSPC-PA Guide 3 “A Guide to Safety in Paint Application”
 - 8. SSPC-SP 12, Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating
 - 9. SSPC-SP 13, Surface Preparation of Concrete
 - 10. SSPC-SP 14, Industrial Blast Cleaning
- B. American Water Works Association (AWWA) Standards
 - 1. D100-21, Standard for Welded Steel Tanks for Water Storage.

2. D102-24, Standard for Painting Steel Water-Storage Tanks.
- C. NSF International (NSF) Standard *{formerly National Sanitation Foundation}*
 1. NSF/ANSI Standard 61, Drinking Water System Components - Health Effects.
- D. The paint manufacturer's published product data shall be adhered to unless changed in writing by the home office of the manufacturer.
- E. Where the foregoing standards, recommendations, and specifications are conflicting, said conflicts shall be brought to the attention of the ENGINEER.

1.3. QUALITY ASSURANCE

- A. Personnel: The CONTRACTOR shall have a full complement of personnel, for the proper coordination and expedition of the Work, on a daily basis until the Work is completed.
- B. Contractor Supervision: Except where the CONTRACTOR is an individual and gives his/her personal superintendence to the work, the CONTRACTOR shall provide a competent superintendent, satisfactory to the OWNER, for the work at all times during working hours with full authority to act for CONTRACTOR. Should, in the opinion of the OWNER, any language barrier exist between the superintendent and the OWNER, the CONTRACTOR shall employ a qualified interpreter or a new superintendent at no additional cost to the OWNER.
- C. Ventilation: Forced ventilation shall be supplied to the interior of the tank for a period of time equal to the paint manufacturer's recommended recoat times for the prime coat and for a continuous period of at least 48 hours after the final coat has been applied. Adequate ventilation of the container bottom, riser, and other low lying areas of the tank and container shall be provided by the CONTRACTOR as required for solvent release and coating cure. This ventilation shall, at a minimum, be in accordance with AWWA D102-24. The CONTRACTOR shall furnish, install, and operate the equipment that is necessary to provide forced ventilation to aid curing. If supplementary heating or dehumidification is required to effect curing, the CONTRACTOR shall furnish, install, and operate the equipment to perform the supplementary heating or dehumidification required at no additional cost to the OWNER.
- D. Inlet, Outlet, and Overflow Piping: The CONTRACTOR shall be responsible for assuring that no foreign material including, but not limited to paint, abrasive, rags, or tools enter the inlet, outlet, or overflow piping during the prosecution of the work. To aid in preventing the entrance of foreign material, the contractor shall either tack weld a plate over the inlet/outlet pipe or place an expandable plug in the pipe. If a plate is tack welded over the pipe, any water in the pipe shall be drained and the plate shall completely cover the pipe and shall not be removed until the interior and exterior painting is complete. After the plate is removed the damaged areas of coating and weld burrs shall be ground smooth and recoated in accordance with the applicable paragraphs in this Section. If an expandable plug is inserted in the pipe, the plug shall be placed approximately 18 in. down in the pipe to allow the proper coating of the pipe.

- E. Recoat Cycle: The CONTRACTOR shall review the manufacturer's published product data for maximum recoat times for all the coating systems selected for use. The manufacturer's recommendations concerning the time between coats and the preparation of the previously painted steel surfaces shall be followed.
- F. Minimum Temperature of Coatings to be Mixed: Each component shall be maintained at a minimum of 75° F prior to mixing. The mixed coatings shall also be maintained at a minimum of 65° F during application. All costs associated with keeping the coating material at the minimum specified temperature shall be included in the **Base Bid**.
- G. Mixing of Coatings: Each component shall be thoroughly mixed on-site with a power agitator to ensure no solids or settled material remains on the bottom of the container before combining the components together. Accurate measuring apparatus shall be used to carefully measure each component by volume into a clean container in accordance with the manufacturer's published product data. The container shall be large enough to hold all components to be mixed, including thinner. The combined material shall be thoroughly mixed with a power agitator to achieve a uniform consistency. **Adherence to proper induction times for the combined coating material in accordance with the manufacturer's published product data shall be accomplished by the CONTRACTOR. No coating shall be applied until the minimum induction time has been reached. Zinc coatings shall be constantly power agitated during mixing and application to prevent the zinc dust or other heavy pigments from settling.**
- H. Application and Damages: The materials shall be applied in accordance with the manufacturer's published product data and such that the end results are in compliance with these specifications (including all others inferred by reference). However, the CONTRACTOR is advised to consult the manufacturer's published product data concerning the length of hose and difference in elevation of the pump and spray gun when applying a zinc coating. Application equipment (including air and airless sprayers, rollers and brushes) shall be good quality, in good condition and shall be as recommended by the coating manufacturer. **Techniques shall be used which will not cause coating droplets, etc. to travel more than 30 ft from the base of the tank. Painting of exterior surfaces shall be performed only when the wind velocity and direction, and temperature and humidity are such that paint damage will not occur to real estate or personal property.** Prior to the cleaning or coating of any surface, the CONTRACTOR shall present a written plan for review by the PROJECT REPRESENTATIVE and the ENGINEER concerning how abrasive and/or paint damage to automobiles and property will be handled, including a process for quick removal of the abrasive or paint, and who will do the Work. This approval in no way shall relieve the CONTRACTOR from the responsibility of settling claims for damage, but is intended as an avenue to expedite and minimize said claims.
- I. Drying times and ventilation requirements of the manufacturer shall be strictly adhered to by the CONTRACTOR.

1.4. SEQUENCING AND SCHEDULING

- A. Work Schedule: The cleaning and painting of the tank shall be accomplished in such a way as to minimize the number of days required for observing the cleaning and painting operations.
- B. Cleaning Areas of Welding and/or Grinding: Areas to be welded shall be welded prior to the final cleaning and painting of surfaces within the heat affected zone. The heat affected zone includes the opposite side of the plate or member being welded. Even if not specifically mentioned as a part of the work under this contract, those areas of paint or coatings in the heat affected zone of areas not specified to be painted shall be cleaned and painted in accordance with the requirements in this Specification. All welded, abraded, or cut areas which have been shop primed shall be cleaned prior to welding or cutting operations. The welded or cut areas shall also be cleaned after welding and grinding and prior to painting.

1.5. SUBMITTALS

- A. Submit sets to the ENGINEER in accordance with Section 01300 - Submittals
 - 1. Product Data:
 - a. Written description and catalog cuts describing each type of proposed abrasive for the interior and exterior surfaces. Include technical data sheets to substantiate compliance with specifications.
 - b. Written description and catalog cuts describing each coating in the system. Information shall include: product delivery, storage, handling, application and curing instructions and limitations. Include technical data sheets to substantiate compliance with specifications.
 - c. Written description and catalog cuts describing each thinner proposed for use with each coating system. Also include thinner or solvent proposed for use in cleaning paint equipment. Include technical data sheets to substantiate compliance with specifications.
 - 2. Certification: Provide certification signed by supplier of the coating attesting that coating system proposed meets the specifications. The CONTRACTOR shall obtain certification from the manufacturer certifying that all coatings, including the final cured zinc coating, will not contain more than 0.025% by weight of lead (or any lead compounds) in the cured coating for each coat applied. The CONTRACTOR shall obtain a letter from coating manufacturer's headquarters stating that the resulting abrasive profile is acceptable for their coating materials. Certification shall be submitted to the ENGINEER.
 - 3. Cleanup Procedures: Prior to the field cleaning or painting of any surface, the CONTRACTOR shall present a written plan to the OWNER and ENGINEER concerning how paint and/or abrasive damage to automobiles and property will be handled, including a process for quick removal of the paint or abrasive, and who will do the work. This approval in no way shall relieve the CONTRACTOR from

the responsibility of settling claims for damage, but is intended as an avenue to expedite and minimize said claims.

4. Containment Procedures: Prior to the field cleaning or painting of any surface, the CONTRACTOR shall present a written plan to the OWNER and ENGINEER for review concerning how spent cleaning debris and/or paint overspray or droplets will be confined to the tank site. Reasonable care shall be exercised by the CONTRACTOR to prevent damage, nuisance, or hazardous conditions to adjacent or nearby property owners.

1.6. DELIVERY, STORAGE, AND HANDLING

- A. Requirements: Deliver, store, handle, apply, and cure materials in accordance with the manufacturer's published product data, including all requirements listed on the Safety Data Sheets (SDS).
- B. Quantity: The amounts delivered shall provide the proper coverage rates, taking into account normal application loss.
- C. New Materials: All coating materials and thinners shall be new and furnished for this job and shall be delivered from the coating manufacturer to the job site in the original factory sealed containers which are clearly and properly labeled by the coating manufacturer showing the manufacturer's name, product number, type of paint, batch number, and expiration date.
- D. Storage: Provide adequate storage facilities. Store coating materials within minimum and maximum ambient temperatures in accordance with the manufacturer's recommendations. Temperature of the coating prior to and during mixing shall be within the range stated in the manufacturers published product data.
- E. Abrasive: All expendable abrasive shall be new and furnished for this job. All abrasive shall be properly stored on skids or in a covered container. The abrasive shall be covered to protect the abrasive from water and weather. Do not allow abrasive to rest directly in contact with the ground.
- F. SDS: Safety Data Sheets (SDS) shall be posted at the job site for each chemical product on the job site, including but not limited to abrasives, coatings, thinners and other solvents, welding materials, and disinfecting agents.

1.7. PROJECT CONDITIONS

- A. Times for Work: No on-site work is to be done during the hours between sunset and sunrise. The times for Work shall also comply with local, state and federal regulations and laws regarding days of week, noise and interference with activities of surrounding property owners. Should temperatures be excessive for personnel welfare or application of coatings during daylight hours, or should other job conditions make nighttime Work beneficial to the CONTRACTOR and OWNER, written permission may be granted by the ENGINEER and OWNER to conduct Work at night, provided that the necessary steel temperature, air temperature, humidity and dew point data is recorded during the application and initial drying or curing of the coatings. This permission shall only be

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granted if the CONTRACTOR provides the proper lighting and safety equipment and informs the neighboring occupants and property owners.

- B. Painting Environment: All temperature and humidity requirements of the coating manufacturer shall be met. In addition, no painting shall be done when: 1) the relative humidity is greater than 85%; or 2) the temperature of the steel is or is expected to be less than 5°F above the dew point temperature during the application and until the coating has cured to resist moisture in accordance with the manufacturer's published product data; or 3) the ambient or steel temperature is below 35°F or is expected to drop below 35°F during the initial cure of the coating.
- C. Humidity and Temperature Measuring Equipment: The CONTRACTOR shall have wet bulb-dry bulb measuring equipment and steel temperature measuring equipment on the job at all times. Readings shall be recorded at the beginning and end of each painting session and at intervals of two hours or less.
- D. Wind Velocities: Wind velocities during exterior painting shall be compatible for the quality application of the exterior coatings.
- E. Safety and Health: The CONTRACTOR shall comply with all health and safety regulations and requirements of OSHA, state and local health regulatory agencies, Safety Data Sheets (SDS), SSPC-PA Guide 3, and the paint and abrasive manufacturers. Should vents, holes, rigging attachments, or any other modification, cutting, or welding be required to meet safety standards, they may be accomplished at the expense of the CONTRACTOR upon submitting of details in writing to, and with subsequent written approval by the ENGINEER.
- F. Rigging Attachments: All rigging attachments present on the tank shall be carefully evaluated by the CONTRACTOR immediately prior to use for the type and magnitude of loads which CONTRACTOR intends to impose on them. The CONTRACTOR assumes all responsibility for use of any existing or added attachments.
- G. Containing Cleaning Debris and Overspray: The CONTRACTOR shall ensure that no spent cleaning/blasting debris, dust, overspray, coating droplets, or emissions of any kind, escape to the atmosphere and travel farther than 30 ft from the base of the tank, or any lesser distance required to avoid contamination of adjacent buildings, work sites and parking lots. The OWNER reserves the right to stop work or to require additional or different containment methods if the CONTRACTOR'S operations create a nuisance beyond the tank site property line in the sole opinion of the OWNER, the ENGINEER, the OWNER'S designated representative, any regulatory agency, or neighbor. All costs of providing an adequate containment system shall be included by the CONTRACTOR in the **Base Bid**.
- H. Dust Collection: The CONTRACTOR shall furnish, operate, and maintain adequate dust collection during the Project to achieve adequate air flow within the tank interior. The dust collection system shall at a minimum meet the requirements of a **Type J1 Air Filtration system**, as specified in Section 5.4.5.1 of the SSPC-Guide 6 (CON), Guide for Containing Debris Generated During Paint Removal Operations. The dust collection shall be operated during all abrasive blast cleaning and after abrasive blast cleaning until

the area is clean enough for coating application. The CONTRACTOR shall be responsible for all sizing, design of ductwork, etc., based upon the CONTRACTOR'S operations, number of blasters, duration of blasting, etc. The CONTRACTOR shall also take precautions to avoid a vacuum from developing inside the tank, as even a slight vacuum inside the tank may cause damage to the roof.

- I. Attractive Nuisances and Cleanup: The job site shall be kept in a clean and safe condition at all times. Hazards or attractive nuisances shall be protected at all times. Upon completion of the Work, the job site and all nearby sites impacted by the Work activities shall be left clean of all debris, cleaning residue, or any other items resulting from the operations of the CONTRACTOR. The cost of any cleanup which must be done by the OWNER shall be deducted from funds due the CONTRACTOR. Removal of the debris from the site and proper legal disposal or recycling of same is to be done at the cost of the CONTRACTOR. The disposal site or recycling facility shall be as approved by the OWNER in writing. This approval by the OWNER shall not relieve the CONTRACTOR from proper legal disposal or recycling of the debris in accordance with all federal, state, and local requirements.
- J. Tank Empty: The tank shall be empty during all cleaning and painting, and curing of the paint.

1.8. ENVIRONMENTAL REGULATIONS

- A. See Section 01060 - Regulatory Requirements.

1.9. FIRST ANNIVERSARY INSPECTION

- A. Requirements: A First Anniversary Inspection shall be performed. The CONTRACTOR'S Performance Bond or a separate Maintenance Bond shall be in force until after any remedial work is performed. The performance of this inspection and/or any remedial work shall not relieve the CONTRACTOR of any responsibility for defects in materials or workmanship which may or may not be evident during the First Anniversary Inspection.
- B. AWWA D102: The First Anniversary Inspection as described in Section 5.2 of AWWA D102 shall apply.
- C. Inspection: The CONTRACTOR shall perform the following duties at the First Anniversary Inspection:
 - 1. The CONTRACTOR shall conduct the inspection, and shall furnish an experienced foreman, laborer, and rigging for the inspection.
 - 2. Washout: The CONTRACTOR shall washout the interior of the container for the one year evaluation. All debris from the interior of the container shall be legally disposed of by the CONTRACTOR at no additional cost to the OWNER.
 - 3. The CONTRACTOR shall be prepared to perform minor touch-up operations.

4. The CONTRACTOR shall have at least one gallon of each of the exterior primer, intermediate coating, and finish coating at the time of the evaluation along with power cleaning tools and abrasive disks for spot cleaning.
 5. The CONTRACTOR shall have at least one quart kit of Aquatapoxy Paint (manufactured by Raven Lining Systems, Tulsa, OK, telephone 800/324-2810) to touch-up the interior surfaces. If more than one quart kit is needed, as determined by the FIELD OBSERVER, then the specified epoxy coatings shall be used to touch-up the interior surfaces.
 6. CONTRACTOR shall open manholes for the inspection and shall close and secure manholes after the inspection including verifying manholes with gaskets are sealed.
 7. Costs: All costs associated with the First Anniversary Inspection shall be included in the Base Bid price.
 8. Repairs: Spot repairs shall be made by the CONTRACTOR before returning the tank back into service. Repairs requiring extensive work and rigging may be delayed until a time mutually agreeable to the OWNER and CONTRACTOR.
 9. Disinfection: It is the CONTRACTOR'S responsibility to disinfect the tank in accordance with Section 02675 - Disinfection of Water Distribution Systems until two consecutive satisfactory water samples are reported from the OWNER'S selected laboratory.
- D. Date of Inspection: Failure of OWNER to establish a First Anniversary Inspection date will not relieve the CONTRACTOR of the responsibility to repair the interior and exterior coating system.

PART 2 -- PRODUCTS

2.1. MATERIALS

- A. Abrasive: The approved abrasive for cleaning shall meet the following requirements:
1. All expendable abrasives shall meet the minimum requirements of SSPC-AB 1, and all abrasives shall meet the requirements of Class A (of SSPC-AB 1) for silica content (crystalline silica less than 1% by weight before blasting). The crystalline silica content shall be determined by the use of infrared spectroscopy or by other analytical procedures, such as wet chemical or x-ray diffraction analysis.
 2. The abrasive shall be of a grit size to produce a 1.5 mil to 2.5 mil profile (unless modified by the coating manufacturer).
 3. Use of abrasive on the exterior of the tank shall be based not only on its compliance with the technical application of the coatings, but also on its lack of nuisance to surrounding property.

4. The abrasive shall be free from contaminants, such as excessive fine particles, paint, earth, moisture, oil, or chlorides, which can cause premature failure of the coating.
- B. Approval of Coatings: All coatings shall be acceptable to the USEPA and/or other controlling local health and environmental regulatory agencies. All interior coating materials, solvents, and other additives shall comply with NSF/ANSI Standard 61 "Drinking Water System Components - Health Effects."
- C. Lead Restrictions: Coatings which contain more than 0.025% lead (or any lead compounds) in the cured coating for each coat applied shall not be used.
- D. Common Manufacturer: The interior and exterior coatings shall be furnished by the same manufacturer unless specifically stated otherwise in these Specifications.
- E. Thinners: Thinners shall be used only in accordance with the manufacturer's instructions. Only thinners recommended and furnished by the coating manufacturer shall be used for this Project.

PART 3 – EXECUTION

3.1. SHOP OBSERVATION

- A. Shop observation of the cleaning and painting of the steel by the FIELD OBSERVER shall be anticipated.

3.2. VERIFICATION OF CONDITIONS

- A. Before application of the coating materials, verify that specified procedures and products will provide adequate protection of the steel surfaces.

3.3. PROTECTION

- A. Furnish and install protective covering over items on the tank and at tank site that are not to be cleaned or painted.

3.4. APPLICATION

- A. The sequence to be followed in cleaning and painting shall be such that a minimum of damage to finished coatings will result. The entire tank should be cleaned and primed prior to the start of the intermediate painting to avoid damage to the topcoats from adjacent cleaning operations.
- B. Do not apply the primer closer than 6 in. to an uncleaned surface.
- C. If the recoat cycle of the exterior primer prevents completely cleaning and priming the tank exterior before applying the intermediate coat, then the CONTRACTOR shall submit, in writing, a schedule for exterior coating application which will avoid damage to the intermediate and finish coats when applied close to uncleaned surfaces. If the recoat

cycle of the interior primer prevents completely cleaning and priming the tank interior before applying the finish coat, then the CONTRACTOR shall submit, in writing, a schedule for interior coating application which will avoid damage to the finish coat when applied close to uncleaned surfaces.

3.5. TOLERANCES

A. Coating Thickness:

1. The thickness of each type coating is essential to the system's integrity.
2. The addition of mils in a succeeding coat of a different generic type or formulation to make up for thin preceding coat(s) shall not be allowed. If a thicker finish coat is needed to hide the underlying darker color on the exterior of the tank, a thicker coat may be applied, but it shall not exceed the maximum allowable thickness recommended by the coating manufacturer. Under no circumstances shall the dry film thickness of an individual coat or of the total coating system exceed the coating manufacturer's maximum allowable thickness limit.
3. Dry mil thickness greater than the coating manufacturer's maximum allowable thickness shall be considered unacceptable and shall be removed by the CONTRACTOR at no additional cost to the OWNER at the direction of the FIELD OBSERVER and OWNER.
4. Coating thickness measurement procedures shall be as outlined in SSPC-PA 2.
5. If determined to be in the best interest of the project, the FIELD OBSERVER may make dry film thickness measurements in excess of the amounts permitted by SSPC-PA 2.

- B. Uniformity: In addition to the minimum and maximum dry film requirements, all sags, runs, dry spray, pinholes, craters, roller nap, or other irregularities shall be removed and repaired.

3.6. OBSERVATION

A. Accessibility for Observation:

1. Notification: The ENGINEER and FIELD OBSERVER shall be notified 7 days, and confirmed 24 hours, prior to the start of shop priming operations of the steel. The interior wet cleaning and priming shall be done under the observation of the FIELD OBSERVER.
2. Accessibility for Observation: All Work shall be made accessible to the ENGINEER and FIELD OBSERVER using the CONTRACTOR'S rigging and equipment. The CONTRACTOR shall include all labor necessary to assist the ENGINEER and FIELD OBSERVER in accessing the work to be observed.

3. CONTRACTOR Supervision: The CONTRACTOR is to supervise the job properly at all times.
4. Observation: The OWNER reserves the right to engage full-time observation services, or to perform observations intermittently.

B. Observation Schedule:

1. Notification: The CONTRACTOR shall notify and make available to the ENGINEER and FIELD OBSERVER for observation all surfaces prior to the application of each coat of paint.
2. Curing: The interior area coating shall be completely cured and the solvents shall be adequately released and the tank shall not be filled with water until observed by the FIELD OBSERVER and the OWNER. The exterior coating on the opposite side of water bearing surfaces shall be completely cured and the tank shall not be filled with water until observed by the FIELD OBSERVER and the OWNER. CONTRACTOR shall perform solvent rub tests, pencil hardness tests, or other industry recognized testing procedures recommended by the coating manufacturer to determine the coatings have cured prior to filling the tank. A letter from the CONTRACTOR certifying their testing results and that the interior wet coating has cured such that it is ready for immersion service shall be submitted to the ENGINEER and OWNER prior to filling the tank. The CONTRACTOR shall monitor the tank bottom plate temperature during the interior coating curing to verify that minimum steel temperature requirements are satisfied.
3. Holiday Testing: All interior coatings, including those above the high water level, shall be tested with a wet sponge low voltage holiday detector in accordance with Section 5.1.3 of AWWA D102 and NACE SP0188 in the presence of the FIELD OBSERVER. Any voids indicated shall be repaired by applying more of the finish coat of paint by brush or roller. The areas shall be retested after the appropriate curing time. The coating system must pass the holiday test regardless of the existing coating thickness.

- C. Destructive Testing of Coatings: If disputes arise concerning the quality of the applied coatings, adhesion tests, Tooke Gage analysis, or some other form of destructive testing may be used to resolve the dispute. If it is found that such Work is defective, CONTRACTOR shall pay 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 uncovering, exposure, observation, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and OWNER shall be entitled to an appropriate decrease in the Contract Price. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, testing, replacement, and reconstruction.

3.7. CLEANING

- A. CONTRACTOR Performed Cleanup: Upon completion of the Work, the job site shall be left clean of all debris, blasting abrasive, or any other items resulting from the operations of the CONTRACTOR.
- B. OWNER Performed Cleanup: The cost of any cleanup which must be done by the OWNER will be deducted from funds due the CONTRACTOR.
- C. Piping: Any material found in the inlet/outlet, drain or overflow piping as a result of the CONTRACTOR'S operations at the time the tank is placed back into service shall be removed at the expense of the CONTRACTOR.
- D. Tank Disinfection: Wash and disinfect tank in accordance with Section 02675 - Disinfection of Water Distribution Systems.

END OF SECTION

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SECTION 09871

EXTERIOR COATING SYSTEM FOR STEEL STORAGE TANK

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PART 1 – GENERAL

1.1. SECTION INCLUDES

- A. Exterior shop primers, field primers, intermediate, and finish coats for steel water storage tank.
- B. Specifications for the coating of the exterior surfaces of a new steel, potable water storage tank and accessories are included in this Section.
- C. Preparation of all exterior surfaces which are to receive coating are included in this Section.
- D. Painting of all exterior surfaces which are to receive coating are included in this Section.
- E. The exterior surfaces included are all exterior surfaces of the tank, including (but not limited to) the shell, bottom plate projection, all piping and appurtenances, and all threads, bolts, nuts, pins, brackets, seams, corners, etc., but excluding the aluminum roof, nameplate, and the ladder safe-climbing device.

1.2. RELATED SECTIONS

- A. Section 09800 - General Specifications for Coating Systems

PART 2 -- PRODUCTS

2.1. MATERIALS AND MANUFACTURERS

- A. Coatings: Acceptable coating manufacturers and specifications for the exterior surfaces of the steel water storage tank follow; however, the CONTRACTOR is advised that all manufacturers presented below must certify that the coatings furnished are in compliance with these Specifications.

1. The Sherwin-Williams Company, Cleveland, OH 44101

(Shop)	Corothane I GalvaPac NSF Zinc Primer	2.5	-	3.5 mils
(Field)	Corothane I GalvaPac NSF Zinc Primer	2.5	-	3.5 mils
(2)	Macropoxy 646-100 FC	2.0	-	3.0 mils
(3)	High Solids Polyurethane or Acrolon Ultra (semi-gloss)	2.0	-	3.0 mils
	Total System Dry Thickness	6.5	-	9.5 mils

2. **Tnemec Company, Inc., Kansas City, MO 64141**

(Shop)	94-H ₂ O Hydro-Zinc, Zinc-Rich Primer	2.5 - 3.5 mils
(Field)	94-H ₂ O Hydro-Zinc, Zinc-Rich Primer	2.5 - 3.5 mils
(2)	V69 Hi-Build Epoxoline II	2.0 - 3.0 mils
(3)	1095 Endura-Shield (semi-gloss)	2.0 - 3.0 mils
	Total System Dry Thickness	<hr/> 6.5 - 9.5 mils

- B. Thinners: Only thinners recommended and furnished by the chosen coating manufacturer shall be used to thin the paint products.
- C. Zinc Dust: The zinc dust used in the zinc coatings shall meet the minimum requirements of ASTM D520, Type III.

PART 3 – EXECUTION

3.1. SURFACE PREPARATION

- A. All surface preparation shall be done in a workmanlike manner.
- B. Clean all exterior steel surfaces in the shop to SSPC-SP10, Near-White Blast Cleaning.
- C. Black Light: When grease or oil is suspected to be on the steel surfaces, the CONTRACTOR shall evaluate the steel by black light to verify any presence of grease or oil on the surface. If present, the grease and/or oil shall be properly removed from the steel surface.
- D. Rough Areas: These paragraphs apply to rough areas created during the fabrication, transportation, and erection processes.
1. Burrs, weld spatter, sharp edges, corners or rough welds which would cause difficulty in achieving a defect-free coating shall be chipped or ground smooth.
 2. It is not the intent to have the welds or scars chipped and/or ground flush. The objective of the chipping and/or grinding is to eliminate sharp edges, corners, and overlaps in order to provide a surface for the application of a uniform thickness coating without voids.
 3. These chipped and/or ground areas shall be cleaned to provide the proper surface profile for the paint.
- E. Pressure Washing: All exterior surfaces shall be pressure washed in the field after erection and prior to field cleaning using potable water at 2000 psi to remove all oil, grease, dirt, rust, salts, or other deleterious material which would cause coating failure. A suitable biodegradable surfactant or detergent may be used if required and permission is granted by the ENGINEER, FIELD OBSERVER and the coating manufacturer.
- F. Field Preparation: After erection, all exterior surfaces which have been welded, abraded, or otherwise damaged shall be cleaned to SSPC-SP10, Near-White Blast Cleaning.

- G. Surface Contamination: The surfaces to be painted shall be free from mud, oil, grease, dust, moisture, halides, or other foreign material which would cause adhesion problems. If field tests by the FIELD OBSERVER find questionable amounts of contamination on the steel surfaces or painted surfaces to be topcoated, a representative of the home office of the paint manufacturer may be called to examine the surfaces in question and assist in determining if the surfaces are in accordance with these Specifications and the manufacturer's recommendations.

3.2. APPLICATION

- A. All painting shall be done in a professional manner.
- B. Shop Priming:
1. Before the formation of rust, the exterior steel surfaces shall be primed with the specified shop primer, with the exception of a 2 in. wide margin at the edges to be field welded.
- C. Field Priming:
1. Not later than during the same day and before the formation of rust, the exterior surfaces cleaned in the field (SSPC-SP10) shall be primed with the specified field primer.
 2. Stripe Coat: After the application of the first coat, all seams, edges, lapped joints, rough areas, bolt heads and nuts, remains of erection lugs and scars, corners (including the intersection of the ladder rungs and the side rails), member intersections, and other deviations from smooth surfaces shall be primed by brush and/or roller using 10% thinned material in a contrasting color to the primer. The 10% thinned material shall be worked sufficiently into all cracks, crevices, and seams. Initial spray application of this stripe coat shall not be permitted.
 3. The primer shall not be applied closer than 6 in. to an uncleaned surface.
- D. Intermediate Coat: After proper curing of the prime coat and prior to any rusting, all primed exterior surfaces shall be given a full intermediate coat of the specified paint by roller and brush techniques. The color shall be slightly darker than that chosen for the finish coat, being dark enough to visually assure application of the finish coat, and light enough to allow proper hiding. (An intermediate coat lighter than the finish coat shall not be permitted due to the inability to distinguish between the lighter intermediate and the highlights of the gloss finish.)
- E. Finish Coat: After adequate curing of the intermediate coat, the entire exterior surfaces shall then be given a final coat of the selected paint in the OWNER selected color by roller and brush techniques.

END OF SECTION

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SECTION 09872

INTERIOR COATING SYSTEM FOR STEEL STORAGE TANK

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PART 1 – GENERAL

1.1. SECTION INCLUDES

- A. Interior primers and finish coats for steel water storage tank.
- B. Sealant for steel water storage tank.
- C. Specifications for the coating of the interior surfaces of a new steel, potable water storage tank and accessories are included in this Section.
- D. Preparation of all interior surfaces which are to receive coating are included in this Section.
- E. Painting of all interior surfaces which are to receive coating are included in this Section.
- F. All interior surfaces of the container, including (but not limited to) the shell, bottom plate, manholes, anti-vortex device, threads, bolts, nuts, pins, brackets, seams, corners, etc. (with the exception of the aluminum roof, all surfaces of the vent interior and exterior, all screens, and all clog-resistant pallet materials, i.e. polyethylene, teflon, etc.), shall be cleaned and painted in accordance with the paragraphs in this Section. The screens and the clog-resistant pallet materials shall be protected from the application of all coatings.

1.2. RELATED SECTIONS

- A. Section 09800 - General Specifications for Coating Systems

PART 2 -- PRODUCTS

2.1. MATERIALS AND MANUFACTURERS

- A. Compliance with NSF/ANSI Standard 61: The approval of potable water tank interior coatings and sealers shall be based on written certification of compliance with NSF/ANSI Standard 61 and compliance with the requirements of state agencies. Adequate manufacturer's published product data concerning the transportation, storage, mixing, thinning, pot life, application, and curing shall be furnished to ensure that the finished product complies with NSF/ANSI Standard 61.
- B. Certification: Manufacturers presented below must certify that their coatings furnished are in compliance with the Specifications.

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- C. Thinners: Only thinners recommended and furnished by the chosen coating manufacturer shall be used to thin the paint products.
- D. Coatings: Acceptable coating manufacturers and specifications for the interior surfaces of the steel water storage tank follow; however, the CONTRACTOR is advised that all manufacturers presented below must certify that the coatings furnished are in compliance with these Specifications. Materials shall be as follows or other equal material approved in writing by the OWNER.

1. **The Sherwin-Williams Company, Cleveland, OH 44101**

(shop)	Corothane I GalvaPac NSF	2.5 - 3.5 mils
(field)	Corothane I GalvaPac NSF	2.5 - 3.5 mils
(2)	Dura-Plate UHS or Sherplate PW (White)	30.0 - 40.0 mils
	Total System Dry Thickness	<u>32.5 - 43.5 mils</u>

2. **Tnemec Company, Inc., Kansas City, MO 64141**

(shop)	94-H ₂ O Hydro-Zinc	2.5 - 3.5 mils
(field)	94-H ₂ O Hydro-Zinc	2.5 - 3.5 mils
(2)	Series 22 or FC22 Epoxoline (White)	30.0 - 40.0 mils
	Total System Dry Thickness	<u>32.5 - 43.5 mils</u>

PART 3 – EXECUTION

3.1. SURFACE PREPARATION

- A. All surface preparation shall be done in a workmanlike manner.
- B. Rough Areas: These paragraphs apply to rough areas created during the fabrication, transportation, and erection processes.
 - 1. Burrs, weld spatter, sharp edges, corners or rough welds which would cause difficulty in achieving a defect-free coating shall be chipped or ground smooth.
 - 2. It is not the intent to have the welds or scars chipped and/or ground flush. The objective of the chipping and/or grinding is to eliminate sharp edges, corners, and overlaps in order to provide a surface for the application of a uniform thickness coating without voids.
 - 3. These chipped and/or ground areas shall be cleaned to provide the proper surface profile for the paint.
- C. Shop Preparation: Clean all interior steel surfaces in the shop to SSPC-SP 10, Near-White Blast Cleaning.
- D. Oil or Grease Contaminants: When grease or oil is suspected to be on the steel surfaces, the CONTRACTOR shall evaluate the steel by black light to verify any presence of grease or oil on the surface. If present, the grease and/or oil shall be properly removed from the steel surface.

- E. Pressure Washing: After the tank is swept "broom-clean", all interior surfaces shall be pressure washed in the field after erection and prior to field cleaning using potable water at 2000 psi to remove all oil, grease, dirt, rust, salts, or other deleterious material which would cause coating failure. A suitable biodegradable surfactant or detergent may be used if required and permission is granted by the ENGINEER, FIELD OBSERVER, and the coating manufacturer.
- F. Field Preparation: After erection, the interior surfaces which have been welded, abraded, or otherwise damaged shall be cleaned to SSPC-SP10, Near-White Blast Cleaning.
- G. Shop Primed Surfaces: All shop primed components that are not coated with finish coats within the coating manufacturer's recommended recoat cycle shall be cleaned to SSPC-SP 7, Brush-Off Blast Cleaning as recommended by the coating manufacturer.
- H. Surface Contamination: The surfaces to be painted shall be free from mud, oil, grease, dust, moisture, halides, or other foreign material which would cause adhesion problems. If field tests by the ENGINEER find questionable amounts of contamination on the steel surfaces or painted surfaces to be topcoated, a representative of the home office of the paint manufacturer may be called to examine the surfaces in question and assist in determining if the surfaces are in accordance with these Specifications and the manufacturer's recommendations.

3.2. APPLICATION

- A. All painting shall be done in a workmanlike manner.
- B. Shop Priming:
 - 1. Before the formation of rust, the interior steel surfaces shall be primed with the specified shop primer, with the exception of a 2 in. wide margin at the edges to be field welded.
- C. Field Priming:
 - 1. Before the formation of rust and after observation of the surface by the FIELD OBSERVER, the cleaned surfaces (SSPC-SP10) shall be primed with the specified primer.
 - 2. Stripe Coat: After the application of the first coat, all seams, edges, lapped joints, rough areas, bolt heads and nuts, remains of erection lugs and scars, corners, member intersections, and other deviations from smooth surfaces shall be primed by brush and/or roller using 10% thinned material. The 10% thinned material shall be worked sufficiently into all cracks, crevices, and seams. Initial spray application of this stripe coat shall not be permitted.
 - 3. The primer shall not be applied closer than 6 in. to an uncleaned surface.
- D. Finish Coat: After adequate curing of the prime coat and stripe coat, the primed interior surfaces shall then be cleaned of all dust, overspray, abrasive, and other contaminants which might cause premature coating failure and given one finish coat of the specified

ultra-high solids epoxy coating. If the finish coat is not applied before the recoat window elapses, then the primed surfaces shall be scarified by abrasive blasting or other method recommended by the manufacturer in order for the finish coat to properly bond to the prime coat. All seams, rough areas, deviations from smooth surfaces, pits, remains of erection lugs and scars, and corners shall be coated with the ultra-high solids epoxy coating using multiple passes and squeegeing of the product to ensure that all surfaces receive the specified film thickness and that the material is worked sufficiently into all cracks, crevices, seams, all edges, rough areas, deviations from smooth surfaces, pits, and corners. Equipment shall have a letter from the coating manufacturer's technical services stating the equipment is appropriate for the use intended in applying the material. All heating of equipment, mixture ratios, storage requirements, and other requirements as set forth in the product data sheets shall be followed.

END OF SECTION

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SECTION 13110 - CORROSION PROTECTION FOR STEEL TANK INTERNALS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Contractor shall provide all materials, manpower, tools, and equipment to complete the Work specified herein and shall perform all subsidiary and incidental work necessary to complete the Work in conformance with the project requirements.
- B. The Work includes all labor and materials to provide and install corrosion control facilities on the new Lake Havasu City North Tank Project. The Work is as follows:
 - 1. A sacrificial anode cathodic protection (CP) system for the internal surfaces of the steel reservoir, which includes supplying all materials; installing anode and portable reference cell access ports; installing anode header cable; installing anodes; installing permanent reference cells and anode control box, repairs to tank roof coating; connecting the anodes and testing; and all accessories required for a complete operable cathodic protection (CP) system.
- C. The Contractor shall retain a qualified Corrosion Engineer to direct the construction of facilities specified herein. The Corrosion Engineer shall test and certify that the corrosion control facilities for this project are constructed properly and as specified, and are fully functional.

1.2 DEFINITIONS

- A. CONTRACTOR: The licensed prime installer selected by the OWNER to install the pipeline.
- B. OWNER: Lake Havasu City (City).
- C. CORROSION ENGINEER: A qualified Corrosion Engineer retained by the Contractor who is either a Registered Professional Corrosion Engineer or an AMPP (formally NACE) Certified Cathodic Protection Specialist.
- D. ENGINEER: The City's Resident Engineer or designated representative.
- E. CITY'S CORROSION ENGINEER: The Engineer's appointed representative from the City.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designations only.

American Society for Testing and Materials (ASTM):

B3	Soft or Annealed Copper Wire
B8	Concentric-Lay Stranded Copper Conductors
B107	Magnesium Alloy Extruded Bars, Rods, Shapes, Tubes, and Wire
D1248	Polyethylene Plastics Molding and Extrusion Materials
D2220	Polyvinylchloride Insulation for Wire and Cable

SECTION 13110 - CORROSION PROTECTION FOR STEEL TANK INTERNALS

American Water Works Association (AWWA):

D100 Welded Steel Tanks for Water Storage

AMPP - National Association of Corrosion Engineers (NACE):

SP0196 Galvanic Anode Cathodic Protection of Internal Submerged Surfaces of Steel Water Storage Tanks

1.4 SUBMITTALS

The following information shall be submitted for approval of the Engineer prior to the start of work:

A. Catalog Cuts (3 copies):

1. Magnesium Anodes (10', Standard Potential)
2. Wire and Cable
3. Wire Splice Materials or Kits
4. Anode Access Ports (by parts)
5. Anode Access Port Aluminum Cap
6. Permanent Reference Cells
7. Reference Cell Access Ports (by parts)
8. Wire Insulators/Hangers
9. Anode Control Box
10. Conduit
11. Exothermic Weld Kits and Charges
12. Weld Caps and Primer
13. Weld Coating
14. Qualifications of the Contractor's Corrosion Engineer

B. The Contractor shall submit as-built drawings (marked-up drawings) showing the actual locations of all anode and reference cell ports, tank penetrations, conduit, and anode control box enclosure. As-built drawings shall be received by the Engineer before the work is considered complete. Any changes shall be clearly marked in red.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials and equipment furnished under this section of the specifications shall be the standard product of manufacturers regularly engaged in the manufacturing of such products and shall be the manufacturer's latest standard design that complies with specification requirements. All materials and equipment shall bear evidence of U.L. approval when U.L. standards exist.

2.2 MAGNESIUM ANODES (10', Standard Potential)

A. Anodes shall be extruded magnesium alloy rods in accordance with ASTM B107 with a steel wire core. The standard potential magnesium alloy shall have a theoretical energy capacity of 1000 ampere-hours per pound and have a nominal useful capacity of 500 ampere-hours per pound.

SECTION 13110 - CORROSION PROTECTION FOR STEEL TANK INTERNALS

- B. The chemical composition shall be as follows:

Aluminum	2.5 to 3.5%
Manganese	0.20% Min.
Zinc	0.7 to 1.3%
Silicon	0.05% Max.
Copper	0.01% Max.
Nickel	0.001% Max.
Iron	0.002% Max.
Other (each)	0.05% Max.
Other (total)	0.30% Max.
Magnesium	Remainder

The open circuit potential of the anode shall be between 1.40 and 1.50 volts versus a copper/copper-sulfate reference electrode.

- C. Anodes shall have an outside diameter of 2.024-inch and a nominal weight of 2.5 pounds per linear foot. Lengths are 10 feet as shown in the Drawings. The steel wire core shall be 3/16-inch diameter.
- D. The anode lead cable shall be attached to the steel wire anode core with suitable brass crimp connector. The connection shall be silver soldered or brazed as shown in the Drawings. The connection shall be insulated with a heat shrink, mastic filled sleeve. The sleeved connection and 2 inches of the anode shall be fully encapsulated with a PVC cap filled with potting epoxy as shown in the Drawings.

2.3 ANODE AND REFERENCE CELL ACCESS PORT ASSEMBLY

- A. Construction: The anode port assembly, shown in the Drawings, shall be fabricated from the following materials:

SS Clevis;
Porcelain Roller;
1/16" Neoprene Washer;
1/16" Nut, Bolt, and Washer
Wire U-clamp

- B. All metallic materials shall be Type 316 stainless steel.

2.4 ACCESS HANDHOLES

- A. Construction: The access handholes shall have a 6-inch diameter cover. The cover shall be 10 Ga. Type 316 stainless steel. The ring gasket shall be 1-inch wide by 1/8-inch thick neoprene with a 5-inch diameter ID. The 3/16-inch - 20 stainless steel bolt and stainless steel nuts and washers shall be as shown in the drawings.

2.5 ANODE CONTROL BOX

- A. Type: Use Corpro CorrPower Magnesium Anode Controller or approved equal.

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- B. Enclosure: epoxy coated steel or stainless steel, NEMA 4X, rain tight enclosure. The enclosure shall have a hinged door with a lock hasp. All hinges and fasteners shall be stainless steel.
- C. Anode Control Box Location/Installation: The anode control box shall be mounted adjacent to the tank ring wall at ground elevation and below the tank penetration for cathodic protection cables (located just below the radial line or “knuckle” of the tank). The steel post shall be installed in the ground to a depth of 2 feet and shall be encased in concrete with a diameter of 24 inches. The post and test box shall extend above grade by 4 feet. Unistrut (epoxy coated) attached to the tank may be used in lieu of the steel post with approval from the engineer.

2.6 COPPER SULFATE REFERENCE ELECTRODE (PERMANENT)

- A. General Requirements: Copper sulfate reference electrodes (or cells) shall be constructed with an ion trap to prevent contamination. The reference electrode shall have a design life of 15 years and a stability of +/-5 millivolts under a 3.0-microampere load.
- B. Reference Electrode Wires: Provide each reference electrode with a No. 14 AWG THWN lead wire. The cells shall have red insulation. For reference cells installed inside tank, each lead wire shall be long enough to extend from the electrode to the anode resistor box without any splices. For buried reference cells installed inside tank, each lead wire shall be long enough to extend from the pipe trench to the test box without any splices.
- C. Type: Use STAPERM™ Model CU-2-FW or approved equal.

2.7 WIRE AND CABLE

- A. All Wire: All wire shall be single conductor, stranded copper of the gauge indicated. Wire sizes shall be based on American Wire Gauge (AWG). Copper wire shall be in conformance with ASTM Standards B3 or B8. Wire with high molecular weight polyethylene (HMWPE) insulation and shall conform with the requirements of ASTM D1248m Type 1, Class C, Grade 5. Wire with THWN insulation shall conform with the requirements of ASTM D-2220.
- B. Anode Lead Wire: The anode lead wires shall be No. 8 AWG HMWPE. Each anode shall have a lead wire of sufficient length to reach from the anode to the splice to the header wire without a splice as shown in the Drawings.
- C. Cable Lengths: Anodes shall be provided with sufficient cable length to effect the installation as shown on the Drawings. Provide at least 3 feet of excess cable.
- D. Header Wire: No. 6 AWG with HMWPE insulation.
- E. Tank Lead Wire: No. 8 AWG with HMWPE insulation.
- F. Reference Cell Lead Wire: No. 14 AWG with RHH-RHW insulation

2.8 WIRE HANGERS AND CONNECTION HARDWARE

- A. Insulators (Wire Hangers): The anode header cable shall be secured to the tank roof with a porcelain insulator with an embedded steel threaded stud which is bolted to the tank roof plates as

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shown in the Drawings. A 1/16-inch thick neoprene gasket shall be placed between the insulator and the inside of the roof plate to completely seal the crevice. The insulators shall be fastened with stainless steel washer and two nuts.

- B. Support Hardware and Fasteners: All bolts, washers and wire support hardware shall be 316 stainless steel.
- C. Wire Connectors: Wire splices shall be made with brass crimp connectors specifically sized for the wire sizes being spliced.
- D. Splice Encapsulation Materials: All wire splices shall be encapsulated in a watertight seal made with butyl rubber electrical putty and vinyl plastic tape. Pre-manufactured splice kits using molds and epoxy potting compounds can be submitted as an alternate for approval by the Engineer.

2.9 CONDUIT AND CONDUIT FITTINGS

- A. Conduit and Fittings: See City Standard Specifications

2.10 EXOTHERMIC WELD KIT

- A. Wire Connections: Wire-to-metal connections shall be made by the exothermic welding process. Weld alloy shall be for steel pipe. It is the CONTRACTOR's responsibility to determine the manufacturer's recommended weld charge size for metallic surfaces.

2.11 WELD CAPS AND PRIMER

- A. Weld Caps: Exothermic welds shall be sealed with a pre-fabricated plastic cap filled with formable mastic compound on a base of elastomeric tape. Weld caps shall be Royston Handy Cap or equivalent.
- B. Weld Primer: Weld cap primer shall be an elastomer-resin based corrosion resistant primer for underground services such as Royston Roybond Primer 747 or equivalent.

2.12 WELD COATING

- A. Coating: All exothermic weld caps shall be over-coated with a cold-applied fast-drying mastic consisting of bituminous resin and solvents per MIL-C-18480B. Use Koppers Bitumastic 50 or 505, Tnemec 40-H-413, Tape-coat TC Mastic or 3M Scotch Clad 244. Apply to at least 25 mils thickness.

PART 3 - EXECUTION

3.1 ANODE STORAGE

- A. Anode Handling and Storage: Care must be taken to prevent damage or bending of the anodes during shipment, handling and storage. The contractor shall store the anodes at ground level on 3 wood 4x4s equally spaced until they are ready to be installed. Lead wires and hardware (stainless steel thimbles, u-bolts, etc.) shall be neatly bundled and stored with the anodes.
- B. Weather Protection: Anodes shall be fully encased with two layers of 8-mil polyethylene sheet. Seal the wrap with tape.

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- C. Location: Anodes shall be stored in the location as directed by the City.

3.2 HARDWARE INSTALLATION SEQUENCE

- A. Access Ports: Anode and reference cell access ports shall be installed and all cutting and welding shall be done before the tank is painted or coated.
- B. Header Wire Hangers: Install all anode header wire suspension hardware after the roof is painted and coated but before the tank is put into service. Holes for insulated cable hangers shall be carefully placed so that there is minimum coating damage. Provide rubber or waterproof gasket between the insulator and the roof on the inside and between the metal washer and the roof on the outside.
- C. Conduit, Wiring and Hardware: All remaining cathodic protection wiring, conduit and hardware (except for the anodes) including: the anode header and feed wire; anode pigtailed and splice; hanger/insulators; conduit; tank penetrations; enclosures with all internal components; anode header-to-feed wire splice; and supporting hardware is to be installed and approved before the tank is put into service.
- D. Anode Pigtails: The Contractor shall splice anode pigtailed to the header wire as shown in the Drawings. The pigtail shall be long enough to loop up through the access port and extend beyond the port by 30-inches minimum. The pigtail shall be secured to the stainless steel clevis and porcelain roller for easy access when the anodes are installed at a later date.
- E. Anode Lead Wire Termination: The exact length of cable from the epoxy anode cap to the thimble shall be determined in the field. Note that the bottom tip of the anode is suspended 7 feet off of the tank bottom. The Contractor shall allow enough anode lead wire to extend above the roof by 30-inches minimum after the anode is suspended.
- F. Splice: All wire splices shall be watertight and suitable for long-term exposure to moist and humid conditions. Copper conductor connections shall be made with a brass crimp connector. The watertight covering shall consist of several layers of butyl rubber electrical putty and at least 6 layers of half-lapped vinyl electrical tape as shown in the Drawings. Alternate splice methods, such as splice kits, will be considered and must be approved by the Engineer before use.

3.3 ANODE AND REFERENCE CELL PORT ASSEMBLY

- A. Location: The approximate location of the anode and reference cell port assemblies is shown on the Drawings. Final locations shall be determined in the field after the new roof is in place. The port locations shall be adjusted to avoid roof beams and rafters. Reference cells and reference cell ports shall be placed as close as possible to the mid-point between the two closest anodes. The Contractor shall record final port locations on as-built Drawings.
- B. Roof Holes: Roof holes for anode and reference cell ports shall be cut in accordance with AWWA D100. No structural members shall be cut. All cut edges shall be ground smooth. Hole diameters shall be 5 inches for anode ports and 5 inches for the reference cell ports.
- C. Coating Repairs: All cutting and welding shall be done prior to coating and painting the tank. Any damaged coating resulting from the installation of header wire hangers or any other cathodic

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protection component shall be hand cleaned with wire brushes and abrasive paper and fully coated with a material compatible with the tank coating or paint.

3.4 ANODE CONTROL BOX

- A. Junction Box: The anode control box shall be installed on the exterior tank wall with suitable brackets welded to the tank. All welded brackets must be painted with the tank exterior. Field route conduit to tank penetration and to ring wall penetration for exterior reference cells. Two tank test lead wires shall be welded to the tank bottom ring wall as shown on the Drawings and routed to the anode control box.

3.5 WIRE, CABLE AND CONDUIT

- A. Anode Pre-Assembly: All anode lead wires shall be connected to the anode by the anode supplier in accordance with the Drawings. Alternate lead wire connections can be submitted to the Engineer for consideration and approval.
- B. Header Wire and Tank Penetrations: The header wires shall be suspended from the tank roof from insulators. The header wire shall be spliced to form a continuous loop and shall be spliced to the anode feed wire from the anode junction box. The anode feed wire shall penetrate the tank shell above the high water line as shown in the Drawings. All wiring shall be done in accordance with the National Electrical Code NFPA 70.
- C. Wire Chafe Protection: Wire chafing shall be prevented by securing anode header, feed or pigtail wires to the roof structure at all points where the wire contacts the structure. A galvanized C-clamp shall be used for this purpose.
- D. Conduit: All conduit placed on the outside of the tank shall be spaced off the tank with clamps and non-metallic spacers as shown in the Drawings.
- E. Damaged Wire: Care shall be taken when handling and installing wire so that the insulation is not stretched, kinked or cut. If wire insulation is damaged during installation, it shall be repaired with a fully watertight seal. Wire insulation repairs shall be observed and approved by the Engineer or City's Representative.

3.6 WIRE TO METAL CONNECTION

- A. Connection Method: All connections of lead wires to the pipe shall be made by the exothermic weld method. Deviations from this connection method require the written approval of the ENGINEER.
- B. Weld Charge Size: It is the CONTRACTOR's responsibility to ensure that the manufacturer's recommended weld charge size is used.
- C. Preparation Of Wire: Do not deform cable. Remove only enough insulation from the cable to allow for the exothermic weld.
- D. Preparation Of Metal: Remove all coating, dirt, grime and grease from the metal structure by wire brushing. Clean the structure to a bright, shiny surface free of all serious pits and flaws by using a file. The surface area of the structure must be absolutely dry.

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- E. Wire Position: The wire is to be held at a 30-degree angle to the surface when welding. Only one wire shall be attached with each weld.
- F. Testing Of Completed Welds: After the weld has cooled, the weld shall be tested by striking the weld with a 2-lb hammer while pulling firmly on the wire. All unsound welds shall be cleaned, re-welded, and re-tested. All weld slag shall be removed.
- G. Coating of Welds: The area to be coated shall be clean and completely dry. Apply a primer specifically intended for use with an elastomeric weld cap. Apply the weld cap and a bituminous mastic coating material to all exposed areas around the cap in accordance with the manufacturer's recommendations. The coating shall overlap the structure coating by a minimum of 3 inches.

PART 4 - INSPECTION

The Contractor's Corrosion Engineer shall submit his/her proposed test procedures to the Engineer at least five (5) days in advance of the time that the cathodic protection system testing is scheduled. The Engineer or the Owner's representative shall witness all testing at their discretion. All test data shall be submitted to the Engineer within seven (7) days of the completion of the testing. All testing shall be conducted under the supervision of a qualified Corrosion Engineer who is retained by the Contractor. All deficiencies found to be due to faulty materials or workmanship shall be repaired or replaced by the Contractor and at his/her expense.

4.1 TEST LEADS

- A. It is the CONTRACTOR's responsibility to test all test leads.
- B. TEST METHOD. All completed wire connection welds shall be tested by striking the weld with a 2-lb hammer while pulling firmly on the wire. Welds failing this test shall be re-welded and re-tested. Wire welds shall be spot tested by the Engineer. After backfilling the pipe, all test lead pairs shall be tested using a standard ohmmeter.
- C. ACCEPTANCE. The resistance between each pair of test leads shall not exceed 150% of the total wire resistance as determined from published wire data.

4.2 COMPLETION OF WORK

- A. General: The work shall not be considered complete until the installation is inspected and accepted by the City. The inspection shall consist of a visual examination and measurements for compliance with the Drawings and these Specifications. Any material or work found not to be in compliance with the Drawings or Specifications shall be repaired or replaced by the Contractor at no cost to the City. The work shall not be complete until it is approved in accordance with the provisions of these Specifications.

4.3 CATHODIC PROTECTION PERFORMANCE TESTING (RESERVOIR)

- A. All performance testing shall be done by the Contractor's Corrosion Engineer. The City will witness the testing at their discretion and must be notified at least 3 days in advance of the testing. The Engineer shall be notified when all cathodic protection facilities have been installed. The contractor must also coordinate the installation and the initial testing of the cathodic protection system with the City when the CP system is activated after the one year coating warranty period.

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- B. After the initial cathodic protection system performance testing has been completed, the Contractor shall disconnect the anode header cable inside of the anode control box such that the anodes and cathodic protection system are de-activated. The cathodic protection system shall remain de-activated for the entire coating warranty period (typically 1 year). After the coating warranty inspection, the anodes shall be re-connected, by the Contractor, and the cathodic protection system shall be adjusted (through the anode control box circuit) to comply with the protected levels described in NACE SP0196.

4.4 COMPLIANCE WITH SPECIFICATIONS.

- A. Deficiencies or omissions in materials or workmanship found by these tests shall be rectified at the Contractor's expense. Deficiencies shall include but are not limited to: broken leads, improper anode installations, improper anode control box installations, and other deficiencies associated with the workmanship, installation, and non-functioning equipment.

4.5 CLEAN UP

- A. All debris, tools and storage materials shall be removed from the tank roof and from the premises when the work is complete. Anode port caps shall be installed. Any cost incurred by the City to clean up debris or materials resulting from this work shall be back charged to the Contractor.

*****END OF SECTION*****

SECTION 13205

WELDED STEEL GROUND STORAGE TANK

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PART 1 -- GENERAL

1.1. SUMMARY

- A. Section Includes: This section includes the fabrication and erection of a 750,000 gallon welded steel ground storage tank with a self-supporting aluminum geodesic dome roof; including foundation, painting, and accessories.
- B. Operating Parameters: The tank shall have the following characteristics:

Minimum Capacity within Head Range	750,000	gallons
Maximum Fill Rate	10,500	gpm
Diameter	approx. 75	ft
Freeboard	minimum 1	ft
Elevation – Overflow Level	754	ft M.S.L.
Elevation – Maximum Operating Level (MOL)	753	ft M.S.L.
Elevation – Top of Foundation	733.5	ft M.S.L.
Elevation – Grade	733	ft M.S.L.

- C. Survey Elevations: Prior to engineering and fabrication, CONTRACTOR shall survey existing adjacent ground storage tank on site to verify the existing tank floor and overflow inlet elevations. CONTRACTOR shall verify the tank floor and overflow inlet for the new tank with the OWNER prior to start of work.

1.2. SUBCONTRACTORS

- A. Subcontracting: Fabrication and erection of the tank shall **not** be subcontracted. Foundation construction and painting may be subcontracted. CONTRACTOR shall state the name and address of proposed SUBCONTRACTORS in the **Bid Form**.

1.3. RELATED SECTIONS

- A. Section 01010 - Summary of Work

1.4. REFERENCES - All of the latest revisions at the time of bidding shall apply:

- A. American Water Works Association (AWWA)
1. D100-21, Standard for Welded Steel Tanks for Water Storage
 2. D102-24, Standard for Painting Steel Water Storage Tanks

3. C151/A21.51-02, ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
- B. American Petroleum Institute (API)
1. API Standard 650, Welded Tanks for Oil Storage, Twelfth Edition, Includes Errata 1 (2013), Errata 2 (2014), and Addendum 1 (2014) and Addendum 2 (2016)
 2. API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction, Fifth Edition (2014)
- C. American Welding Society (AWS)
1. Publication D1.1-20, Structural Welding Code, Steel
- D. American Society for Testing and Materials (ASTM)
1. A 36, Structural Steel
 2. A 53, Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 3. A 442, Pressure Vessel Plates, Carbon Steel, Improved Transition Properties
 4. A 516, Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
 5. A 537, Pressure Vessel Plates, Heat-Treated, Carbon-Manganese-Silicon Steel
 6. A 573, Structural Carbon Steel Plates of Improved Toughness
 7. A 580, Stainless and Heat-Resisting Steel Wire
 8. A 588, High-Strength Low-Alloy Structural Steel With 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
 9. F 593, Stainless Steel Bolts, Hex Cap Screws, & Studs
 10. F 594, Stainless Steel Nuts
 11. A 633, Normalized High-Strength Low-Alloy Structural Steel
 12. A 662, Pressure Vessel Plates, Carbon-Manganese, for Moderate- and Lower-Temperature Service
 13. A 678, Quenched and Tempered Carbon Steel Plates for Structural Applications
- E. American Society of Civil Engineers (ASCE)
1. ANSI/ASCE 7-22, Minimum Design Loads for Buildings and Other Structures

- F. American Society of Mechanical Engineers (ASME)
 - 1. Boiler and Pressure Vessel Code
- G. American National Standards Institute (ANSI)
 - 1. Standard A14.3, Safety Code for Fixed Ladders
- H. Occupational Safety and Health Administration (OSHA)
 - 1. Regulation 1910.23, Ladders
 - 2. Regulation 1910.28, Duty to have fall protection and falling object protection
 - 3. Regulation 1910.29, Fall protection systems and falling object protection-criteria and practices
 - 4. Regulation 1926.1053, Ladders
- I. International Conference of Building Officials (ICBC)
 - 1. International Building Code (IBC)
- J. AMPP, The Association for Materials Protection and Performance (formerly SSPC, The Society for Protective Coatings and NACE, National Association of Corrosion Engineers)
 - 1. Standard SP0178-2007-SG – Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to be Lined for Immersion Service
 - 2. Visual Comparator - Surface Finishing of Welds (Complements NACE Standard SP0178)
- K. NSF International (NSF) *{formerly National Sanitation Foundation}*
 - 1. ANSI/NSF Standard 61, Drinking Water System Components - Health Effects

1.5. SYSTEM DESCRIPTIONS

- A. Design Requirements:
 - 1. Standards: The tank, foundation, and all accessories shall comply with AWWA D100-21 or Section 14, Alternative Design Basis for Standpipes and Reservoirs of the AWWA D100-21 except as herein modified, deleted, or amplified. The effects of pressure stabilization shall not be included in the design of cylinders or cones. The minimum plate thickness for any tank shell plate, stiffener, or accessory item located in the interior region shall be 1/4 in. The minimum plate thickness for any exterior accessory items shall be 3/16 in.
 - 2. Design Loads: The tank and foundation shall be designed using the most conservative foundation, member sizes, and support steel thicknesses as

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determined by utilizing the IBC and/or AWWA D100-21, Section 3.1 "Design Loads" allowable loads and stresses. The maximum permissible compressive stress for cylindrical, conical or double-curved sections shall be determined in accordance with AWWA D100-21, Section 3.4.3.

3. Wind Loads: The tank and foundation shall be designed using the most conservative foundation, member sizes, and support steel thicknesses as determined by utilizing the IBC design and allowable stresses (110 mph wind speed) and/or AWWA D100-21 design and allowable stresses (110 mph wind speed).
4. Seismic Loads: The tank and foundation shall be designed using the most conservative design for seismic loading in accordance with the requirements of the IBC and/or AWWA D100-21, Section 13.
5. Geotechnical Investigation: A geotechnical investigation has been conducted by the SOIL CONSULTANT. A copy of the soil borings and report shall be available at the office of the OWNER and ENGINEER. A copy of the soil investigation shall be furnished with the bid documents sent to CONTRACTORS, if specifically requested. However, the report is provided for information only and is not a part of the contract documents. Foundations shall be designed based on the findings in this report using the CONTRACTOR'S loadings. The allowable soil pressure to be used for spread foundations shall be 2,500 PSF at a minimum depth of 3 ft below existing grade. The bearing value stated above shall not be exceeded for all direct loads including wind. The bearing values stated above may be increased 33% for all direct loads including earthquake. If the CONTRACTOR deems the soils information provided as inadequate or inaccurate, he may conduct his own investigation at his own expense, but must inform the OWNER and ENGINEER of this inadequacy or inaccuracy in writing prior to the bid opening. This soils information is provided for the benefit of the CONTRACTOR and is in no way guaranteed by the OWNER or ENGINEER. The BIDDER must contact the OWNER and ENGINEER prior to conducting any additional site investigations. For spread foundations or for deep foundations the CONTRACTOR shall pay for the soils laboratory to verify the allowable soil bearing pressure.
6. Foundation Design: The reinforced concrete tank foundation shall be designed by the CONTRACTOR based on the results of the subsurface explorations and associated recommendations. The foundation shall be designed based on 3500 psi concrete. However, the concrete construction shall be performed using 4000 psi concrete as specified in Section 03300 - Concrete. The tank bottom plates shall rest on a 6 in. compacted sand cushion. See Section 02200 - Earthwork for further requirements of sand cushion. The 6 in. sand cushion shall slope upwards towards the center of the tank at a slope of 1 in. vertical to 10 ft horizontal. The concrete foundation shall extend a minimum of 3 ft below existing grade. The top of the foundation shall be 6 in. minimum to 12 in. maximum above the finish grade. See Section 02200 - Earthwork, Section 03100 - Concrete Formwork, Section 03200 - Concrete Reinforcement, Section 03300 - Concrete, and Section 03600 - Nonmetallic Grout.

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7. Foundation Construction: The tank foundation excavation shall be carried to sound soil at the strata specified in Section 02200 - Earthwork and verified by the SOIL CONSULTANT. See Section 02200 - Earthwork, Section 03100 - Concrete Formwork, Section 03200 - Concrete Reinforcement, Section 03300 - Concrete, and Section 03600 - Nonmetallic Grout.
8. Nozzles and Attachments: All nozzles and attachments to the tank shall be designed for the loads imposed by mechanical action, pressure deformation, and earthquake.
9. Corrosion Allowance: No corrosion allowance is to be included in the design of this structure, unless deemed necessary as a part of the normal design practice of the CONTRACTOR.
10. Seal Welding: All connections and interfaces on the container interior on or below the top of the shell (including any steel mounting brackets welded to the shell for the aluminum roof-to-steel shell connections) shall be seal welded to eliminate all crevices and open joints. (Seal welding means no unwelded interfaces at the intersection of any steel members, structural or nonstructural). The minimum plate lap allowed in the tank bottom shall be the greater amount; 1-1/2 in. or five (5) times the plate thickness, and the maximum plate lap allowed shall be 4 in.
11. Corners and Edges: Unless specified otherwise, all protruding corners that are not welded to another member shall be rounded to 1 in. minimum radius prior to cleaning and painting, and all protruding edges that are not welded to another member shall be ground to 1/16 in. minimum radius prior to cleaning and painting.
12. Dimensional Tolerances: The following dimensional tolerances shall be utilized to produce a tank of acceptable appearance and to prevent undue excessive stresses in the structure:
 - a. Plumbness: The maximum out-of-plumbness between the top and bottom of the tank shell shall not exceed 0.1% of the overall height of the tank shell.
 - b. Roundness: Radii measured from a theoretical common center point of the tank to a point on the container shall not exceed the following tolerances (offsets may be utilized to measure distance from theoretical center):

<u>Diameter Range</u>	<u>Radius Tolerance</u>
0 to 40 ft, exclusive	$\pm 1/2$ in.
40 to 150 ft, exclusive	$\pm 3/4$ in.
150 to 250 ft, exclusive	± 1 in.
250 ft and over.....	$\pm 1-1/4$ in.
 - c. Peaking: With a horizontal sweep board 36 in. long, peaking shall not exceed 1/2 in.

- d. Banding: With a vertical sweep board 36 in. long, banding shall not exceed 1/2 in.
 - e. Measurements: Measurements shall be taken prior to the water test, and shall apply to all points on the surfaces (not restricted to seams). Peaking and banding measurements shall also be performed on the roof.
13. Roof Contour: The roof shall be designed and erected such that the final contour provides positive drainage after end of exposure to water (rain or other source). The roof shall be an aluminum geodesic dome in accordance with Section 13207 - Aluminum Dome Roof.
14. Design and Drawing Certification: All designs, drawings, and details for this project shall be performed under the supervision of a Professional Engineer registered in the State of Arizona and shall have the dated seal and signature of that P.E. affixed to such submittals in accordance with Section 01300 - Submittals.

1.6. SUBMITTALS

A. Submit sets to the ENGINEER in accordance with Section 01300 - Submittals.

- 1. Site Security: The site is located at the airport and as such CONTRACTOR shall comply with the security requirements of the airport and shall submit procedure for keeping the outer perimeter gate closed.
- 2. Construction Drawings: Drawings, data, etc. shall be reviewed by the ENGINEER within approximately two (2) weeks after receipt. Review of these drawings shall not relieve the CONTRACTOR from responsibility for compliance with the specifications or for the adequacy of the design and construction methods or for completion of the Project on time. If necessary to verify the structural adequacy of a structural member and/or connection, the CONTRACTOR shall provide design and detailing data to the ENGINEER.
 - a. Details: The location and size of all manholes, vents, piping, and stairs shall be detailed on the construction drawings. These construction drawings shall include all member thicknesses, dimensions, welding details, material specifications, shop and field assembly instructions (including any temporary attachments or openings), cleaning and painting instructions, and foundation interface dimensions and loadings. Upon specific request of the ENGINEER, design calculations may be required to support the construction drawings.
 - b. Capacity Chart: CONTRACTOR shall submit copies of the tank capacity chart using one-half (1/2) foot increments.
- 3. Roll-Out: Submit a roll-out layout of the tank showing all weld seams and where the tank will be cut and rewelded for erection, rigging, or ventilation purposes, including distinctions between seams welded in the shop, on the ground, and in the air. This drawing shall also be used to record all radiograph locations. This

drawing shall be submitted prior to tank erection. Other items to be noted on the roll out:

- a. Locations and total footage of primary stressed welds (with shop, ground, and air welds designated and the thickness range for each grouping).
- b. Locations and total footage of secondary stressed welds (with shop, ground, and air welds designated and the thickness range for each grouping).
- c. Approximate minimum number of required radiographs for shop, ground, and air welds.

The field foreman shall use the roll-out to record the welder's initials on each seam so as to keep a permanent record of the specific welder for each welded seam.

4. Product Data:

- a. Safe-Climbing Device: Submit safe-climbing device catalog cuts and manufacturers installation details.
- b. Vandal Deterrent: Submit vandal deterrent catalog cuts and manufacturers installation details.
- c. Submittal Compliance with Specifications: All drawings, catalog cuts or other descriptive information submitted to the ENGINEER for review shall bear a signed approval by the CONTRACTOR that the submitted material meets these specifications.
- d. Domed Aluminum Roof: Details of the new aluminum dome roof and all appurtenances if different than that shown on Drawings, including design calculations for the roof and wind girder/shell stiffener. These drawings and calculations shall be signed by a Registered Professional Engineer in the State of Arizona.

5. Certifications:

- a. Welder's Qualifications: All welders shall be certified to the process, procedure and positions used in the assembly of the tank. The CONTRACTOR shall submit copies of each welder's qualifications (ANSI/AWS B2.1, Standard for Welding Procedure and Performance Qualification or ASME Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications) to the ENGINEER prior to the start of any work. The ENGINEER and FIELD OBSERVER shall be permitted to request positive identification of each welder working on the tank.
- b. Mill Test: Submit mill test certifications of all primary stressed, secondary stressed, and load bearing plate, structural components, and safety related components to the ENGINEER prior to the start of the erection of the tank.

- c. Safe-Climbing Device: Submit certification signed by the supplier of the safe-climbing device attesting that the safe-climbing device meets these specifications and all applicable laws and regulations.
- d. Welding Procedures: Submit welding procedures for all joints utilized in the construction of the tank and accessories.

6. Contract Closeout Submittals:

- a. Written Report: At the conclusion of the erection of the tank, the CONTRACTOR shall submit a written report as specified in AWWA D100-21, Section 11.2. Copies of the report including completed copies of the "roll-out" drawing referred to above shall be forwarded to the ENGINEER **prior** to starting the field painting of the tank.
- b. "As-Built" Drawings: The CONTRACTOR shall submit five (5) sets of ENGINEER reviewed "As-Built" drawings and catalog cuts and descriptive literature needed by the OWNER for proper operation of the tank and accessories. This documentation shall be submitted to the ENGINEER **prior** to acceptance of and final payment for the project.
- c. O&M Manual: Submit O&M Manual in digital and hard copy formats, that includes, but not limited to, the following items needed by the OWNER for proper operation of the tank accessories. This documentation shall be submitted to the ENGINEER prior to acceptance of and final payment for the project.
 - (1) operating and maintenance instructions of items fabricated and installed by the CONTRACTOR,
 - (2) vendor/supplier o&m's,
 - (3) inspection frequency checklist,
 - (4) tank drawings,
 - (5) foundation drawings,
 - (6) cleaning and painting instructions (if prepared by CONTRACTOR),
 - (7) tank capacity chart, and
 - (8) any other catalog cuts and descriptive literature.

1.7. DELIVERY, STORAGE, AND HANDLING

- A. Requirements: Deliver, store and handle materials in strict accordance with the manufacturer's recommendations.
- B. Protection: Protect galvanized and aluminum parts from damage during handling and storage. Do not allow galvanized or aluminum parts to rest directly in contact with the ground, and do not allow the galvanized coating to become damaged.
- C. Material Storage: All materials and equipment stored at the site shall be protected from the elements where such exposure would be detrimental, and shall be adequately supported to prevent bending, warping, damage to painted surfaces, and other

degradation of material properties. Painted components shall also be stored on supports to minimize contact with the ground.

- D. Handling: Allow shop applied coatings (paint) to cure adequately before stacking for storage or transportation.

1.8. PROJECT CONDITIONS

- A. Location: The tank site is located off of Whelan Drive in Lake Havasu City, Arizona. The OWNER shall establish and drive a stake at the center of the tank prior to the start of any Work at the site. The OWNER shall note a temporary bench mark elevation for use during construction. See site plan for the tank location and for the temporary bench mark information. The site is located at the airport and as such CONTRACTOR shall comply with the security requirements of the airport and FAA regulations.
- B. Site Access: Access to the site is by streets and thoroughfares and a CONTRACTOR furnished access road from publicly owned roads to the tank site. The area of the access road shall be restored to rut-free condition upon completion of the Work by the CONTRACTOR. After the completion of the Project, all roads damaged by the CONTRACTOR'S actions shall be restored to the condition at the time of the bid opening.
- C. Times for Work: No on-site work is to be done during the hours between sunset and sunrise. The times for Work shall also comply with local, state and federal regulations and laws regarding days of week, noise and interference with activities of surrounding property owners. Should temperatures be excessive for personnel welfare during daylight hours, or should other job conditions make nighttime Work beneficial to the CONTRACTOR and OWNER, written permission may be granted by the ENGINEER and OWNER to conduct Work at night. This permission shall only be granted if the CONTRACTOR provides the proper lighting and safety equipment and informs the neighboring occupants and property owners.
- D. Contractor Supervision: Except where the CONTRACTOR is an individual and gives his/her personal superintendence to the work, the CONTRACTOR shall provide a competent superintendent, satisfactory to the OWNER, for the work at all times during working hours with full authority to act for CONTRACTOR. The CONTRACTOR shall have a full complement of personnel, for the proper coordination and expedition of the work, on a continuous basis until the work is completed. Should, in the opinion of the OWNER, any language barrier exist between the on-site superintendent and the OWNER, the CONTRACTOR shall employ a qualified full-time interpreter or provide a new on-site superintendent at no additional cost to the OWNER.
- E. Safety and Health: The CONTRACTOR shall comply with safe working practices and all health and safety regulations and requirements of Federal OSHA, state and local health regulatory agencies, Material Safety Data Sheets (MSDS), and the paint manufacturer. This compliance shall be accomplished without supervision from the OWNER, ENGINEER, FIELD OBSERVER, or other direct or indirect agents of the OWNER. Should vents, holes, rigging attachments, or any other modification, cutting, or welding be required to meet safety standards, they may be accomplished at the expense

of the CONTRACTOR upon submitting of details in writing to, and with subsequent review by the ENGINEER.

- F. Attractive Nuisances and Cleanup: The job site shall be kept in a clean and safe condition at all times. Hazards or attractive nuisances shall be protected at all times. The daily debris shall be cleaned up and stored at least daily in covered dumpsters. Each dumpster shall be labeled or marked clearly with the date the first waste is deposited in the dumpster. The debris shall be disposed of by the CONTRACTOR in a manner which will place no liability for hazardous waste on the OWNER. Upon completion of the Work, the job site and all nearby sites impacted by the Work activities shall be left clean of all debris, blasting residue, or any other items resulting from the operations of the CONTRACTOR. The cost of any cleanup that must be done by the OWNER shall be deducted from funds due the CONTRACTOR. Removal of the debris from the site and proper legal disposal of same is to be done at the cost of the CONTRACTOR. The disposal site shall be as approved by the OWNER in writing. This approval by the OWNER shall not relieve the CONTRACTOR from proper legal disposal of the debris in accordance with all federal, state, and local requirements.
- G. Operation of Valves and Equipment: All operations which would include closing valves, switching, starting, stopping, or removal from service of any equipment shall be done by the OWNER'S personnel. If the CONTRACTOR desires the OWNER to close valves, operate switches, start, stop, or remove any equipment from service, the CONTRACTOR shall submit a written request to the OWNER, and if the OWNER determines that such action will not adversely affect the operations of the OWNER to provide water, then the OWNER may close valves, operate switches, start, stop, or remove the equipment from service. Such requests shall be directed to the PROJECT REPRESENTATIVE so interruptions, if any, of the OWNER'S operations or systems will be no longer than necessary. The CONTRACTOR shall have a full complement of personnel working on a continuous basis until the Work causing the interruption is completed. All Work performed under this Agreement shall be performed in close cooperation with the OWNER.
- H. OWNER Performed Work: The CONTRACTOR shall cooperate with the OWNER who may be conducting other operations on or near the tank.
- I. Site Finish: The CONTRACTOR shall remove all construction equipment and debris, including welding rod stubs, any miscellaneous pieces of steel, and other construction supplies or materials from the tank site upon completion of the Project. The design finish grade elevations shall be as shown on Section 00850 - Drawings.

1.9. PERMITS AND APPROVALS

- A. The OWNER shall obtain and pay for all local permits and certificates. The CONTRACTOR shall obtain and pay for all other state permits and certificates required in conjunction with this Work.
- B. The site is located at the airport and as such CONTRACTOR shall comply with the security requirements of the airport and FAA regulations. The FAA form 7460-1 for the permanent structure was submitted to FAA and the study assigned number ASN 2025-

AWP-4301-NRA. CONTRACTOR shall file with FAA the form 7460-2 for the permanent structure and shall file with FAA regarding any of the CONTRACTOR'S temporary structures to be used for the work such as cranes.

1.10. FIRST ANNIVERSARY INSPECTION

- A. A first anniversary inspection shall be performed. The CONTRACTOR'S Performance Bond or a separate Maintenance Bond shall be in force until after any remedial work is performed. The CONTRACTOR shall be present for the first anniversary inspection and shall furnish an experienced foreman, laborer, rigging, and assistance for the evaluation. Repairs requiring extensive work and rigging may be delayed until a time mutually agreeable to the OWNER and CONTRACTOR. All costs associated with the first anniversary inspection, including disinfection, shall be included in the Base Bid price. The performance of this inspection and/or any remedial work shall not relieve the CONTRACTOR of any responsibility for defects in materials or workmanship which may or may not be evident during the first anniversary inspection. See Section 09800 - General Specifications for Coating Systems for further first anniversary inspection requirements.

1.11. SEQUENCING AND SCHEDULING

- A. Schedule Submittal: Within two weeks after receipt of the Notice to Proceed and prior to starting the Work, the CONTRACTOR shall submit a bar chart showing, at a minimum, the anticipated schedule of the following functions for the new tank:
1. site clearing
 2. foundation construction and piping installation
 3. tank fabrication
 4. tank erection
 5. tank water testing
 6. tank painting
 7. tank disinfection
 8. site grading and clean-up

Also indicated on the bar chart shall be the anticipated progress payment request. The bar chart and payment request schedule shall be updated monthly and submitted with the payment request. **No separate payment shall be made for bonds, insurance, design, drawings, or paint materials not incorporated into the Work.**

- B. Notification: The CONTRACTOR shall notify the OWNER, ENGINEER and the FIELD OBSERVER at least seven (7) days before starting each phase of the Work at the site. Arrival time shall be verified to the OWNER, ENGINEER and FIELD OBSERVER 24 hours prior to commencement of site work. The phases of the Work shall be as listed in the Schedule Submittal paragraph above.
- C. Foundation: Construct foundation and include all necessary sleeves through foundation for piping, etc.

- D. Fabricate and Shop Prime Steel: Fabricate tank parts and shop clean and paint prior to delivery to site.
- E. Field Clean and Coat: After erection, field clean and paint abraded and damaged areas and along weld seams.
- F. Disinfection: After proper curing of coatings, clean and disinfect tank.
- G. Project Time: The fabrication and erection of the tank shall be accomplished in such a way as to minimize the number of days required for observing the fabrication and erection operations.

PART 2 -- PRODUCTS

2.1. MATERIALS

- A. All structural steel components shall be fabricated from new ASTM A 36 material.
- B. All new steel pipe attached to the tank shall be ASTM A 53.
- C. All steel plates, shapes, and bars shall be fabricated from new ASTM A 36 material if the tank is designed in accordance with AWWA D100-21. All steel plates, shapes, and bars shall be fabricated from new ASTM A 36, A 442, A 516, A 537, A 573, A 588, A 633, A 662, or A 678 material if the tank is designed in accordance with AWWA D100-21, Section 14, Alternative Design Basis for Standpipes and Reservoirs. All steel plates and shapes shall be free from any laminations that bring questions as to the structural integrity of the member. Laminations exposed on the surface or edges of the steel shall be repaired or the member replaced. The CONTRACTOR shall be responsible for ultrasonically or otherwise investigating the extent of sub-surface laminations to the satisfaction of the ENGINEER. Members found to have internal laminations shall be replaced in a timely manner at the expense of the CONTRACTOR.
- D. All safety railing members shall have a minimum thickness of 1/4 in.
- E. All screen material shall be made of aluminum or Type 316, stainless steel wire conforming to ASTM A 580.
- F. All stainless steel bolts and nuts shall conform to ASTM F 593 and F 594.
- G. All interior bolts and nuts below the high water line shall be of silicon bronze material.
- H. Clog-Resistant Aluminum Vent: All aluminum used in the aluminum clog-resistant vent shall be fabricated from the following materials:
 - 1. Structural Shapes: All aluminum structural shapes of the vent shall be alloy 6061-T6.

2. Plates and Sheets: All aluminum plates and sheets shall be mill finished alloy 3003-H16, 3004, 6061-T6 or 5052-H32 and shall have a minimum nominal thickness of 0.050 in.
3. Bolts and Fasteners: All bolts and fasteners shall be Series 304 stainless steel, 2024-T4 aluminum, or anodized 7075-T73 aluminum. Only stainless steel fasteners with nylon shoulder washers shall be used to attach aluminum to steel.

2.2. COMPONENTS

- A. Temporary Construction Openings (Door Sheet): If the CONTRACTOR desires to have a temporary opening through the permanent structure (including the roof) for equipment and personnel access, the CONTRACTOR shall submit the following information for review by the OWNER and ENGINEER **prior** to cutting or welding on the shell. If the submittal is favorably reviewed by the OWNER and ENGINEER, the CONTRACTOR shall remove and replace the shell plate in accordance with American Petroleum Institute (API) Standard 653, API Standard 650, and AWWA D100-21. All required temporary stiffening shall be installed by the CONTRACTOR prior to cutting the temporary shell opening. The CONTRACTOR shall remove the temporary stiffening after the door sheet is welded back in place and repair any surface imperfections prior to coating those areas of the tank surfaces. The CONTRACTOR shall submit for review the following minimum information prior to performing any cutting or welding on the shell or pressure boundary:
 1. A detailed drawing showing the size and configuration of the proposed opening, including details at the intersections with the existing weld seams, corners of the opening, and cut back of corner welds or girth seams.
 2. Details of the location of the proposed opening relative to existing shell openings or penetrations, weld seams, or other attachments to the shell, such as anchor bolts chairs (if any).
 3. A detail drawing of the proposed temporary stiffening along each side and across the top of the opening, including the weld details.
 4. The proposed method (i.e. plasma arc, saw, flame cut, carbon arc-gouge, etc.) and sequence for cutting the opening in the shell and making cut backs. The corner weld between the shell and the bottom shall be gouged on each side at least 12 in. beyond the opening.
 5. Details of the weld joint preparation for the shell and door sheet, including process for grinding and beveling (how the bevel will be made).
 6. Description of weld procedures of all joints and attachment welds, including any preheating or post weld heat treating requirements, rod size, etc.
 7. Description of weld sequence for reinstalling the door sheet.

8. Details of the proposed non-destructive examination (NDE) plan with the number and location of x-rays, magnetic particle testing, visual testing, dye penetrant testing, etc.
 9. Welder credentials and certifications.
 10. Weld qualification procedures.
- B. Support: The tank shall be supported on a reinforced concrete ringwall. The tank shall be either anchored or unanchored as determined by the tank design. If the tank is anchored, anchor bolts shall be provided to resist all lateral shear forces and all moments due to the design loads.
- C. Anchor Bolt Clearance: If the tank is anchored, then the anchor bolts shall have a clear spacing of at least 2 in. between the bolt and the side plates of the anchor bolt chairs and at least 1 in. between the shell and the anchor bolt. If a CONTRACTOR has less spacing around the anchor bolt, then the anchor bolt chair shall be hermetically sealed around the anchor bolt, fitted with lubrication fitting and air relief plugs and sealed with a corrosion inhibitive grease.
- D. Inlet Pipe: The twenty (20) in. diameter inlet piping shall project from the bottom of the shell. Reinforcing and pipe nozzle shall be in compliance with AWWA D100, API 650, and API 653 standards. The pipe shall extend and connect to piping on site below grade by the CONTRACTOR. A flexible expansion joint (such as EBAA Iron Flex-Tend force balanced double ball joint, or Romac Industries FlexiJoint, or equal) shall be located outside the tank to accommodate the minimum movement required by AWWA D100. Butterfly valve shall be furnished and installed by the CONTRACTOR between the flexible expansion joint and tank. Butterfly valve shall be Pratt Model FL (serial number 1233980-2-1HP) or equal approved by OWNER. Pipe supports and footing shall be furnished and installed at the pipe and not on the flanges. Any supports between the tank and the flexible expansion joint shall allow for vertical movement of the piping and flexible expansion joint. The tank shell shall be designed to resist the mechanical, pressure, and seismic loads imposed by this flexible joint. The inlet pipe shall tee inside the tank and shall be equipped with a Waterflex valve and Series 35 check valve as manufactured by Tideflex, or equal allowed by OWNER. Dissimilar metals inside the tank shall be electrically isolated from one another.
- E. Outlet Pipe: The twenty-four (24) in. diameter outlet piping shall project from the bottom of the shell. Reinforcing and pipe nozzle shall be in compliance with AWWA D100, API 650, and API 653 standards. The pipe shall extend and connect to piping on site below grade by the CONTRACTOR. A flexible expansion joint (such as EBAA Iron Flex-Tend force balanced double ball joint, or Romac Industries FlexiJoint, or equal) shall be located outside the tank to accommodate the minimum movement required by AWWA D100. Butterfly valve shall be furnished and installed by the CONTRACTOR between the flexible expansion joint and tank. Butterfly valve shall be Pratt Model FL (serial number 1233980-2-1HP) or equal approved by OWNER. Pipe supports and footing shall be furnished and installed at the pipe and not on the flanges. Any supports between the tank and the flexible expansion joint shall allow for vertical movement of the

piping and flexible expansion joint. The tank shell shall be designed to resist the mechanical, pressure, and seismic loads imposed by this flexible joint.

- F. Interconnect Pipe: The twelve (12) in. diameter interconnect piping shall project from the bottom of the shell. Reinforcing and pipe nozzle shall be in compliance with AWWA D100, API 650, and API 653 standards. The pipe shall extend and connect to piping on site below grade by the CONTRACTOR. A flexible expansion joint (such as EBAA Iron Flex-Tend force balanced double ball joint, or Romac Industries FlexiJoint, or equal) shall be located outside the tank to accommodate the minimum movement required by AWWA D100. Butterfly valve shall be furnished and installed by the CONTRACTOR between the flexible expansion joint and tank. Butterfly valve shall be Pratt Model FL (serial number 1233980-2-1HP) or equal approved by OWNER. Pipe supports and footing shall be furnished and installed at the pipe and not on the flanges. Any supports between the tank and the flexible expansion joint shall allow for vertical movement of the piping and flexible expansion joint. The tank shell shall be designed to resist the mechanical, pressure, and seismic loads imposed by this flexible joint.
- G. Target Gage: The CONTRACTOR shall furnish and install a target gage on the tank exterior. The target gage shall be Shand & Jurs Model 92302 (Kit No. 2, Class A) as manufactured by L&J Technologies, Hillside, Illinois 60162, telephone 708/236-6000, or equal allowed in writing by the OWNER. This shall include, but not be limited to, all bracket supports, float, cables, guides, sheaves, pipe, fittings, etc. and any other items necessary for the proper operation of the new target gage. The steel brackets shall be fully welded to the shell and roof with continuous fillet welds. No penetrations shall be allowed through the tank shell or roof below the high water level. The indicator board shall be aluminum (with graduations in feet) and all cables, guide cables, clamps, etc. inside the tank shall be stainless steel. Dissimilar metals inside the tank shall be electrically isolated from one another.
- H. Exterior Staircase: A staircase along the exterior shell from grade to the roof access conforming to OSHA 1910.25, OSHA 1910.28, and AWWA D100-21 shall be furnished and installed. The staircase shall include a landing at the access to the roof. The location of the staircase shall be verified by the CONTRACTOR with the OWNER prior to design and fabrication, and the design shall be submitted to the OWNER for review and approval prior to fabrication.
- I. Bolted Shell Flush Cleanout: The CONTRACTOR shall furnish and install a 36 in. x 36 in. flush cleanout at the bottom of the shell. The flush cleanout shall be reinforced, and all portions of the flush cleanout, including reinforcing of the neck, the bolting, and the cover, shall be designed to withstand the weight and pressure of the tank contents. All bolted covers shall be hinged or connected by a davit to the tank shell. The cover shall be equipped with a 4 in. diameter drain valve.
- J. Bolted Shell Manholes: The CONTRACTOR shall furnish and install two (2) 36 in. diameter shell manholes in compliance with AWWA D100-21 at approximately 180° from each other. The location shall be as directed by the FIELD OBSERVER and shown on the Drawings. The shell manholes shall be reinforced to comply with Section 3.13 of AWWA D100-21, and all portions of the manholes, including reinforcing of the neck, the bolting, and the cover, shall be designed to withstand the weight and pressure of the tank

contents. All bolted covers shall be hinged or connected by a davit to the tank shell. Shell manholes shall be at approximately 90° from the roof manhole.

- K. Manhole Gaskets: After the completion of the painting and curing of the interior and exterior coatings, new 1/4 in. thick minimum rubber gaskets shall be furnished and installed between the flanges of the bolted shell manholes.
- L. Overflow: A vortex prevention device shall be placed on the water side of the overflow entrance. The overflow pipe shall not be inside the container at any point. The overflow pipe shall be supported at a maximum of 10 ft intervals by attachment to the tank structure. The overflow pipe and vortex prevention device shall be sized by the CONTRACTOR based on a maximum pumping rate into the tank of 10,500 gpm, but the pipe shall be 12 in. minimum diameter. The overflow pipe shall be wrought steel pipe (1/4 in. minimum wall thickness) and shall continue down the outside of the shell terminating with a flange and 24 x 24 mesh screen at 12 in. minimum to 24 in. maximum above a concrete splash pad. The flow shall discharge onto the concrete splash pad adjacent to the concrete foundation.
- M. Overflow Splash Pad: A contoured 5 ft x 10 ft splash pad shall be furnished and installed directly under the discharge end of the overflow pipe to direct water away from the foundation. The concrete splash pad shall be reinforced with 10 gage, 6 X 6 wire mesh. The thinnest portion of the pad shall be no less than 6 in. thick. A 5 ft wide by 10 ft long by 1 ft deep area at the end of the overflow splash pad shall be filled with 4 in. to 6 in. minimum diameter stone rip rap. The pad shall be constructed as shown in Drawing.
- N. Shell Vents: The upper shell above the overflow level shall be equipped with twelve (12) perimeter vents as shown on Drawings. Vents shall be shielded and equipped with 24 x 24 mesh aluminum or 316 stainless steel screens.
- O. Cathodic Protection System: The CONTRACTOR shall furnish and install a cathodic protection system in accordance with Section 13110, including the associated brackets, entrance penetrations, and cabinet mounting brackets. A drawing submittal showing the location of the anode brackets, entrance penetrations and cabinet mounting brackets shall be required. The rectifier, cabinet, anodes, wiring, and conduit shall be furnished under this Contract. All cutting and welding shall be performed prior to the field cleaning of the tank.
- P. Cleaning and Painting Exterior Surfaces: The exterior surfaces of the tank shall be cleaned and painted in accordance with Section 09800 - General Specifications for Coating Systems and Section 09871 - Exterior Coating System for Steel Storage Tank.
- Q. Cleaning and Painting Interior Surfaces: The interior surfaces of the tank shall be cleaned and painted in accordance with Section 09800 - General Specifications for Coating Systems and Section 09872 - Interior Coating System for Steel Storage Tank.
- R. Grout: Furnish and install 1 in. minimum thickness of nonmetallic grout under the tank bottom plate in accordance with Section 03600 - Nonmetallic Grout. The grout shall be applied after erection and allowed to cure properly before filling the tank with water. All steel shim plates within 6 in. of the edge of the bottom plate shall be removed after the

grout has attained sufficient strength and the voids left by removal of the shims shall be grouted.

- S. Nameplate: The tank shall be equipped with a nameplate, bolted to a mounting bracket on the shell above a shell manhole, which lists the height to high water line, capacity, contractor, contract number, year erected, and if the tank was designed in accordance with AWWA D100-21, Section 14 noting the type(s) of materials used. If the tank nameplate is of different metal than that of the shell, the nameplate shall be sufficiently insulated from the shell as to not corrode or cause corrosion due to contact of dissimilar metals. The nameplate shall be protected from the application of paint on the exposed surface.

2.3. SOURCE QUALITY CONTROL

- A. Shop Observation: Shop observation of the fabrication and shop painting by the ENGINEER, FIELD OBSERVER and OWNER may be anticipated.

PART 3 – EXECUTION

3.1. PREPARATION

- A. Foundation: Install the foundations according to the Drawings and Section 02200 - Earthwork, Section 03100 - Concrete Formwork, Section 03200 - Concrete Reinforcement, and Section 03300 - Concrete.
- B. Grout: Install grout as described in Section 03600 - Nonmetallic Grout.
- C. Painting: The exterior and interior surfaces of the tank shall be abrasive blast cleaned and primed in the shop, in accordance with Section 09871 - Exterior Coating System for Steel Storage Tank and Section 09872 - Interior Coating System for Steel Storage Tank. The damaged areas and weld seams on the exterior and interior surfaces shall be cleaned and primed and the entire surfaces field coated in accordance with Section 09871 - Exterior Coating System for Steel Storage Tank and Section 09872 - Interior Coating System for Steel Storage Tank.
- D. Removal of Brackets: Any unnecessary brackets and/or rigging lugs shall be removed from the tank. These areas shall then be treated as described in the following paragraph.
- E. Burrs and Fitting Scars: Any resulting burrs, weld spatter, sharp edges, corners, or rough welds which would cause difficulty in applying a holiday-free coating shall be ground smooth by the tank erection crew. Any gouges shall be filled in with weld where necessary. No fit up equipment, lugs, or the like shall remain on the structure. All painter's rails, braces, brackets, or the like which will be submerged shall be seal welded. Scaffolding shall not be removed until the FIELD OBSERVER has observed the removal of weld spatter and grinding of sharp edges. No weld undercut shall be allowed in welds on submerged surfaces, and any weld undercut on other surfaces exceeding that allowed by AWWA shall be repaired. See Section 09871 - Exterior Coating System for Steel Storage Tank and Section 09872 - Interior Wet Coating System for Steel Storage Tank for further requirements for smooth surfaces.

- F. Cleaning Welded Areas: It shall be necessary to clean painted areas prior to the welding of items to the tank. All areas that have been welded and/or ground smooth shall be cleaned again after welding and grinding and prior to painting to provide proper profile for the coating system. Areas to be welded shall be welded prior to the final cleaning and painting of surfaces within the heat affected zone. The heat affected zone includes the opposite side of the plate or member being welded. See Section 09871 - Exterior Coating System for Steel Storage Tank and Section 09872 - Interior Coating System for Steel Storage Tank for further requirements for smooth surfaces.

3.2. FIELD QUALITY CONTROL

- A. Tank Bottom Welds Evaluation: On completion of welding the tank bottom and prior to painting, the tank bottom joints, including the shell-to-bottom joint (corner weld), shall be tested for water tightness as outlined in AWWA D100-21, Section 11.10. If the CONTRACTOR designs the tank in accordance with AWWA D100-21, Section 14, then the shell-to-bottom joint (corner weld) shall be tested as outlined in AWWA D100-21, Section 14.4.2. All testing shall be performed at the CONTRACTOR'S expense. The CONTRACTOR shall have the testing performed in the presence of the FIELD OBSERVER.
- B. Welding Evaluation: Evaluation of welding shall be by radiographic means at the expense of the CONTRACTOR. The number and locations of radiographs shall be as outlined in AWWA D100-21, Section 11.5. If the CONTRACTOR designs the tank in accordance with AWWA D100-21, Section 14, then the number and locations of radiographs shall be as specified in Section 14.4. Shop welds, field ground assembly welds, and field after erection welds shall each respectively constitute separate or individual quantities of welds to be tested. All door sheet and construction access opening butt-welds shall be full penetration double butt-welds and shall undergo radiographic examination in accordance with API 653, Section 10.2.1.5. Each group of welds; shop, field-ground, and field-air shall be treated as separate types of welds when determining the number of radiographs required with an initial radiograph taken at the first 10 ft of each weld. The ENGINEER and FIELD OBSERVER shall be advised 48 hours and confirmed 24 hours prior to the time when radiographs are being taken and shall be present during the taking of and grading of the radiographs. The radiographs shall be returned to the CONTRACTOR for his files. All weld slag shall be removed to facilitate visual observation of the welding. Grinding of the weld surfaces at the radiograph locations to facilitate reading of the radiographs shall be done if desired by the CONTRACTOR or if requested by the ENGINEER or FIELD OBSERVER. The second sentence of AWWA D100-21, Section 11.6.11 Defective Welds beginning "However, if the original radiograph shows at least 3 in. of acceptable weld" shall not apply to the construction of this tank. Should more than two (2) sections of welds taken in the shop, on the ground, or in the air, respectively, be shown by radiography to be defective, the CONTRACTOR shall take two (2) additional radiographs for each rejected radiograph at locations designated by the ENGINEER or FIELD OBSERVER. For example, if 3 radiographs of the field air welding are defective, then 2 additional radiographs will be taken at locations designated by the ENGINEER or FIELD OBSERVER. These additional radiographs shall be in excess of the tracer radiographs taken adjacent to the weld section originally shown to be defective. All defects found by testing shall be air

carbon arc gouged and rewelded. All repaired areas shall then be retested at no cost to the OWNER.

- C. Timing: If the tank welds in a group have not all been completed at the time of the radiographs are taken, the number of radiographs taken during this session shall be prorated for the percent of completed welds in the respective groups, and the remaining Primary radiographs shall be taken after the welds have been completed.
- D. Temporary Construction Opening: All construction access opening butt-welds shall be full penetration double butt-welds and shall undergo radiographic examination. Construction access opening includes any plate omitted to allow access during construction or an opening cut in a plate for access during construction. After the construction access opening plate is installed, at least one radiograph shall be taken in a vertical joint, at least one radiograph shall be taken in a horizontal joint, and at least one radiograph shall be taken at each corner.
- E. Weld Contour: Weld crown for double-butt welded joints shall not exceed 1/16 in. for plates up to and including 1/2 in.; 3/32 in. for plates greater than 1/2 in. and less than or equal to 1 in.; and in no case shall the reinforcement exceed 1/8 in. The slope of the weld bead as it intersects the base metal shall not exceed 30 degrees. Butt, lap, and tee welds may have natural ripples, provided that they are not so sharp as to cause holidays in the coating. NACE International has developed visual and written standards of contour as outlined in "Standard Recommended Practice - Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service." The following references for surface condition refer to NACE Visual Comparator - Surface Finishing of Welds (Complements NACE Standard RP0178). Although it is the intent that the as-welded contour should require a minimum of chipping and grinding, the finished butt or lap weld contour shall approximate Condition "D" or smoother on both the interior and exterior surfaces. Welds with a contour condition "E" shall indicate a reject condition.
- F. Accessibility for Observation: All Work shall be made accessible to the ENGINEER and FIELD OBSERVER using the CONTRACTOR'S rigging and equipment. If assistance is required for the ENGINEER and FIELD OBSERVER to safely access the work, the CONTRACTOR shall furnish labor to assist the ENGINEER and FIELD OBSERVER. The cost of this labor shall be included in the base contract amount.
- G. Water Test: The tank shall be water tested after painting in the presence of the FIELD OBSERVER. One tank of water shall be furnished and disposed of by the OWNER at no charge to the CONTRACTOR for the water test. The CONTRACTOR shall provide suitable backflow prevention for the filling operations. Additional water shall be furnished at current water utility rates of the OWNER. No leaks shall be repaired unless the water level is 2 ft below the area to be repaired.

END OF SECTION

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SECTION 13207

ALUMINUM DOME ROOF

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PART 1 -- GENERAL

1.1. SUMMARY

- A. Section Includes: This section includes the fabrication and erection of a self-supporting aluminum dome roof on the new welded steel tank. The aluminum dome roof shall be designed, fabricated and erected in accordance with AWWA D108-19 unless modified by this specification. The steel tank shall be designed in accordance with Section 13205 – Welded Steel Ground Storage Tank.

1.2. SUBCONTRACTORS

- A. Subcontracting: Fabrication and erection of the aluminum dome roof may be subcontracted. CONTRACTOR shall state the name and address of proposed SUBCONTRACTORS in the **Bid Form**.

1.3. REFERENCES

- A. All of the latest revisions at the time of bidding shall apply:
- B. American Water Works Association (AWWA)
1. D108-19, Aluminum Dome Roofs for Water Storage Facilities
- C. International Conference of Building Officials (ICBC)
1. International Building Code (IBC)

1.4. SYSTEM DESCRIPTIONS

- A. Design Requirements:
1. General Design: The roof shall be clear-span and designed to be self-supporting from the periphery structure with primary horizontal thrust contained by an integral tension ring or a steel wind girder. Full provisions shall be made to allow for thermal expansion. The minimum dome radius shall be 0.7 times the tank diameter and the maximum dome radius shall be 1.2 times the tank diameter.
 2. Standards: In the design of the aluminum dome roof, the following standards shall apply. All other standards mentioned elsewhere in this specification shall also apply where applicable.
 - a. AASHTO Division 1 Section 15 "Polytetrafluoroethylene Self-Lubricating Slide Bearings"

- b. AASHTO Division 2 Section 25 "Elastomeric Bearings"
 - c. AISI "Stainless Steel Cold-Formed Structural Design Manual"
 - d. Aluminum Association "Specifications for Aluminum Structures"
 - e. Federal Specification TT-S-00230 (silicone compound sealants)
 - f. Federal Specification ZZ-R-765, class 2, grade 50 (preformed silicone gasket material)
3. Design Loads: All design loads shall be in accordance with AWWA D108-19.
 4. Seismic Loads: The aluminum dome roof shall be designed using the most conservative design for seismic loading in accordance with the requirements of the IBC and/or AWWA D108-19.
 5. Flame Cutting and Welding: Flame cutting and welding of the aluminum roof structure shall not be allowed, unless the strength reduction of the members due to welding or cutting is sufficiently compensated for in the design of the members.
 6. Joint Design: The total allowable shear force in a joint shall not be greater than the summation of the allowable shear force of the individual fasteners. The allowable shear force in a fastener shall be equal to the net area of the fastener through the shear plane and the allowable shear stress of the material. The allowable stresses of the materials shall be in accordance with the Aluminum Association's "Specifications for Aluminum Structures" and the AISI "Stainless Steel Cold-Formed Structural Design Manual," for aluminum and stainless steel fasteners, respectively.
 7. Thermal Expansion and Dissimilar Metals: Full provisions shall be made to allow for thermal expansion. Dissimilar materials which are not compatible (such as steel-to-aluminum) shall be physically separated or insulated from each other by means of gaskets or insulating compounds.
 8. Electrical Grounding: The aluminum dome roof shall be electrically interconnected and bonded to the steel tank shell or rim. As a minimum, 1/8 in. diameter stainless steel cable conductors shall be installed at every third support point. The choice of cable should take into account strength, corrosion resistance, conductivity, joint reliability, flexibility and service life.
 9. Plain Carbon Steel: All plain carbon steel (both new and existing) components that will be made difficult to paint after the roof installation shall be painted prior to the roof installation. Areas difficult to paint shall be determined by the ENGINEER, but will generally mean any area within 24 in. of the roof or areas which will be covered by the flashing and inaccessible. The painting shall be in accordance with the Section 09800, 09871, and 09872 of these Detailed Technical Specifications. All painted surfaces shall be smooth to accept the aluminum roof ring without localized abrasion.

10. Design and Drawing Certification: All designs, drawings, and details for this project shall be performed under the supervision of a Professional Engineer registered in the State of Arizona.

1.5. SUBMITTALS

- A. Submit sets to the ENGINEER in accordance with Section 01300 - Submittals
 1. Construction Drawings: Drawings, data, etc. shall be reviewed by the ENGINEER as stipulated in Section 01300 - Submittals. If necessary to verify the structural adequacy of a structural member and/or connection, the CONTRACTOR shall provide design and detailing data to the ENGINEER.
 2. Bid Sketch: A bid sketch of the new exterior wind girder, wind girder bracing, shell stiffeners, etc. showing member sizes, thicknesses, loadings, and location of the wind girder on the existing shell shall be submitted with the Bid.
 3. Erection Location on Site: Description or sketch of proposed site location where the aluminum dome roof will be assembled and how the dome roof will be set in place shall be submitted with the Bid.
 4. Details: Details of the new aluminum dome roof and all appurtenances if different than that shown on Drawings ARR-1, ARR-2, and ARR-3, including design calculations for the roof and wind girder/shell stiffener. The location and size of all roof support members, panels, manholes, vents, piping, stairways, and walkways shall be detailed on the construction drawings. These drawings shall include all member thicknesses, dimensions, material specifications, shop and field assembly instructions (including any temporary attachments or openings), cleaning and painting instructions, and loadings. These drawings and calculations shall be signed by a Professional Engineer registered in the State of Arizona. Details of all interfaces with existing steel shall also be shown, indicating what type of insulation material shall be used to separate dissimilar metals. Also, all details of any new steel added to the tank for attachment of the aluminum roof shall be shown. All such details shall at a minimum meet the requirements of API 650 and API 653.
 5. Shell Platform: Details of the new exterior shell platform and safety railing if different than shown in Drawing ARR-4.

1.6. DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials in strict accordance with the manufacturer's recommendations.
- B. Protect aluminum parts from damage during handling and storage. Do not allow aluminum parts to rest directly on or come in contact with the ground.
- C. Store painted components on supports to minimize contact with the ground.
- D. Allow shop applied coatings (paint) to cure adequately before stacking for storage or transportation.

1.7. WARRANTY

- A. All work shall be guaranteed for one (1) year after the date of substantial completion. This guarantee shall be provided for in the CONTRACTOR'S performance bond or a separate maintenance bond. The CONTRACTOR shall be present for the inspection and shall furnish an experienced foreman, laborer, rigging, and assistance for the inspection. Repairs requiring extensive work and rigging may be delayed until a time mutually agreeable to the OWNER and CONTRACTOR. See Section 09800 - General Specifications for Coating Systems for further Warranty Inspection requirements.

PART 2 -- PRODUCTS

2.1. MATERIALS

- A. Materials: All components of the roof/cover structure above the steel walls shall be aluminum or stainless steel. Carbon steel shall **not** be permitted in the roof/cover. All materials used in the roof/cover construction, including gasket and sealant materials, shall meet USEPA and NSF regulations on water extractability. The materials shall be in accordance with AWWA D108-19. All gaskets and/or sealants shall be resistant to ozone and ultraviolet light.
- B. Clog-Resistant Aluminum Vent: All aluminum used in the aluminum clog-resistant vent shall be fabricated from the following materials:
1. Structural Shapes: All aluminum structural shapes of the vent shall be alloy 6061-T6.
 2. Plates and Sheets: All aluminum plates and sheets shall be mill finished alloy 3003-H16, 3004, 6061-T6 or 5052-H32 and shall a minimum nominal thickness of 0.050 in.
 3. Bolts and Fasteners: All bolts and fasteners shall be Series 304 stainless steel, 2024-T4 aluminum, or anodized 7075-T73 aluminum. Only stainless steel fasteners with nylon shoulder washers shall be used to attach aluminum to steel.

2.2. COMPONENTS

- A. Aluminum Dome Roof: The CONTRACTOR shall furnish and install a self-supporting aluminum dome roof complete with all necessary attachments in accordance with AWWA D108-19 and these specifications.
- B. Wind Girder/Shell Stiffener: The CONTRACTOR shall design, furnish and install a wind girder/shell stiffener near the top of the shell to resist all wind loads and all loads transmitted from the aluminum roof to the shell. The CONTRACTOR shall closely coordinate the wind girder design with the dome manufacturer. The CONTRACTOR shall have a Professional Engineer design the wind girder/shell stiffener and the design and drawings shall be signed and sealed by a Professional Engineer registered in the State of Arizona and submitted for review. The CONTRACTOR shall determine the required member sizes and plate thicknesses. In no case shall the wind girder be constructed from less than 1/4 in. thick steel plate. The wind girder shall be continuously welded to the

shell from the top side, seal welded on the bottom side, and located a minimum of 8 in. and a maximum of 12 in. below the top of the new shell ring. Suitable drain holes shall be installed in the horizontal member. Stair access through the wind girder and safety railings shall be furnished and installed.

- C. Vertical Shell Stiffeners: The CONTRACTOR shall design, furnish and install vertical shell stiffeners to transmit the vertical loads of the aluminum roof to the shell. The CONTRACTOR shall have a Professional Engineer design the vertical shell stiffeners and the design and drawings shall be signed and sealed by a Professional Engineer registered in the State of Arizona and submitted for review. Vertical shell stiffeners shall be provided as required by the design, but shall meet the minimum requirements as shown in Drawing ARR-2. The vertical shell stiffeners shall be designed to not hold water or provisions shall be incorporated to adequately drain the water. Suitable drain holes shall be installed in any horizontal member. The shell stiffeners shall be continuously welded to the shell on both sides.
- D. Aluminum Clog-Resistant Vents: Two (2) new 24 in. minimum diameter clog-resistant vent assemblies shall be installed in the new aluminum dome at locations unobstructed by any roof member, and at least 6 in. away from a roof seam and with one as near to the center of the roof as possible. The new assemblies shall be supplied and installed by the CONTRACTOR and shall conform to the dimensions and installation details approved by the ENGINEER. The CONTRACTOR shall submit copies of the vents with the construction drawings to the ENGINEER prior to fabrication. The aluminum roof vents shall be designed in accordance with AWWA and the Drawings to insure fail-safe operation in the event that the insect screens become occluded or frost over. The aluminum vents shall each be bolted to a flanged manhole. The vents shall be sized to accommodate the flow of the twenty-four (24) inch diameter outlet pipe and sixteen (16) inch diameter inlet pipe for the following conditions; 1) pressure - maximum pumping rate into the tank of 10,500 gpm and 2) vacuum – inlet and outlet pipe breaking outside the ringwall foundation. The vent screen shall be 24 x 24 mesh aluminum with greater than 50% open area and shall be supported so as not to produce a gap greater than 0.10 in. The vent screens or pallets shall be designed to return to their original design locations without human effort after the release of any pressure or vacuum and the screens shall continue to provide screening of the vent during subsequent tank operation. The bolts and nuts utilized in the tank vent shall be of 316 stainless steel or silicon-bronze material. The vent cap shall be designed with a vertical overhang to prevent the entrance of wind driven debris and precipitation. The vents shall be removable so as to provide a 24 in. minimum size free opening for additional access during inspections or future repairs. A rubber gasket shall be located under the aluminum vent flange. CONTRACTOR shall submit a drawing and calculations showing the venting capacity of the vent. Alternative proprietary designs may be submitted for review.
- E. Perimeter Venting: The area between the aluminum flashing and the steel shell around the perimeter of the roof shall be screened with 24 x 24 mesh insect screening. The insect screening shall be stainless steel or aluminum and shall be adequately supported to not produce a gap greater than 0.10 in. The perimeter vent screen material shall be oriented horizontally. If a vertical orientation of the perimeter screening is necessary, adequate shielding shall be provided to prevent wind-driven dust and precipitation from entering the container.

- F. Roof Manhole: There shall be a minimum 30 in. square hinged roof manhole for access to the tank interior. The manhole shall be located near the roof access from the stairs. The manhole cover shall be equipped with a hasp for a padlock. The cover shall open at least 135° and have a downturned edge overlapping the neck at least 2 in. The roof opening shall have a neck of sufficient length to provide a 4 in. minimum protrusion above the roof at the point of installation. The opening shall be at least 12 in. above the water level at maximum overflow pipe flow capacity. At the completion of erection and painting the painter shall install a padlock furnished by the OWNER.
- G. Roof Stairway and Walkway: The CONTRACTOR shall furnish and install a continuous stairway and a nonskid walkway to access the roof vent and emergency vent/manhole near the center of the aluminum dome roof and shall continue to the second hinged roof manhole. The walkway shall be in accordance with OSHA and AWWA D108-10. The nonskid walkway shall extend from the platform and shall extend to within 2 ft of the roof vent and continue to the second hinged roof manhole. All handrails and edges shall be ground smooth and free of any burrs or sharp edges.

PART 3 -- EXECUTION

3.1. CONSTRUCTION

- A. Alignment: The dome shall be constructed plumb, level, and in proper alignment. Field refabrication of structural components or panels will not be accepted. Forcing of the structure to make fit up during construction is forbidden and not acceptable.
- B. Leak Testing: Water for the leak test shall be applied for a minimum duration of 30 minutes.

END OF SECTION

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SECTION 16000

GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A.** Furnish and install all electrical Work as shown on the Drawings and specified. Work includes electrical connections to equipment, wiring devices, disconnects, panelboards for electrical distribution, service entrance, conduit, conductors, and control panels.

1.2 RELATED WORK

- A.** Refer to all drawing sheets for the scope of the electrical work.

1.3 QUALITY ASSURANCE

- A.** All work to be completed to latest edition of National Electrical Code.
- B.** All material to be U.L. listed.
- C.** All equipment to conform to ANSI and NEMA standards.

1.4 SHOP DRAWINGS

- A.** Submit complete Shop Drawings for:
 - 1.** Conduit, Fittings and accessories, (See Section 16111)
 - 2.** Wire, Cable and accessories (See Section 16120)
 - 3.** Grounding (See Section 16450)

1.5 CERTIFICATES AND FEES

- A.** The Electrical Contractor will pay for all fees, connection charges, permits and inspections.

1.6 GROUNDING

- A.** All grounding, as a minimum, will be according to the latest edition of the National Electrical Code, Article 250. Provide a full-size grounding conductor in all conduits.

1.7 DELIVERY, STORAGE AND HANDLING

- A.** Deliver all materials and equipment direct to the job site utilizing Contractor's personnel and not to the Owner's receiving area.
- B.** Store all materials and equipment in a dry area, protected from the weather. Verify location of storage areas with the Owner.

1.8 EXISTING CONDITIONS

- A.** Visit the site and become familiar with existing conditions and limitations.
- B.** Perform all cutting necessary to install the electrical work indicated and all patching, painting, etc. to return the finished surfaces to the original condition. All wiring devices to be installed flush unless noted otherwise.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL

- A.** Install all electrical Work as shown on the Drawings.
- B.** Utilize conduit for all feeders, branch circuiting, and control wiring.

**** END OF SECTION 16000 ****

SECTION 16111

CONDUIT, FITTINGS AND ACCESSORIES

PART 1 - GENERAL

1.1 Description: This Section includes all conduit, fittings and accessories.

1.2 References

1. American National Standards Institute (ANSI)

ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.

2. American Society For Testing and Materials (ASTM)

ASTM A123 - Zinc (Hot Galvanized) Coating on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.

ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.

3. National Electrical Code (NEC)

4. National Electrical Manufacturers Association (NEMA)

FB1 - Fittings and Supports for Conduit and Cable Assemblies.

RN1 - Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.

5. Underwriters' Laboratories, Inc. (UL)

1 - Flexible Metal Electric Conduit.

6 - Rigid Metal Electrical Conduit.

263 - Fire Tests of Building Construction and Materials.

360 – Liquid tight Flexible Steel Conduit

514A - Metallic Outlet Boxes, Electrical.

514B - Fittings for conduit and Outlet Boxes.

514C - Nonmetallic Outlet Boxes, Flush Device Boxes and Covers.

6. Steel Structures Painting Council (SSPC)

SP3 - Power Tool Cleaning.

SP11 - Power Tool Cleaning to Bare Metal.

- 7.** All electrical and control equipment and material shall bear the recognized Underwriters Laboratories, Inc. (UL) seal of approval. It is Vendor's responsibility to obtain local inspection approval for all non-UL labeled equipment and pay all fees in connection with the same.

1.3 Submittals

- . Submit as specified in SECTION 1300.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Rigid Steel Conduit

1. Allied Tube and Conduit Corporation.
2. LTV Steel.

B. Rigid Steel Conduit with Bonded Polyvinyl Chloride (PVC) Jacket

1. OCAL Inc.
2. Robroy Industries.
3. Perma-Cote Industries.

C. Liquid-tight: Flexible Metal Conduit:

1. Anamet, Inc.

2. Electri-Flex Company.

D. Rigid Polyvinyl Chloride (PVC) Conduit

1. Kraloy Plastic Pipe Company.
2. Certain-Teed Products Corporation.
3. Carlon Products Division

E. InnerDuct for Fiber Optic Cable

Smoothwall, HDPE Innerduct may be used only and exclusively for underground installation of fiber optic cable.

1. Kraloy Plastic Pipe Company.
2. Certain-Teed Products Corporation.
3. Carlon Products Division

E. Rigid Steel Conduit Fittings

1. Heavy-duty Cast Malleable Iron Fittings

- a. Appleton Electric Company.
- b. Crouse Hinds Company.

2. Conduit Expansion and Deflection Fittings

- a. O-Z /Gedney Company.

F. Rigid Steel Conduit Boxes

1. Indoor and Outdoor Boxes

- a. Hoffman Engineering Company of Anoka, Minnesota.

2. Conduit Hubs

- a. Appleton Electric Company.
- b. Myers Industries, Inc. (ITT).
- c. Crouse-Hinds Company.
- d. O-Z /Gedney Company.

G. Supports

- 1. B-Line Company.
- 2. Midland-Ross Corporation.
- 3. Unistrut Products Corporation.
- 4. U.S. Gypsum Company.
- 5. Van-Huffel Tube Corporation.

H. Wall Entrance Seals

- 1. O-Z/Gedney Company.

I. Explosion-proof Fittings

- 1. Crouse-Hinds Company
- 2. Appleton Electric Company

J. Fire-stopping Materials

- 1. 3M, (Minnesota Mining and Manufacturing Company)
- 2. Thomas and Betts
- 3. Hilti
- 4. Dow Corning

K. Duct Seal

- 1. Ideal Industries

2. 3M, (Minnesota Mining and Manufacturing Company)

2.2 Design Requirements

- A.** Each length of threaded conduit furnished with coupling on one end and metal or plastic thread protector on other end.
- B.** UL listed and labeled conduit, on each length, fittings and accessories.
- C.** Sizes of conduit, fittings and accessories as indicated, specified or as required by Electrical Codes and Standards.
- D.** Provide and meet the requirements of the following sections for the conduit, fittings and accessories indicated.

2.3 Rigid Steel Conduit

- A.** Conform to ANSI C80.1 and UL-6.
- B.** Mild ductile steel, circular in cross section with uniform wall thickness sufficiently accurate to cut clean threads.
- C.** Each length threaded on both ends with threads protected.
- D.** All scale, grease, dirt, burrs and other foreign matter removed from inside and outside prior to application of coating materials.
- E.** Galvanized by the hot-dip process as follows:
 - 1.** Interior and exterior surfaces coated with a solid, unbroken layer of 99% virgin zinc by dipping.
 - 2.** Coating not to show fixed deposits of copper after four 1-minute immersions in a standard copper sulfate solution.
 - 3.** One coat of zinc chromate finish on inside and outside surfaces to prevent oxidation and white rust.
- F.** Couplings and elbows fabricated, coated and finished by the same process as conduit.

2.4 Rigid Steel Conduit and Fittings with Bonded Polyvinyl Chloride (PVC) Jacket

- A.** Conform to hot-dipped galvanized rigid steel conduit as specified in NEMA-RN1, RIGID STEEL CONDUIT, this Section, and as follows.
- B.** Prior to application of PVC coating, clean interior and exterior surfaces to remove contaminants to provide a suitable surface for bonding.
- C.** Bond the PVC coating to the conduit. Extruded PVC jackets are unacceptable.
- D.** Coated externally with PVC to a nominal 40 mils, 0.035-inch to 0.045-inch.
- E.** Uniformly coat around outside diameter and full length of the conduit.
- F.** Coat the prethreaded ends with a urethane coating having a nominal thickness of 2 mils (0.002-inch).
- G.** Coat the interior surfaces of all conduits and feed-through fittings (except where prohibited by design) with a two-part, chemically cured, urethane coating having a nominal thickness of 2 mils (0.002-inch).
- H.** Exceed the tensile strength of coating with bond between metal and jacket.
- I.** Couplings, elbows, and other conduit fittings, boxes, cover-plates, supports, hardware and related items shall be treated and coated with the same process as conduit.
- J.** Each coupling and fitting shall include a PVC sleeve that overlaps the conduit.
- K.** Length of the overlapping sleeve equals diameter of the conduit or 2 inches, whichever is least.
- L.** Final cured PVC coating capable of withstanding a minimum electrical potential of 2000V.
- M.** All conduit accessories, clamps, and hardware that are uncoated shall be stainless steel.

2.5 Liquid-Tight Flexible Metal Conduit

- A.** Conform to UL-360.
- B.** Liquid-tight conduit with flexible galvanized-steel core and a synthetic rubber, polyvinyl chloride, or thermoplastic covering.
- C.** Spiral encased copper bonding conductors for conduit in sizes 1-1/4 inches and smaller.
- D.** External grounding jumper as required.
- E.** Polyvinyl chloride (PVC) jacket, Type HA or Type O.R. "Seal-Tite" for oil-resistant applications.

2.6 Rigid Polyvinyl Chloride (PVC) Conduit

- A.** Fabricated from self-extinguishing high-impact polyvinyl chloride designed for aboveground and underground installations.
- B.** Type EPC Schedule 80 heavy-wall rigid conduit.
- C.** Fittings and accessories fabricated from same materials as conduit.
- D.** Solvent-cement-type joints as recommended by manufacturer.

2.7 Rigid Steel Fittings

A. Heavy-Duty Cast Malleable Iron Fittings

- 1.** Mogul type for conduit sizes 1-1/2 inches and larger.
- 2.** LBD or roller action type LB for right angle fittings for conduit sizes 2 inches and larger.
- 3.** Full-threaded hubs and rubber-gasketed covers.
- 4.** Zinc, cadmium-plated or bronze hardware bolts and screws for assembly.
- 5.** Finish with cadmium-plated or galvanizing.
- 6.** Standard and junction fittings.

B. Conduit Expansion Fittings

1. Line of Conduit Type

- a. Galvanized expansion fittings for rigid conduit movement up to 4 inches.
- b. Insulated metal bushing on ends of the conduit, bonding jumper, and with expansion head sealed with a high-grade graphite packing.
- c. O-Z/Gedney Company, Type AX with Type AJ bonding jumper or Thomas and Betts Corporation, Type XJG.

2. End Type

- a. For conduit terminating in a junction box.
- b. O-Z/Gedney Company, Type EXE with Type BJ-E bonding jumper.

C. Conduit Expansion and Deflection Fittings

- 1. Provide for movement of 3/4-inch from normal in all directions between two rigid conduits.
- 2. Integral bonding jumper.
- 3. O-Z/Gedney Company, Type DX.

D. Conduit Wall Entrance Seals

- 1. Provide where required or indicated.
- 2. O-Z/Gedney Company Type FSK.

E. Conform to NEMA Type 3R enclosure in all nonhazardous areas except as specified or indicated otherwise.

2.8 Fittings, Couplings and Boxes for Rigid Steel Conduit

A. Fittings

- 1.** Explosion-proof or weather-proof as specified.
- 2.** Cast malleable iron.
- 3.** Threaded cover to conform to NEC.
- 4.** Full thread hubs.
- 5.** Seal compound well for seal.
- 6.** Drain seals as indicated or required to provide a continuous automatic drain of water.
- 7.** Chico compound for all sealing fittings.
- 8.** PVC jacketed in corrosive areas and where indicated.

B. Couplings

- 1.** Explosion-proof or weather-proof as specified.
- 2.** Flexible.
- 3.** Conform to NEC.
- 4.** Threaded, steel or bronze end fittings securely fastened to the core and braided to ensure electrical continuity.
- 5.** Vinyl plastic coating in severely corrosive locations as indicated.

2.9 Rigid Steel Conduit Boxes

A. Indoor Boxes

- 1.** Hot-dipped galvanized steel.
- 2.** Galvanized steel covers.

2. For special boxes where it is not possible to provide hot-dip galvanizing, apply organic zinc-rich primer at 3 mils dry film thickness after SSPC-SP3 Power Tool Cleaning.

3. Minimum gage requirements:

No surface area exceeds	No single dimension exceeds	Steel Gage
1000 sq in.	40 in.	14
1500 sq in.	60 in.	12
over 1500 sq in.	over 60 in.	10

4. Explosion-proof or weather-proof as specified.

5. Threaded conduit entrances or rigid conduit hubs on all boxes.

6. Include piano-hinged, gasketed cover, and interior mounting panel when used for enclosing terminal blocks and control relays.

9. Oiltight JIC boxes modified for NEMA Type 3R or Type 4 enclosure for non-explosion-proof areas.

B. Outdoor Boxes

1. 11-gauge minimum galvanized steel with drip lip and galvanized-steel covers fastened with bronze or cadmium-plated screws or bolts, or cast iron with galvanized finish and flanged bolted covers.

2. For special boxes where it is not possible to provide hot-dip galvanizing, apply organic zinc-rich primer at 3 mils dry film thickness after SSPC-SP3 Power Tool Cleaning.

3. Threaded conduit entrances or rigid conduit hubs on all boxes.

4. Rubber or neoprene gasket for cover.

5. Explosion-proof or weather-proof as specified. Conform to NEMA Type 3R enclosure for non-explosion-proof applications in all outdoor installations unless indicated otherwise.
6. Include piano-hinged, gasketed cover, and interior mounting panel when used for enclosing terminal blocks and control relays.
7. Oiltight JIC boxes modified for NEMA Type 3R or Type 4 enclosure in non-explosion-proof applications.

B. Metallic Barriers

1. Designed not to separate phases of a power circuit.
 2. Provide as indicated for the isolation of power circuits from other type circuits.
- C.** Box size as required, or as indicated, for each particular installation.
- D.** Include provisions for mounting cable supports where indicated, specified or as required by NEC.
- E.** Provide as required for cable pulling, junctions, terminals, and for mounting of switches, outlets and control devices.

2.10 Support System

- A.** Fabricated from structural steel or manufactured framing members equal to "Unistrut" P-3000 series as manufactured by Unistrut Corporation.
- B.** Minimum 12 gage.
- C.** Construct as required to rigidly support all conduit runs and boxes.
- D.** Hot-dip galvanized steel conduit clamps or stainless steel, sized for the specific conduit size, to support all exposed metallic conduit.
- E.** Nonmagnetic clamps to support nonmetallic conduits.
- F.** Provide stainless steel rods, anchors, inserts, bolts, washer, and nuts.

G. Materials shall be compatible with the equipment supported.

H. Manufactured Framing Members

1. Wet Locations

a. Channel hot-dipped galvanized after all manufacturing operations are completed.

b. Galvanizing zinc weight of 2 ounces per square foot on surface to conform to ASTM A123 and ASTM A153.

2.11 Fire-stopping and Duct Seal

A. Fire-stopping

1. Weather-resistant silicone sealant.

2. Provide 4-hour fire rating.

3. UL tested system.

B. Duct Seal

1. Non-corrosive, permanently soft compound.

2. Nontoxic.

3. Provide flexible re-enterable and repairable seal around cables in conduit.

4. Prevent air movement and drafts through conduits.

5.

PART 3 - EXECUTION

3.1 Preparation

A. Provide suitable protection for conduit risers against damage during construction.

B. Cap ends of all conduits before concrete is poured.

C. Cap all conduits and provide pullstring after cleaning where conduits are to be left empty by this contract.

- D.** Carefully ream ends of all conduit lengths after cutting to eliminate sharp burrs.
- E.** Clean out all conduit before pulling wire.
- F.** Clean out all conduits immediately after concrete work is finished.

3.2 Installation

A. General Requirements

1. Location

- a.** Install conduit as near as possible to the routing indicated.
- b.** Shift locations as required to avoid interference with other equipment and piping being installed.
- c.** Where routing of conduit is not indicated, such as for lighting home run circuits and other systems requiring small conduit runs, route conduit as specified subject to approval by Engineer.

- 2.** Do not use conduit in sizes smaller than 3/4-inch, except 1/2-inch may be used for connections to control devices and thermocouples where necessary.

3. Holes and Sleeves

- a.** Provide through floors, walls and roofs as necessary for conduit runs, including approved flashing and weather proofing at outside walls and on roofs.
- b.** Install sleeves or forms for all openings in new work.
- c.** Provide the required inserts and holes, completely sleeved, bonded, curbed, flashed and finished off in an approved manner, whether in concrete, steel grating, metal panels or roofs.
- d.** Core-drill all holes required in existing building work using a dustless method.

- e. Place nonshrinking grout or Dow Corning 3-6548 Silicone RTV (or equivalent General Electric RTF 762) foam as specified, in the following locations:
 - (1) All holes in concrete, walls, floor and roof slabs after installation of conduit.
 - (2) All unused holes and sleeves as approved by Engineer.
 - f. Install wall entrance seals where conduit enters the building or vaults from exterior underground.
 - g. Install fire-stopping at all conduit penetration of fire rated walls, ceilings and floors. Fire-stopping shall equal or exceed the fire rating of the wall, ceiling or floor in which it is installed.
4. Make connections to boxes, panels, and other equipment as follows:
- a. **For Indoor Dry Locations:** Double locknuts, one inside and one outside.
 - b. **For Outdoor and Damp Locations:** Rigid weather-proof conduit hubs.
 - c. **For Explosion-proof Locations:** Use conduit connector seals approved for the hazardous location specified.
 - d. **Bushings**
 - (1) Threaded malleable iron or steel.
 - (2) Insulated with Bakelite, molded and bonded into the bushing.
 - (3) Placed on end of conduit in addition to locknuts.
 - (4) Install with integral grounding connector and conductor where all conduits pass through multiple concentric panel knockouts and where

the conduit must be bonded to equipment it is not attached to.

- e. Install duct seal in conduits around cables in non-hazardous locations at all conduit terminations at control panels and boxes containing terminations and splices.
5. Running threads will not be permitted.
 6. Coat all field cut threads in galvanized conduit with aluminum paint.
 7. Comply with applicable requirements of NEC pertaining to installation of conduit systems.
 8. Place drainage fittings or weep holes at unavoidable low points where moisture can collect.
 9. Install an entire conduit system that is electrically continuous with bonding jumpers provided as necessary to conform to NEC.
 10. Install expansion fittings at all building expansion joints and every 100 feet of continuous conduit.
 11. Provide all spare or empty conduits with pullstrings for future use.

B. Rigid Steel Conduit

1. Exposed

- a. Install where specified or indicated on drawings.
- b. Install above grade outdoors.
- c. Install horizontal runs as high above floor as possible and in no case lower than 7 feet above floor, walkway or platforms in passage areas.
- d. Run conduit parallel or perpendicular to walls, ceiling, beams, and columns unless indicated otherwise.

- e.** Route to clear all doors, windows, access wells, and openings.
- f.** Group parallel runs in neatly aligned banks where possible with minimum of 1-inch clearance between conduits.
- g.** Maintain 6-inch clearance between conduit and coverings on all hot lines; steam, hot water, etc.
- h.** Do not exceed a distance of 8 feet between supports on horizontal or vertical runs.
- i.** When terminating at cable tray, attach conduit to tray and electrically bond conduit with ground wire to the cable tray. Install duct seal in conduits around cables to prevent ingress of water.

2. Concealed

- a.** Conceal conduit for lighting, convenience outlets, and other circuits in walls, ceiling and floors where possible.
- b.** Do not install conduit in concrete where conduit outside diameter exceeds one-third of concrete thickness.
- c.** Install parallel runs with a minimum spacing of three conduit diameters between conduits.
- d.** Use expansion and deflection fitting with bonding jumpers at all concrete expansion joints.
- e.** Tie securely in place to prevent movement when concrete is poured.
- f.** Install in floor slabs in as straight a run as possible. Conduit crossovers are not permitted unless conduit total outside diameter is one-third of the concrete thickness or less.
- g.** Use long radius elbows except on risers where curved portion of elbow would extend above the finished floor or foundation.

h. Make all joints watertight after installation by coating all finished joints with coal tar solution applied at 15 mils minimum dry film.

(1) Kop-Coat - No. 50.

(2) Tnemec - 46-449.

3. Buried

a. Place where indicated.

b. Use PVC jacketed conduit or rigid PVC Schedule 80 as indicated.

c. Make all joints watertight by field-applied coat of vinyl plastic compound or PVC welding solution furnished by the conduit manufacturer.

d. Use bender one size larger for conduit sized 1 inch or less and conventional bender for conduit sized above 1 inch.

e. Use strap wrench to tighten conduit. Repair damaged coating with liquid patching compound recommended by conduit manufacturer.

f. Install in as straight a run as possible between termination points of exact routing to be determined in the field and subject to approval by Engineer.

g. Bury conduits a minimum of 24 inches (to top of conduit) below finish grade unless indicated otherwise or required by code.

h. Slope conduit away from conduit risers where possible.

i. Maintain 6-inch separation from underground piping.

j. Use long radius bends at all risers unless indicated otherwise.

k. After trench bottom has been finished to grade, lay conduit. Backfilling shall be as specified in DIVISION 2.

- l.** Cap ends of all conduit risers before backfilling.
- m.** Provide watertight seal around wires where conduit terminates in pull box.
- n.** Use PVC coated rigid galvanized steel conduit when making transitions from buried to above ground conduit runs.

C. Liquid-Tight Flexible Metal Conduit

- 1.** Use between rigid conduit and motor terminal boxes except where conduit runs down from above and cannot be conveniently supported by a floor flange.
- 2.** Place between rigid conduit or conduit box and control device cases where direct connection is not desirable for reasons of equipment movement, vibration, or for ease of maintenance.
- 3.** Install at all points of connection to equipment mounted on supports to allow for expansion and contraction.
- 4.** Conform to NEC with installation of conductors.
- 5.** Install at locations where rigid conduit connections are impractical.
- 6.** Use minimum length consistent with manufacturer's standard lengths, the acceptable bending radius, and with required movement of equipment.
- 7.** Maximum length of 3 feet unless otherwise approved by Engineer.
- 8.** Install an external bonding jumper to conform to NEC on conduit sized 1-1/2 inches and larger.

D. Flexible Metal Conduit

1. Use between rigid conduit and devices, except in hazardous areas and areas subject to dampness, water, and corrosive fumes. Do not use with vapor-tight fixtures. Use in accordance with the National Electrical Code Article 350.
2. Use in lieu of direct connection of rigid conduit where it is not desirable for reasons of equipment movement, vibration, or for ease of maintenance.
3. Install as required for expansion and contraction.
4. Use minimum length consistent with manufacturers' standard lengths, the acceptable bending radius, and with required movement of equipment.
5. Maximum length of 3 feet unless otherwise approved by Engineer.
6. Install in sizes smaller than 3 inches.
7. Install an external bonding jumper to conform to the National Electrical Code on conduit sized 1-1/2 inches and larger.

E. Conduit Fittings

1. Installations of special fittings as required.
2. All materials shall be compatible.
3. Install as required.

F. Boxes

1. Install special boxes as indicated of size required for conduits and cables entering and leaving box.
2. Install where required for pull or junction boxes and for mounting or connecting to switches, outlets, intermediate terminal blocks or control devices.
3. Provide 1/4-inch weep holes in interior boxes where conduits enter from exterior or buried installation.

G. Supports

- 1.** Construct with sufficient rigidity to hold all mounted equipment and material in permanent and neat alignment.
- 2.** Design to provide 1/4-inch space between equipment housings and walls or columns upon which they are mounted.
- 3.** Do not exceed load requirements in NEC and NEMA standards.
- 4.** After Power Tool Cleaning SSPC-SP11, paint all welds, field cuts and damaged areas with organic zinc-rich primer at 3 mils dry film thickness.
 - a.** Ameron - 68HS.
 - b.** Carboline - Carbozinc 858.
 - c.** Porter - Zinc-Lock 308.
 - d.** Tnemec-Tneme Zinc 90-93.
- 5.** Use electrogalvanized steel conduit clamps and nonmagnetic conduit clamps to support electrogalvanized steel conduit and nonmagnetic conduit, respectively.
- 6.** Provide stainless steel rods, anchors, inserts, bolts, washers and nuts.

I. Explosion-proof Fittings

- 1.** Install explosion-proof fittings in the rigid steel conduit system as required by the NEC.
- 2.** Install necessary fittings where not indicated, but required by code.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A.** No measurement will be made for this item.

4.2 Payment

- A.** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 16111 ****

SECTION 16120

WIRE, CABLE, AND ACCESSORIES

PART 1 - GENERAL

1.1 Description

A. This Section includes furnishing and installing (including terminations) of all electrical wire, cable, and accessories.

B. Related Work Specified Elsewhere

Lighting Section 16500

Grounding Section 16450

Field Testing Section 16950

1.2 References

1. American Society for Testing and Materials (ASTM)

ASTM B3 - Soft or Annealed Copper Wire.

ASTM B8 - Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

ASTM B33 - Tinned Soft or Annealed Copper Wire for Electrical Purposes.

ASTM B172 - Rope-Lay-Stranded Copper Conductors, Having Bunch Stranded Members, for Electrical Conductors.

ASTM B189 - Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes.

2. Insulated Cable Engineers Association (ICEA)

S-19-81 - Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

S-61-402 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

S-66-524 - Cross-Linked Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

S-68-516 - Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

S-81-570 – 600-Volt Rated Cables of Ruggedized Design for Direct Burial.

S-105-692 – 600Volt Single Layer Thermoset Insulated Utility Underground Distribution Cables.

T-29-520 – Vertical Cable Tray Flame Tests at 210,000 Btu.

3. National Electric Manufacturers Association (NEMA) and Insulated Cable Engineers Association (ICEA)

WC55/S-82-552 – Instrumentation Cables and T.C. Wire.

WC57/S-73-532 – Standard for Control Cables.

WC70/95-658 - Non-Shielded Power Cables Rated 2000V or Less.

4. Institute of Electrical and Electronic Engineers (IEEE)

48 - Test Procedures and Requirements for High Voltage Alternating-Current Cable Terminations.

5. National Fire Protection Association

National Electrical Code (NEC) NFPA-70.

Standard for Electrical Safety in the Workplace, NFPA 70E

6. Underwriters Laboratories, Inc. (UL)

44 - Rubber-Insulated Wires and Cables.

83 - Thermoplastic-Insulated Wires and Cables.

263 - Fire Tests of Building Construction and Materials.

854 - Service Entrance Cables.

1277 - Electrical Power and Control Tray Cables with Optional Optical Fiber Members.

- 7. National Electrical Safety Code, IEEE C2.**
- 8. Occupational Safety and Health Administration, OSHA.**
- 9.** All electrical and control equipment and material shall bear the recognized Underwriters Laboratories, Inc. (UL) seal of approval. It is Vendor's responsibility to obtain local inspection approval for all non-UL labeled equipment and pay all fees in connection with the same.

1.3 Submittals

- A.** Submit as specified in Section 1300.
- B.** Includes, but not limited to, the following:
 - 1.** Data sheets for each wire and cable type specified.
 - 2.** Data sheets for wire and cable accessories.
 - 3.** Cable manufacturer's approval of splicing and terminating materials.
 - 4.** Cable manufacturer's approval of pulling compounds.
 - 5.** Cable manufacturer's installation requirements such as maximum pulling tensions, sidewall pressures, minimum bending radii, etc.
 - 6.** Other equipment and materials to be used.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Wire and Cable

Acceptable manufacturers for each wire and cable type will be manufacturers that have been manufacturing the specified cable for a minimum of five years and meet all the requirements listed on the Wire and Cable Specification Sheets.

B. Wire and Cable Accessories

1. Cable Connectors for Control and Instrument Cable

- a.** AMP Special Industries.
- b.** Hollingsworth Solderless Terminal Company.
- c.** Panduit Corporation.
- d.** Minnesota Mining and Manufacturing (3M).
- e.** Thomas and Betts Company, Inc.

2. Cable Connectors for Power Cable

- a.** AMP Special Industries.
- b.** Thomas and Betts Company, Inc.
- c.** Minnesota Mining and Manufacturing (3M).
- d.** Panduit Corporation.

3. Termination and Splice Kits

- a.** Minnesota Mining and Manufacturing (3M).
- b.** Raychem.

4. Tape and Insulation Putty: Minnesota Mining and Manufacturing (3M).

5. Cable Ties

- a.** AMP Special Industries.
- b.** Dennison Manufacturing Company.
- c.** Panduit Corporation.
- d.** Minnesota Mining and Manufacturing (3M).
- e.** Thomas and Betts Company, Inc.

6. Cable Supports

- a. O-Z/Gedney Company.
- b. Hubbell, Kellems Grips.

7. Terminal Blocks

- a. Allen-Bradley.
- b. Buchanan.
- c. Phoenix Contact.
- d. Weidmuller.

8. Cable Identification Tags

- a. Allen Marking Products, Kansas City, MO.
- b. Floy Tag and Manufacturing Co., Seattle, WA.
- c. Panduit Corporation (Panduit).
- d. Specialty Products Company, Rock Hill, SC.
- e. Thomas and Betts Company, Inc. (Thomas and Betts).

9. Cable Fire and Smoke Stop Fittings

- a. Crouse Hinds.
- b. Nelson Electric.
- c. O-Z/Gedney Company.

2.2 Wire and Cable

A. Building Wires

- 1. Conductors: stranded for 12 AWG and larger. Minimum size: 12 AWG.

2. Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

B. MC, Metal Clad Cables

1. Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
2. Insulation: Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.
3. Inner jacket.
4. Armour: continuous aluminum.
5. Overall covering: flame retardant polyvinyl chloride material meeting requirements of Vertical Tray Fire Test.

C. Instrument Cable – Shielded Twisted Pairs/Triads

1. Conductors: stranded for 16 AWG and larger. Minimum size: 16 AWG.
2. Copper conductors: size as indicated, with 600 V insulation of PVC material rated RW90. Color code shall use pigmented compounds, white and black for pairs, white, black and red for triads. Each conductor shall include sequential numbers printed on surface of conductors.
3. Conductor jacket: nylon.
4. Shields: aluminized mylar or polyester tape with tinned copper drain wire.
5. Jacket: Polyvinyl chloride (PVC).

D. Control Cables

1. Class B or C soft annealed stranded copper conductors, sized as indicated, with cross-linked thermosetting polyethylene, outer PVC jacket rated for outdoor use.

2. 600 V type: with cross-linked polyethylene type, RW90 (x-link) and overall jacket.

E. Temperature Rating

Cables shall be suitable for operation with a maximum conductor temperature of 90°C, continuous, wet or dry locations.

F. Insulation and Jacket Thickness

See references, Section 1.2.

G. Factory Tests

See references, Section 1.2, including the flame test requirement, ICEA T-29-520 and UL 1277.

H. Certification

Cables shall be certified to be in conformance with all applicable codes and standards as referenced.

All cables shall include surface identification showing manufacturer's name, insulation type, conductor size, conductor type, voltage rating and UL label.

2.3 Connectors

A. General Requirements

1. Designed and sized for specific cable being connected.
2. Solderless, pressure-type connectors constructed of non-corrodible tin-plated copper.
3. Rated current-carrying capacity equal to or greater than the cable being connected.
4. Application tooling for connectors shall contain die or piston stops to prevent over-crimping and cycling or pressure relief to prevent under-crimping. Dies of all application tooling shall provide dot or wire size coding for quality control verification. All tooling shall be manufactured by the connector manufacturer.

B. Power Connectors (10 AWG and Smaller) 600V and Below

1. "Scotchlok" preinsulated spring wire connectors.
2. Buchanan open-end copper splicing caps, applied with "Lok-Seal" tool, with nylon snap-on insulators.

C. Power Connectors (sizes 8-4 AWG) 600V and Below

1. Noninsulated ring-tongue type.
2. Ring tongue sized to match terminal stud size.
3. Brazed barrel seam.
4. Application tooling designed to crimp the wire barrel (conductor grip) with a one-step crimp.

D. Power Connectors (sizes 2 AWG - 750 kcmil) 600V and Below

1. Non-insulated one-hole rectangular tongue for sizes 2 AWG through 3/0 AWG and two-hole rectangular tongue for 4/0 AWG through 750 kcmil.
2. Application tooling shall be hydraulically operated.

E. Control, Instrument, and Specialty Cable Connectors

1. Tin-plated copper.
2. Vinyl preinsulated spring-type spade terminals. (Hollingsworth "Mini Spring Spades"; Thomas and Betts "Locking-Fork"; Panduit "Locking Fork.")
3. Sized to match terminal stud size.
4. Have insulation grip sleeve to firmly hold to cable insulation.
5. Insulation grip sleeve shall be funneled to facilitate wire insertion and prevent turned-back strands.
6. Application tooling designed to crimp the wire barrel (conductor grip) and the insulation grip sleeve with a one-step crimp.

2.4 Motor Lead Termination/Splice (Low-Voltage, 600v and Below, Power Cable)

- A.** Splices shall be made using compression-type connectors bolted together. The compression-type connectors shall be properly sized for the cables.
- B.** Splice to be covered with heat-shrinkable tubing connector insulators or slip-on rubber boot or sleeve.
- C.** Splicing shall be done in accordance with the instructions provided with the Raychem brand MCK Motor Connector Kit or 3M Company 5300 Series Motor Lead Splice Kit.

2.5 Cable Supports

- A.** Cable supports for cables in vertical conduit risers shall be O-Z/Gedney Type "R" wedging plug type or approved equal.
- B.** Kellems basket type wire mesh grip for cables in vertical installations.

2.6 Cable Ties

- A.** Nylon self-locking type.
- B.** Have a normal service temperature range of -40°C to 85°C.
- C.** Be weather-resistant and sun-light resistant type for outdoor use.
- D.** Meet requirements of Military Specifications MIL-S-23190D.
- E.** AMP Special Industries "AMP-TY," Dennison Manufacturing Company "BAR-LOK," Panduit Corporation "PAN-TY," Thomas & Betts "TY-RAP," or Minnesota Mining and Manufacturing 3M Brand cable ties.

2.7 Terminal Blocks

- A. For mounting in terminal boxes (TBs)**
 - 1.** Designed and sized for the cables being terminated.
 - 2.** Block rated 600V.

3. Binding screw-type terminals for power cables and strap screw or tubular clamp terminals for control and instrument cables.
4. Rated current carrying capacity equal to or greater than the cable being terminated.
5. Marking strip.

B. For Mounting in Cabinets, Panels, Control Boards, Etc.

1. Designed and sized for the cables being terminated.
2. Block rated 600V.
3. Binding screw type terminals for power cables and current transformer circuits and strap screw or tubular clamp terminals for control and instrument cables.
4. Rated current carrying capacity equal to or greater than the cable being terminated.
5. Marking strip on blocks for power cables and control and instrument cables.
6. Short-circuit strips with one shorting screw for each terminal for current transformer circuits.

2.8 Cable Identification Tags

- A. Designed to provide a permanent wire and cable identification system.
- B. Show complete cable number. Cable numbers are defined in the Cable Schedule and/or Contract Drawings.
- C. Cable numbers may be stamped or typed in a legible and permanent manner. Hand-lettering is not acceptable.
- D. Character size for cable numbers shall be a minimum of 1/8-inch.
- E. Material shall be nonmetallic and impervious to moisture and resistant to fading in sun-light.

- F.** Be securely attached to cables and accessible for inspection.
- G.** Cable identification tags, marking and attachment methods shall be subject to approval of the Engineer.

2.9 Fastenings

- 1.** One hole malleable iron straps to secure surface cables 2 inch diameter and smaller. Two hole steel straps for cables larger than 2 inches.
- 2.** Channel type supports for two or more cables.
- 3.** Threaded rods: 3/8 inch dia. stainless steel to support suspended channels.

PART 3 – EXECUTION

3.1 Installation

A. Wire and Cable

1. General Requirements

- a.** Install in conduit, duct system or tray as indicated.
- b.** Do not subject cable to pulling tensions or sidewall pressures in excess of manufacturer's recommendations.
- c.** Attach pulling grips over the cable sheath to prevent slipping of the insulation.
- d.** Do not subject cable to bending radius less than those recommended by the cable manufacturer or as noted below (whichever is greater) during or after installation:
 - (1)** Eight times the cable outside diameter for 600V or lower rated cables.
- e.** Install intermediate splices only as indicated or as required to avoid subjecting cable to excessive pulling tension or sidewall pressures. Cable splicing locations

shall be approved by Engineer prior to cable installation.

- f.** Support cables at connections or termination points such that any strain on cable will not be transmitted to the connection or termination.
- g.** Install cable supports in vertical runs of conduit, at boxes and at terminations in equipment, and as required to meet intermediate support requirements of National Electrical Code (NEC).
- h.** All pulling compounds shall be approved by wire and cable manufacturer as being compatible with cable materials.
- i.** Attach a cable identification tag to each cable at all termination or end points.
- j.** Install fire and smoke stop fittings at all cable penetration of fire rated walls, floors and ceilings.

2. Power (600V and Below), Control, Instrument, and Specialty Cable

- a.** Install metallic barrier in all tray and boxes to separate power, control and instrumentation from low-level signal (50V or less) instrumentation circuits where run in the same box.
- b.** Cables in vertical trays shall be secured every 3 feet or less.
- c.** Tie together with cable ties all single conductor cable on each individual circuit in each junction box, and equipment at intervals not to exceed 6 feet.
- d. Attach a cable identification tag to each cable.**
 - (1)** At each terminal to identify the circuit and cable.
 - (2)** Use nylon ties and identification tabs color coded as follows:

- (a) 480V circuits - Red.
- (b) 277, 240, or 208Vac circuits - Orange.
- (c) 120V circuits - White.
- (d) Control cables - Natural Nylon.

e. Insulation Color Coding

- (1) Conductors shall be coded or numbered over the entire length.
- (2) Colors shall not be changed between source and device. No white wire shall be used in lighting and convenience outlets except as a grounded neutral conductor.

f. Tag each individual conductor or wire with wire markers as follows:

- (1) With terminal designation indicated on schematic diagrams or given on manufacturer's equipment drawings.
- (2) At each terminal.
- (3) In addition to specified circuit tags.

g. Terminate and ground, control, instrument, and specialty cable shields as indicated and recommended by the manufacturer of the equipment being connected. In general, ground the shields at the control boards for control cables and at the receiving end equipment for instrumentation and specialty cables.

h. Control and instrument cable splices shall be as follows:

- (1) Made only in junction or terminal boxes.
- (2) Made on terminal blocks with marking strips.

- (3) Conductor color coding shall be maintained.
- (4) For shielded cables, shield continuity and isolation shall be maintained.
- i. **Power cable (600V or below) splices and motor terminations shall be as follows:**
 - (1) Made only in junction or terminal boxes.
 - (2) Splices shall be made using compression type connectors bolted together.
 - (3) Splice to be covered with a heat-shrinkable connector insulator.
- j. **Lighting Cable:** Install as specified in this Division.
- k. **Ground Cable:** Install as specified in this Division.
- l. Install fire and smoke stop fittings at all cable penetrations of fire-rated walls, floors, and ceilings.

3. Cable Connections and Terminations

- a. Make up clean and tight to assure a low-resistance joint.
- b. Make only in terminal boxes, equipment or other accepted enclosures and not in conduit.
- c. Install all connectors with tooling manufactured by the connector manufacturer and as specified.

3.2 Field Quality Control

- A. Manufacturer's Field Services:** Provide as specified in DIVISION 1.
- B. Field Testing:** Specified in Section 16950.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

- A. No measurement will be made for this item.

4.2 Payment

- A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 16120 ****

SECTION 16450

GROUNDING

PART 1 - GENERAL

1.1 Description

- A.** This Section includes the following:
- 1.** Facility ground grid and ground rod system.
 - 2.** Ground riser extensions to structural steel, electrical equipment, and mechanical equipment.

1.2 References

1. American Society For Testing and Materials (ASTM)

ASTM B8 - Concentric-Lay Stranded-Copper Conductors, Hard, Medium-Hard, or Soft.

2. National Electrical Safety Code (NESC)

3. National Fire Protection Association (NFPA)

70 - National Electrical Code.

70E – Standard for Electrical Safety in the Workplace

4. Underwriters' Laboratories (UL)

467 - Electrical Grounding and Bonding Equipment.

5. Occupational Safety and Health Administration, OSHA.

- 6.** All electrical and control equipment and material shall bear the recognized Underwriters Laboratories, Inc. (UL) seal of approval. It is Vendor's responsibility to obtain local inspection approval for all non-UL labeled equipment and pay all fees in connection with the same.

1.3 Submittals

- A.** Submit as specified in Section 1300.
- B.** Includes, but not limited to, catalog cuts for the following:
 - 1.** Ground Rods.
 - 2.** Cable.
 - 3.** Grounding Lugs.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Ground Rods

- 1.** Joslyn Manufacturing and Supply Company.
- 2.** Copperweld Bimetallics Group.
- 3.** Knight-Metalcraft, Division of Whitaker Cable.
- 4.** ITT Blackburn Company, a Division of International Telephone and Telegraph Corporation.
- 5.** Harger

B. Cable-to-Equipment Ground Lugs

- 1.** Burndy Corporation (Burndy).
- 2.** Knight-Metalcraft, Division of Whitaker Cable.
- 3.** Harger

2.2 Wire and Cable

- A.** Type BC2 as specified in this Division (Section 16120).
- B. Conductor Sizes**
 - 1.** As indicated for specific connections.

2. For required connections not indicated, use conductor size not less than No. 4/0 AWG if buried in earth or cast in concrete, or No.2 AWG at other locations, unless otherwise noted.

2.3 Ground Rods

- A. Copper-clad steel or copper-alloy sectional-type rods.
- B. One end pointed to facilitate driving.
- C. 3/4-inch diameter x 10 feet long with diameter and length stamped near top of rod.

2.4 Connection Materials

- A. Cable-to-cable and cable-to-rod cable-to-connector connections of exothermic-welding-type process.
- B. **Cable-To-Equipment Ground Lugs**
 1. Compression type.
 2. Bolted to equipment housing with silicon bronze bolts and lock washers.

2.5 Coatings

- A. **Coal Tar**
 1. Kop Coat - No. 50.
 2. Tnemec - 46-449.

PART 3 - EXECUTION

- 3.1 **Inspection:** Do not cover up connections before they are inspected by Engineer.

3.2 Installation

- A. **Wire and Cable**
 1. Install using as few joints as possible.

2. Protect against abrasion by several wrappings of rubber tape at all points where cable leaves concrete in exposed areas.
3. Suitably protect cable against damage during construction.
4. Replace or suitably repair cable if damaged by anyone before final acceptance.
5. All Connections to be metal to metal. Remove all paint, grease, dirt, etc. before making connections.

6. In Exposed Installations

- a. Route runs as indicated.
- b. Route along the webs of columns and beams, and in corners where possible for maximum physical protection.
- c. Support at intervals of 3 feet or less with nonmagnetic clamp-type supports.
- d. Where exposed and no natural protection available, provide physical protection as required to protect ground conductor.

7. In Buried Installations

- a. Lay in bottom of trench or in other excavations at least 30 inches below finished grade.
- b. Maintain clearance of at least 12 inches from all underground metal piping or structures, except where connections thereto are specifically indicated.
- c. Backfill as specified in DIVISION 2.

B. Ground Rods

1. Install rods as indicated by driving and not by drilling or jetting.
2. Drive rods into undisturbed earth where possible.

3. Where rods must be installed in excavated areas, drive rods into earth after compaction of backfill is completed.
4. Drive to a depth such that top of rods will be approximately 18 inches below final grade or subgrade, and connect main grid ground cable thereto.

C. Connections

1. Conform to manufacturer's instructions.
2. Chemically degrease and dry completely before welding.
3. Apply one coat of coal tar coating at 15 mils dry film thickness to all exothermic-welded connections to be buried.
4. **Make connections to equipment as follows:**
 - a. Make up clean and tight to assure a low-resistance connection with resistance not exceeding 1 ohm.
 - b. Install so as not to be susceptible to mechanical damage during operation or maintenance of equipment.
 - c. Provide direct copper connection to buried ground grid system.
 - d. Prior to making connections remove all paint, grease, etc. from connection location.

D. Metallic Conduit Grounds

1. Adequately and properly ground at all terminal points and wherever isolated from equipment or grounded steel.
2. Where extending into floor-mounted equipment from below, connect to equipment ground bus or frame.
3. Where extending into manholes, handholes, or cable trenches, connect to the ground riser or cable at that structure using grounding bushings.

E. Rack Grounds

1. Ground at intervals not to exceed 20 feet.
2. Ground all continuous runs as well as isolated sections at least at one point.

F. Box Grounds: Unless grounded by conduit system, ground all boxes by direct copper connection to the buried ground grid system.

G. Motor Grounds: Ground all motors with "identified" ground conductor in addition to conduit system. Route in conduit with phase conductors unless external ground is indicated.

3.3 Field Testing: Specified in Section 16950.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

A. No measurement will be made for this item.

4.2 Payment

A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 16450 ****

SECTION 16900

GENERAL REQUIREMENTS INSTRUMENTATION AND CONTROLS

PART 1-GENERAL

1.1 SUMMARY

- A.** Work Includes:
 - a. The Engineering, furnishing, installing, calibrating, adjusting, testing, documenting, starting up, and Owner training for Process Instrumentation and Control (PIC) for each well site.

- B.** Major Components:
 - a. Programmable logic controllers and remote I/O modules.
 - b. Coordinated startup activities for new PLCs Division includes instruments, meters, control devices. and control panels as specified in each Section.

- C.** Complete Detailed PIC Design: PIC as shown and specified includes functional and performance requirements and component specifications.

- D.** Coordinated Startup and Commissioning: Coordinate with other trades, vendors, and programmers for testing, startup, and commissioning.

- E.** **Work performed by Others - Owner/Engineer**
 - a. Programming of PLC.
 - b. Programming of SCADA Interface.
 - c. Review of contractor provided submittals, control panels, including I/O tables and tag names, etc.
 - d. Assistance during Startup and Commissioning.

1.2 References

1. **Instrument Society of America (ISA)**

S20 - Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.

2. Others as specified in applicable Sections.

3. National Fire Protection Association

National Electrical Code, NFPA 70

Standard for Electrical Safety in the Workplace, NFPA 70E

4. National Electrical Safety Code, IEEE C2.

5. Occupational Safety and Health Administration, OSHA.

- 6.** All electrical and control equipment and material shall bear the recognized Underwriters Laboratories, Inc. (UL) seal of approval. It is Vendor's responsibility to obtain local inspection approval for all non-UL labeled equipment and pay all fees in connection with the same.

1.3 System Responsibility – System Integrator

Systems may utilize equipment of different manufacturers but one System Integrator is to assume overall responsibility for the complete system.

A. Approved System Integrator

- 1.** Alliance Service and Control Specialists, Inc.
- 2.** Darcor and Associates, Inc.
- 3.** PRIMEX
- 4.** Engineer prior approved equal.

B. System Integrator Pre-Qualification

System Integrator shall be provided by a firm specializing in control panel construction. Request for approval shall be submitted to engineer a minimum of 10 days prior to bid.

PART 2 CONTROL PANEL AND CONTROL DESCRIPTION

2.1 Existing Airport Booster Station PLC

Connect to existing Airport Booster Station PLC. Utilize existing PLC I/O points. Coordinate with OWNER. Programming and Graphics to be performed by OWNER.

PART 3 SUBMITTAL DRAWINGS AND DOCUMENTS

3.1 Compliance Submittals

1. Submit as specified in Section 1300.
2. Manufacturer with prime responsibility shall assume responsibility for all Compliance Submittals.
3. Includes, but not limited to, the following:
 - a. Fabrication drawings, front elevation, wiring, diagrams, and bills of material for control panels.
 - b. Engraving schedule and physical dimensions for nameplates and phenolic overlays.
 - c. Electrical and mechanical connection diagrams for all separately mounted instruments.
 - d. Individual specification or descriptive sheets for instruments, annunciators and similar major system components to conform to ISA S20.

3.2 Instruction Books

For all instruments, transducers, and similar major system equipment. In addition to the requirements as specified in DIVISION 1, submit single-page specification sheets for each instrument which lists the type, model number, function, scale, input, actuation, output and other specific features of that instrument.

A. Action Submittals:

1. General:
 - a. Shop Drawings, full-scaled details, wiring diagrams, catalog cuts, and descriptive literature.
 - b. Identify proposed items and options. Identify installed spares and other provisions for future work (for example, reserved panel space; unused components, wiring, and terminals).
 - c. Legends and Abbreviation Lists: Complete definition of symbols and abbreviations used on this Project (for example, engineering units, flow streams, instruments,

structures, and other process items used in nameplates, legends, and data sheets).

2. Bill of Materials: List of required equipment.
 - a. Group equipment items as follows:
 - 1) I&C Components: By component identification code.
 - 2) Other Equipment: By equipment type.
 - b. Data Included:
 - 1) Equipment tag number.
 - 2) Description.
 - 3) Manufacturer, complete model number, and all options not defined by model number.
 - 4) Quantity supplied.
 - 5) Component identification code where applicable.
3. Catalog Cuts:
 - a. I&C Components, Electrical Devices, and Mechanical Devices:
 - 1) Catalog information, mark to identify proposed items and options.
 - 2) Descriptive literature.
 - 3) External power and signal connections.
 - 4) Scaled drawings showing exterior dimensions and locations of electrical and mechanical interfaces.
4. Component Data Sheets: Data sheets for I&C components.
 - a. Format and Level of Detail: In accordance with ISA-S20.
 - b. Include component type identification code and tag number on data sheet.
 - c. Specific features and configuration data for each component:
 - 1) Location or service.
 - 2) Manufacturer and complete model number.
 - 3) Size and scale range.
 - 4) Setpoints.
 - 5) Materials of construction.
 - 6) Options included.
 - d. Name, address, and telephone number of manufacturer's local office, representative, distributor, or service facility.
5. Sizing and Selection Calculations:
 - a. Primary Elements: Complete calculations plus process data used. Example, for flow elements, minimum and maximum values, permanent head loss, and

- assumptions made.
 - b. Controlling, Computing and Function Generating Modules: Actual scaling factors with units and how they were computed.
6. Panel Construction Drawings:
- a. Scale Drawings: Show dimensions and location of panel mounted devices, doors, louvers, and subpanels, internal and external.
 - b. Panel Legend: List front of panel devices by tag numbers, nameplate inscriptions, service legends, and annunciator inscriptions.
 - c. Bill of Materials: List devices mounted within panel that are not listed in panel legend. Include tag number, description, manufacturer, and model number.
 - d. Construction Details: NEMA rating, materials, material thickness, structural stiffeners and brackets, lifting lugs, mounting brackets and tabs, door hinges and latches, and welding and other connection callouts and details.
 - e. Construction Notes: Finishes, wire color schemes, wire ratings, wire and terminal block, numbering and labeling scheme.
7. Panel Control Diagrams: For discrete control and power circuits.
- a. Diagram Type: Ladder diagrams. Include devices, related to discrete functions, that are mounted in or on the panel and that require electrical connections. Show unique rung numbers on left side of each rung.
 - b. Item Identification: Identify each item with attributes listed.
 - 1) Wires: Wire number and color. Cable number if part of multiconductor cable.
 - 2) Terminals: Location (enclosure number, terminal junction box number, or MCC number), terminal strip number, and terminal block number.
 - 3) Discrete Components:
 - a) Tag number, terminal numbers, and location ("FIELD", enclosure number, or MCC number).
 - b) Switching action (open or close on rising or falling process variable), setpoint value and units, and process variable description

(for example, Sump Level High).

- 4) Relay Coils:
 - a) Tag number and its function.
 - b) On right side of run where coil is located, list contact location by ladder number and sheet number. Underline normally closed contacts.
 - 5) Relay Contacts: Coil tag number, function, and coil location (ladder rung number and sheet number).
 - c. Show each circuit individually. No "typical" diagrams or "typical" wire lists will be permitted.
 - d. Ground wires, surge protectors, and connections.
 - e. Circuit Names: Show names corresponding to Circuit and Raceway Schedule for circuits entering and leaving a panel.
8. Panel Wiring Diagrams: Show point-to-point and terminal-to-terminal wiring within panel.
 9. Installation Details: Include modifications or further details required to adequately define installation of I&C components.
 10. List of spares, expendables, test equipment and tools.
 11. Additional Equipment Recommended: List of, and descriptive literature for, additional spares, expendables, test equipment and tools recommended.

B. Informational Submittals:

Provide Manufacturer's Certificate of Proper Installation and readiness for operation.

1. Operation and Maintenance (O&M) Manuals: Operation and Maintenance Data, unless otherwise specified in this section.
 - a. Content and Format:
 - 1) Complete sets O&M manuals.
 - 2) Sufficient detail to allow operation, removal, installation, adjustment, calibration, maintenance and purchasing replacements for each PIC component.
 - 3) Final versions of Legend and Abbreviation Lists.
 - b. Include:
 - 1) Process and Instrumentation Diagrams: One

reproducible copy of revised P&ID to reflect as-built PIC design.

- 2) Refer to Paragraph Shop Drawings for the following items:
 - a) Bill of Materials.
 - b) Catalog Cuts.
 - c) Component Data Sheets.
 - d) Panel Control Diagrams.
 - e) Panel Wiring Diagrams, one reproducible copy.
 - f) Panel Plumbing Diagrams, one reproducible copy.
 - g) Loop Diagrams, one reproducible copy.
 - h) Interconnecting Wiring Diagrams, one reproducible copy.
 - i) Application Software Documentation.
- 3) Device O&M manuals for components, electrical devices, and mechanical devices include:
 - a) Operations procedures.
 - b) Installation requirements and procedures.
 - c) Maintenance requirements and procedures.
 - d) Troubleshooting procedures.
 - e) Calibration procedures.
 - f) Internal schematic and wiring diagrams.
 - g) Component Calibration Sheets from field quality control calibrations.
- 4) List of spares, expendables, test equipment and tools provided.
- 5) List of additional spares, expendables, test equipment and tools recommended.

2. **Performance Acceptance Tests (PAT)** Submittals:
 - a. Preliminary Test Procedures: Outlines of proposed tests, forms, and checklists.
 - b. Final Test Procedures: Proposed test procedures, forms, and checklists.
 - c. Test Documentation: Copy of signed off test procedures when tests are completed.

PART 4 - MATERIALS - Specified in applicable sections, SECTION 16902.

PART 5 - EXECUTION

5.1 Testing

- A.** As a minimum, the manufacturer's standard tests and calibration procedures shall be conducted on all instruments.
- B. Performance Acceptance Tests (PAT):** All field devices to be calibrated at factory prior to shipment to site. Applicable test reports to be shipped with field device.
- C.** Conduct all tests in the presence of Engineer or Owner under the supervision of equipment manufacturer's field engineer.
 - 1.** Notify Engineer two weeks prior to the commencement of all tests.
 - 2.** Include all tests recommended by the equipment manufacturer unless specifically waived by Engineer.
 - 3.** Include all additional tests recommended by Engineer that he deems necessary because of field conditions, to determine that equipment and material and systems meet requirements of Contract Documents.
 - 4.** Be responsible for all damage to equipment and material due to improper test procedures or test apparatus handling.

5.2 Acceptance Testing Procedures – Systems Integrator

- 1. Prior to Startup and Performance Evaluation period, inspect, test, and document that associated PIC equipment is ready for operation. Divide Functional Test into two parts.
 - Functional Test Part 1.
 - Functional Test Part 2.
- 2. **Functional Test Part 1:** Performed by Systems Integrator to test and document that PIC is ready for operation. Excluding Owner/Programmer provided applications software.
 - a. Loop/Component Inspections and Tests:
 - 1) These inspections and tests do not require witnessing will be spot checked by Engineer.

- 2) Check PIC for proper installation, calibration, and adjustment on loop-by-loop and component-by-component basis.
- 3) Provide space on forms for signoff by PICS Subcontractor.
- 4) Use loop status report to organize and track inspection, adjustment, and calibration of each loop and include the following:
 - a) Project name.
 - b) Loop number.
 - c) Tag number for each component.
 - d) Checkoffs/Signoffs for Each Component:
 - (1) Tag/identification.
 - (2) Installation.
 - (3) Termination wiring.
 - (4) Termination tubing.
 - (5) Calibration/adjustment.
 - e) Checkoffs/Signoffs for the Loop:
 - (1) Panel interface terminations.
 - (2) I/O interface terminations with PLCs.
 - f) I/O Signals for PLCs, RTUs are Operational: Received/sent, processed, adjusted.
 - g) Total loop operational.
 - h) Space for comments.
- 5) Component calibration sheet for each active I&C component (except simple hand switches, lights, gauges, and similar items) and each PLCs, I/O module and include the following:
 - a) Project name.
 - b) Loop number.
 - c) Component tag number or I/O module number.
 - d) Component code number for I&C elements.
 - e) Manufacturer for I&C elements.
 - f) Model number/serial number for I&C elements.
 - g) Summary of Functional Requirements; For Example:
 - (1) Indicators and recorders, scale and chart ranges.
 - (2) Transmitters/converters, input and output ranges.
 - (3) Computing elements' function.
 - (4) Controllers, action (direct/reverse) and control modes (P, I, D).

- (5) Switching elements, unit range, differential (fixed/adjustable), reset (auto/manual).
 - (6) I/O Modules: Input or output.
 - h) Calibrations, for example, but not limited to:
 - (1) Analog Devices: Actual inputs and outputs at 0, 10, 50, and 100 percent of span, rising and falling.
 - (2) Discrete Devices: Actual trip points and reset points.
 - (3) Controllers: Mode settings (P&ID).
 - (4) I/O Modules: Actual inputs or outputs of 0, 10, 50, and 100 percent of span, rising and falling.
 - (5) Space for comments.
 - b. Maintain loop status reports, and component calibration sheets at Site and make them available to Engineer at all times.
 - c. Engineer reviews loop status sheets and component calibration sheets and spot-check their entries periodically, and upon completion of Preparation for Testing. Correct deficiencies found.
 - d. Forms: See example Performance Acceptance Test Sheet in Article Supplements.
3. **Functional Test Part 2:** Combined effort between Contractor, Systems Integrator, and Owner/Programmer/Engineer to confirm PIC is ready for operation. This is to include the software and Owner/Programmer/Engineer provided software configurations.
- a. Prerequisite:
 - 1) Completion of Functional Test Part 1.
 - b. Joint test with Owner/Programmer.
 - c. Test procedures provided by Engineer based on Functional Test Part 1 and application software tests.
 - d. Completed when Functional Test has been conducted and Engineer has approved associated test forms and checklists in field.
4. Required Test Documentation: Test procedures, forms, and checklists. Signed by Engineer and Contractor except for Functional Test items signed only by Contractor.

B. Performance Test During and After Facility Startup:

- 1. Some control processes cannot be completely tested until the facility is up and able to pump water. These functions require an

additional performance testing after or during facility startup. Once a facility's Functional Test has been completed, perform jointly with Engineer, and Owner/Programmer. Make O&M data available to Engineer at Site both before and during testing.

2. Determination of Ready for Operation: When Functional Test has been completed.

5.3 System Integrator Field Services

- A. Testing and Startup Period:** Provide Systems Integrator Field Services for a minimum of **two working days**, with additional days as necessary to accommodate the commissioning and startup. Coordinate startup periods with the engineer, owner and general contractor.
- C.** Test and start-up supervision shall continue until the system is in proper operating condition as determined by the Engineer.
- D.** Provide Systems Integrator Field Services during Work to correct deficiencies in equipment and to correct deficiencies in the installation and wiring of equipment. Corrections shall be at no increase in the contract price.
- F.** Provide Systems Integrator Field Services for all instruments, control devices, and other devices furnished as a part of the control panel or instruments and associated control devices separately mounted to assure proper installation, setting, connection. and functioning.

PART 6 MEASUREMENT AND PAYMENT

6.1 Measurement

- A.** No measurement will be made for this item.

6.2 Payment

- A.** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 16900 ****

SECTION 16902

MEASURING AND CONTROLLING INSTRUMENTS AND LOOPS

PART 1 - GENERAL

1.1 Summary

A. This Section includes the following

1. Transducers and function modules.
4. Float Switches and Pressure Switches.
5. Instrument loops.

1.2 References

1. American National Standards Institute (ANSI)

ANSI B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings.

2. National Electrical Manufacturers Association (NEMA)

3. As specified in each applicable section, this Division.

4. National Fire Protection Association

National Electrical Code, NFPA 70

Standard for Electrical Safety in the Workplace, NFPA 70E

5. National Electrical Safety Code, IEEE C2.

6. Occupational Safety and Health Administration, OSHA.

7. All electrical and control equipment and material shall bear the recognized Underwriters Laboratories, Inc. (UL) seal of approval. It is Vendor's responsibility to obtain local inspection approval for all non-UL labeled equipment and pay all fees in connection with the same.

1.3 Submittals: Submit as specified in Section 1300.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Transducers and Function Modules (with Local Digital Display) NOT USED.

1. Rosemount Inc. (Rosemount).
2. Honeywell Process Control Division (Honeywell).
3. Andress Hauser

B. Magnetic Flowmeters (with Local Digital Display) NOT USED

1. Rosemount Inc. (Rosemount)

C. Level Transducers (W/O Local Display)

1. Endress Hauser Differential Pressure Transmitter 0-24' Range.
2. Engineer Approved Equal

2.2 General

- A.** Transmitters shall have an output signal of 4 to 20 mA dc into a minimum load range of 0-600 ohms at 24Vdc.
- B.** All analog indicating and recording receivers shall have evenly graduated scales.
- C.** Provide all mounting brackets, pipe stands, supports, physical protection, and accessories required to install all field-mounted instruments.
- D.** Splices in transducer cable are not allowed. Provide sufficient length from transducer to PLC/Remote/IO termination block without splices.
- E.** Furnish and install all accessories required for complete and working systems as specified and indicated.

2.3 Transducers and Function Modules

- A.** Solid-state design.
- C.** Provide with terminals for external connections.
- D.** Designed to operate from a 120Vac power source.
- E. Signal Transducers**
 - 1.** Input/output signal ranges shall be standard 1-5Vdc, 4-20 mA dc, or 3-15 psi as indicated.
 - 2.** Provide where required, indicated, or specified to change signal to one compatible with the equipment furnished.

2.4 Float Switches (Not Used)

2.5 Magnetic Flowmeters (Not Used)

- A.** Flowmeter system shall consist of a flow element and an indicating transmitter mounted remotely from the meter tube assembly.
- B.** System shall be accurate to within (1% of flow rate for velocities between 3 and 30 feet per second.
- C. Meter Body**
 - 1.** 304 stainless steel tube with flanged ends.
 - 2.** 150-pound steel with flange that matches the piping provided.
 - 3.** Electrodes shall be 316 stainless steel and conical shaped for self-cleaning action.
 - 4.** Liner shall be polyurethane, PTFE and Neoprene.
 - 5.** Size as specified in this Section.

D. Transmitter

1. Magnetic flowmeter shall have "DC" excited coils.
2. The transmitter electronics shall be microprocessor based.
3. Shall accept the millivolt input from the meter and provide a (4-20 mA) linear output signal proportional to flow.

E. Accessories

1. Provide a stainless steel grounding ring on the inlet and outlet.

2.6 Instrument Loops

A. Well Flow (Not Used)

1. Flow Indicating Transmitter (FIT)
 - a. Provide a mag flow meter as specified
 - b. Install the meter and ground it as indicated
 - c. Calibrate the remote transmitter for full range of meter.
 - d. Mount remote transmitter on equipment rack, and power it from 120 volt panelboard
 - e. Provide a linear 4-20 mA output signal over the specified range. As indicated, wire the output signal to the flow indicating controller and than to the PLC Remote I/O Modules.

PART 3 - EXECUTION

3.1 Installation

- A. Panel Mounted Devices:** As specified in Section 16901.

B. Field Mounted Devices

1. Install as follows

- a.** Mount on floor or wall as required using 2 inch pipe mounts.
 - b.** Mount plumb and level.
 - c.** Mount on walls with bottom of box or instrument 4 feet above floor unless indicated otherwise and instrument case spaced at least 1/2-inch away from wall.
 - d.** Install supports as specified in this Division.
 - e.** Provide sunshade for all instrument displays located outdoors to prevent UV damage to instrument displays.
- 2.** Connect inputs and outputs as indicated on the manufacturer's shop drawings and as follows:
 - a.** Transmitters requiring electric power are supplied from the control panels.

3.2 Manufacturer's Field Services: As specified in Section 16900.

3.3 Field Testing

A. Instrument Tests and Adjustments

- 1.** All instruments to be calibrated at factory, where possible, prior to installation.
- 2.** With each system variable transmitter disconnected from its normal source of input signal, apply an input with manometer, instrument potentiometer, or other device and adjust span and zero on all instruments transmitting, receiving, or retransmitting the resulting variable current or voltage signal and on all final control devices. Check instruments and final control devices at several points over the instrument measuring or control device span.
- 3.** Apply manually adjustable time duration or current signals directly to receivers where required to adjust zero and span

and to check operation of the instrument over the measuring span.

4. Accurately measure variable current and voltage signals as required to adjust all receivers, transmitters, transducers, and final control devices.
5. With input signals as specified in 1 above, adjust zero and span of each controller; check operation of controller with various set points and system variable inputs; adjust controller proportional band, reset, and rate to conform to instructions from manufacturer's representative and Engineer.
6. Check operation of each instrument with system in actual operation.
7. Readjust controller settings as required to obtain desired control of the associated system variables.

B. Functional Testing of Controls

1. Perform before equipment is placed in service.
2. Include operating control system from each control point.
3. Completely check each annunciated point and equipment alarm.
4. Operate by hand all relays and other system components that cannot be operated in normal manner with plant not in service.
5. Repeat with plant in operation.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A.** No measurement will be made for this item.

4.2 Payment

- A.** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 16902 ****

Job Safety Analysis Form

INSTRUCTIONS FOR COMPLETING JOB SAFETY ANALYSIS FORM

Job Safety Analysis (JSA) is an important accident prevention tool that works by finding hazards and eliminating or minimizing them *before* the job is performed, and *before* they have a chance to become accidents. Use your JSA for job clarification and hazard awareness, as a guide in new employee training, for periodic contacts and for retraining of senior employees, as a refresher on

jobs which run infrequently, as an accident investigation tool, and for informing employees of specific job hazards and protective measures.

Set priorities for doing JSAs: jobs that have a history of many accidents, jobs that have produced disabling injuries, jobs with high potential for disabling injury or death, and new jobs with no accident history.

Here's how to do each of the three parts of a Job Safety Analysis:

SEQUENCE OF BASIC JOB STEPS	POTENTIAL HAZARDS	RECOMMENDED ACTION OR PROCEDURE
<p>Break the job down into steps. Each of the steps of a job should accomplish some major task. The task will consist of a <i>set</i> of movements. Look at the first set of movements used to perform a task, and then determine the next logical set of movements. For example, the job might be to move a box from a conveyor in the receiving area to a shelf in the storage area. How does that break down into job steps? Picking up the box from the conveyor and putting it on a handtruck is one logical set of movements, so it is one job step. Everything related to that one logical set of movements is part of that job step.</p> <p>The next logical set of movements might be pushing the loaded handtruck to the storeroom. Removing the boxes from the truck and placing them on the shelf is another logical set of movements. And finally, returning the handtruck to the receiving area might be the final step in this type of job.</p> <p>Be sure to list all the steps in a job. Some steps might not be done each time—checking the casters on a handtruck, for example. However, that task is part of the job as a whole, and should be listed and analyzed.</p>	<p>Identify the hazards associated with each step. Examine each step to find and identify hazards—actions, conditions, and possibilities that could lead to an accident.</p> <p>It's not enough to look at the obvious hazards. It's also important to look at the entire environment and discover every conceivable hazard that might exist.</p> <p>Be sure to list health hazards as well, even though the harmful effect may not be immediate. A good example is the harmful effect of inhaling a solvent or chemical dust over a long period of time.</p> <p>It's important to list <i>all</i> hazards. Hazards contribute to accidents, injuries and occupational illnesses.</p> <p>In order to do part three of a JSA effectively, you must identify potential and existing hazards. That's why it's important to distinguish between a hazard, an accident and an injury. Each of these items has a specific meaning:</p> <p>Hazard – A potential <i>danger</i>. Oil on the floor is a <i>hazard</i>. Accident – An unintended <i>happening</i> that may result in injury, loss or damage. Slipping on the oil is an <i>accident</i>. Injury – the <i>result</i> of an accident. A sprained wrist from the fall would be an <i>injury</i>.</p> <p>Some people find it easier to identify possible accidents and illnesses and work back from them to the hazards. If you do that, you can list the accident and illness types in parentheses following the hazard. But be sure you focus on the <i>hazard</i> for developing recommended actions and safe work procedures.</p>	<p>Using the first two columns as a guide, decide what actions are necessary to eliminate or minimize the hazards that could lead to an accident, injury, or occupational illness.</p> <p>Among the actions that can be taken are: 1) engineering the hazard out; 2) providing personal protective equipment; 3) job instruction training; 4) good housekeeping; and 5) good ergonomics (positioning the person in relation to the machine or other elements in the environment in such a way as to eliminate stresses and strains.)</p> <p>List recommended safe operating procedures on the form, and also list required or recommended personal protective equipment for each step of the job.</p> <p>Be specific. Say <i>exactly</i> what needs to be done to correct the hazard, such as "lift, using your leg muscles." Avoid general statements like "be careful."</p> <p>Give a recommended action or procedure for <i>every</i> hazard.</p> <p>If the hazard is a serious one, it should be corrected immediately. The JSA should then be changed to reflect the new conditions.</p>

APPENDIX

CONSTRUCTION - CONTRACTOR SAFETY CHECKLIST

Project: _____

Location: _____

General Contractor: _____

Date: _____

This safety checklist references the Code of Federal Regulations (CFR) Title 29 Part 1926.

Safety Submittals

- The Contractor shall submit the Contractor’s Company Safety Plan, Site Specific Safety Plan (IIPP), and Job Safety Analysis.

Worksite Safety

- The Contractor shall provide general and health provisions with environmental controls in accordance with CFR Title 29 Part 1926 Subpart A, Subpart B, Subpart C, Subpart D, and other applicable Subparts, including state and local requirements.
- The Contractor shall provide traffic control in accordance with Public agency requirements as shown on the approved Traffic Control Plan for the project.
- Will the Contractor have a first aid kit on the job site? **YES** **NO**
- Will the Contractor enforce a drug free workplace? **YES** **NO**

Personal Safety

- The Contractor shall provide personal protective and life saving equipment in accordance with CFR Title 29 Part 1926 Subpart E and other applicable Subparts, including state and local requirements.

Fire Protection and Prevention

- The Contractor shall provide fire protection and prevention equipment in accordance with CFR Title 29 Part 1926 Subpart F and other applicable Subparts, including state and local requirements.
- Has Contractor developed fire prevention program **YES** **NO**
29CFR 1926.24

Electrical Safety

- The Contractor shall ensure all electrical conductors and equipment are approved and in accordance with CFR Title 29 Part 1926 Subpart K and other applicable Subparts, including state and local requirements.
- Will contractor ensure all pull boxes, junction boxes, and fitting are covered. If metal covers are used, they shall be grounded. YES NO
29CFR 1926.405(b) (2)
- Will contractor maintain a Lockout and tagging of circuits? YES NO
29CFR 1926.417

Hazard Communication

- The contractor shall insure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. This transmittal of information shall include container labeling and other forms of warning, material safety data sheets (MSDS) and employee training.

Location of contractor MSDS on site: _____.

The Contractor shall conform with the provisions of CFR Title 29 Part 1910.1200 (e)(1), (e)(2), (f)(1),(g)(1),(h)(1) and (2)(i) through (iii) made applicable to construction by 1926.59, and other applicable Subparts, including state and local requirements.

Signs, Signals, and Barricades

- The Contractor shall provide signs, signals, and barricades in accordance with CFR Title 29 Part 1926 Subpart G and other applicable Subparts, including state and local requirements.

Material and Equipment Safety

- The Contractor shall handle, store, stack, rack, block, interlock, use and dispose of materials in accordance with CFR Title 29 Part 1926 Subpart H and other applicable Subparts, including state and local requirements.
- Will contractor use power industrial trucks (forklifts) on site? YES NO
- Have power industrial truck (forklift) operators received training? YES NO
29CFR 1910.178(I) (1)
- Where will the Contractor's materials, equipment and vehicles will be stored and parked?

Address

Address

Hand and Power Tool Safety

- The Contractor shall ensure all hand and power tools and similar equipment, whether furnished by the employer or the employee, shall be maintained in a safe condition in accordance with CFR Title 29 Part 1926 Subpart I and other applicable Subparts, including state and local requirements.

Welding and Cutting Safety

- The Contractor shall ensure suitable fire extinguishing equipment is available and maintained in accordance with CFR Title 29 Part 1926 Subpart J and other applicable Subparts, including state and local requirements.

Scaffolding Safety

- The Contractor shall ensure all scaffolding is designed, erected, and maintained in accordance with CFR Title 29 Part 1926 Subpart L and other applicable Subparts, including state and local requirements.
- Will contractor erect or dismantle scaffolding? YES NO
29CFR 1926.451(e) (9) (i)
- Contractor's scaffolding erection/ dismantling competent person for project is:

Name and Phone Number

Confined Space Entry

- The Contractor's working in confined spaces shall comply with CFR Title 29 Part 1926 Subpart AA, Confined Spaces in Construction.
- Contractor working in confined spaces? YES NO
- Contractor has a confined space program in place? YES NO
- Contractor's confined space competent person for project is:

Name and Phone Number

Fall Safety

- The Contractor shall provide fall protection in accordance with CFR Title 29 Part 1926 Subpart M and other applicable Subparts, including state and local requirements.
- Has a competent person trained affected employees? YES NO
29CFR 1926.503(a)(2)
- Contractor's fall safety competent person for this project is:

Name and Phone Number

Crane, Derricks, Hoists, Elevators, and Conveyor Safety

- The Contractor shall ensure hoisting equipment is inspected, maintained, and operated in accordance with CFR Title 29 Part 1926 Subpart N and other applicable Subparts, including state and local requirements.
- Contractor will use authorized, qualified employees to operate cranes, including mobile and tower cranes or hoisting apparatus. YES NO
8 CCR 5006, 5006.1

Trenching/Excavation Safety

- The Contractor shall conduct all excavations in accordance with CFR Title 29 Part 1926 Subpart P and other applicable Subparts including state and local requirements.
- Will a competent person be on site conducting inspections? YES NO
1926.651(k)(l)
- Contractor's excavation safety competent person for this project is:

Name and Phone Number

Steel Erection Safety

- The Contractor shall ensure steel erection is in accordance with CFR Title 29 Part 1926 Subpart R and other applicable Subparts including state and local requirements.
- Has Contractor provided a training program for all employees exposed to fall hazards? 1926.761(b)(2) YES NO

Other

- The Contractor shall incorporate all applicable Subparts of the CFR Title 29 Part 1926, including state and local requirements as required for the project.

The topics covered above are intended as generic, non-exhaustive overview of hazards related to plant construction. This checklist does not alter or absolve the Contractor from compliance responsibilities set forth in the OSHA standards themselves, and the Occupational Safety and Health Act. By signing below, the contractor is NOT absolved from full responsibility for complying with all local, state, federal regulations.

Authorized Contractor Representative (Sign and Date)

DAILY JOBSITE SAFETY SURVEY REPORT

To be completed by Contractor and submitted to Resident Project Representative on a daily basis

Job # _____ Job Name/Location _____ Date: _____ Time: _____

Contractor Competent
Person (Printed)

Contractor
Competent Person
(signature)

O.K.				
Corrective Action Required				
Not Inspected, N/A				
Corrected				
1. Personal Protective Equipment Worn				
Hard Hats				
Eye Protection				
Hearing Protection				
Respirators				
Protective Clothing				
Protective Footwear				
Fall Protection				
2. Housekeeping				
Waste/Hazardous Waste Properly Stored				
Waste testing completed				
Debris Removal				
Daily Site Clean-Up				
3. Ladders/Stairs				
Ladders in good condition				
Ladders tied off				
Extends 36" above landing				
4. Open Floors and sides				
Perimeter guardrail in place				
Floor Openings covered / protected				
5. Scaffolds				
Guardrails, toeboards, access points in place.				
Rigged IAW OSHA requirements				
In good condition and inspect.				

O.K.				
Corrective Action Required				
Not Inspected, N/A				
Corrected				
7. Fire Protection				
Adequate extinguishers in place.				
Flammable material properly stored.				
Fire watch in place for Welding/Cutting.				
8. Tools				
Good condition				
Tool guards in place.				
Power Cords in good condition.				
Temporary Power Boxes in good condition.				
9. Site/Public Protection				
Fences in place.				
Barricades in place.				
Safety signage posted.				
10. Weather Hazard				
High Winds				
Rain				
Temperature (Too High or Too Low)				
10. First Aid				
Trained Personnel on site.				
Kits/Supplies on site and maintained.				
Sanitation/Water available to workforce.				
11. Programs/Information				
JSA Reviewed with workforce.				
New Hire Orientation				
Hazardous Substances identified and MSDS sheets available.				
Safety Meetings conducted weekly.				
Safety Signs Posted.				

6. Electrical

Adequate Lighting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Grounded/GFCI protected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cords, plugs & receptacles in good condition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. Confined Space Entry:

Gas testing conducted.	<input type="checkbox"/>	<input type="checkbox"/>
Permit Required confined space?	<input type="checkbox"/>	<input type="checkbox"/>
Non permit required confined space?	<input type="checkbox"/>	<input type="checkbox"/>

Number of Men in Crew: _____

Names of Crew Members:

Work Day Safety Comments:

Any safety accidents/incidents during the work day ?

Were the accidents/incidents reported to the appropriate parties ?



SUBMITTAL CHECK LIST

Sub. No.	Item	Submit By	Date Received	Date Reviewed	Previous Sub. No.	Status
1.	Insurance Certificate	CD				
2.	Name of Competent Person	CD + 15 days				
3.	A letter (on company letterhead) from the Contractor stating/certifying that the Contractor's Competent Person(S) has/have received training in accordance with local, state, and federal regulations	CD + 15 days				
4.	Documentation of Training for Support Personnel	CD + 15 days				
5.	Welder(s) Certification (submitted at site)	prior to welding				
6.	Work Safety Program	CD + 15 days				
7.	Confined Space Entry Procedure	CD + 15 days				
8.	Traffic Control Plan	CD + 15 days				
9.	Public Safety Plan	CD + 15 days				
10.	Bar Chart or Progress Schedule	CD + 15 days				
11.	Schedule of Values	CD + 15 days				
12.	Submittal for Times of Work	CD + 15 days				
13.	Descriptive written plan concerning how abrasive and/or paint damage to automobiles and property will be handled, including a process for quick removal of the abrasive or paint, and who will do the Work	CD + 15 days				
14.	Letter From Soils Laboratory Verifying the Allowable Soil Bearing Pressure	within 3 days of performance of field work				
15.	Reinforcing Steel Mill Test Certifications	CD + 60 days				
16.	Reinforcing Steel Order List	CD + 30 days				
17.	Concrete Mix Design	CD + 20 days				
18.	Concrete Compression Test Results - 7 day	test + 14 days				
19.	Concrete Compression Test Results - 28 day	test + 14 days				
20.	Foundation Drawings	CD + 30 days				
21.	Tank Drawings	CD + 30 days				
22.	Capacity Chart (1 ft increments)	CD + 30 days				
23.	Weld Roll-Out Drawing	CD + 30 days				
24.	Welding Procedures	CD + 30 days				
25.	Steel Mill Test Certifications	CD + 60 days				
26.	Exterior Prime Coat - Supplier, Type, PDS	CD + 20 days				
27.	Exterior Intermediate Coat - Supplier, Type, PDS	CD + 20 days				
28.	Exterior Finish Coat - Supplier, Type, PDS	CD + 20 days				
29.	Exterior Intermediate Color and Finish Color	CD + 20 days				
30.	Interior Prime Coat - Supplier, Type, PDS	CD + 20 days				
31.	Interior Finish Coat - Supplier, Type, PDS	CD + 20 days				
32.	Concrete First Coat - Supplier, Type, PDS	CD + 20 days				
33.	Concrete Second Coat - Supplier, Type, PDS	CD + 20 days				
34.	Flexible Sealant - Supplier, Type, PDS	CD + 20 days				
35.	Solventless, Underwater-Curing Epoxy - Supplier, Type, PDS	CD + 20 days				
36.	Thinners - Supplier, Type, MSDS	CD + 20 days				
37.	Disinfectant - Supplier, Type, MSDS	CD + 20 days				
38.	Abrasives - Supplier, Type, MSDS, and Size	CD + 20 days				
39.	Abrasives - letter from coating manufacturer's HQ stating the Resulting Abrasive Profile is acceptable	CD + 20 days				
40.	Plan for Forced Ventilation for Interior Coating Cure	CD + 20 days				

Status Abbreviations ** NEN = No Exceptions Noted, MCN = Make Corrections Noted, R&R = Revise & Resubmit, REJ = Rejected, See Comments,
 NAR = No Action Required by Engineer or Owner
 CD = Contract Date --- All Submittals Shall be Received Prior to Contractor Starting Work on Site

<u>Sub. No.</u>	<u>Item</u>	<u>Submit By</u>	<u>Date Received</u>	<u>Date Reviewed</u>	<u>Previous Sub. No.</u>	<u>Status</u>
41.	Compliance with ANSI/NSF Standard 61 (if not stated on PDS)	CD + 20 days				
42.	Certification from manufacturer that Alternate Coating Materials Meet the Specifications	CD + 20 days				
43.	Certification from manufacturer that all coating materials contain less than 0.025% by weight of lead (or any lead compounds), cadmium, and chromium in the cured coating for each coat applied	CD + 20 days				
44.	Cathodic Protection Bracket Location Drawing	CD + 20 days				
45.	Catalog Cuts, Installation, and Operation Instructions of Ladder Safe-Climbing Device	CD + 20 days				
46.	Certification from coating manufacturer that the interior coating has cured such that it is ready for immersion service	prior to filling tank				
47.	Contract Close-Out Written Report	end of Project				
48.	Contract Close-Out "As-Built" Drawings	end of Project				

Status Abbreviations ** NEN = No Exceptions Noted, MCN = Make Corrections Noted, R&R = Revise & Resubmit, REJ = Rejected, See Comments,
 NAR = No Action Required by Engineer or Owner
 CD = Contract Date --- All Submittals Shall be Received Prior to Contractor Starting Work on Site

Submittal Cover Sheet

New 750,000 Gallon Tank

(Name of Contractor)

Lake Havasu City, Arizona
900 London Bridge Road
Lake Havasu City, Arizona 86403

(Address)

(City, State Zip)

Tank Industry Consultants
7740 West New York Street
Indianapolis, Indiana 46214

5 Sets of Each Submittal Included
1 set of reviewed submittals returned to CONTRACTOR
1 set of reviewed submittals forwarded to OWNER

TIC Project No.: _____._____.S1803.002

Submittal
No. Date

--	--

SUBMITTAL

Checklist Specification
Item No. Section Description

Checklist Item No.	Specification Section	Description

**Review is for General Compliance with Contract Documents and Specifications.
No Responsibility is Assumed for Correctness of Dimensions or Details.**

- _____ **No Exceptions Noted**
- _____ **No Action Required by Engineer or Owner**
- _____ **Make Corrections Noted**
- _____ **Revise & Resubmit**
- _____ **Rejected – See Comments**

Tank Industry Consultants

By: _____ Date: _____

SCS

GEOTECHNICAL DATA

for the

Fabrication and Erection of

One 750,000 Gallon Welded Steel Ground Storage Tank

Including Aluminum Dome Roof, Foundation, Painting,

Piping, Site Work, and Accessories

for the

Lake Havasu City, Arizona

NOTE: The following "Geotechnical Investigation" is provided for information only. Any actions taken or decisions made as a result of the Investigation shall be at the risk of the party taking the action or making the decision. The ENGINEER and OWNER do not guarantee nor certify the accuracy and completeness of the Investigation. Costs incurred as a result of correcting damage caused by use of the Investigation shall be borne by the party performing the work that was damaged.

TIC 24.125.S1803.002

GEOTECHNICAL EVALUATION REPORT

WELDED STEEL GROUND STORAGE TANK

34.561138° N; -114.355844° W

Lake Havasu City, Arizona

WT Job No. 25-224186-0

PREPARED FOR:

Lake Havasu City

2330 McCulloch Boulevard North

Lake Havasu City, Arizona 86403

Attn: Mr. Jason C. Hart, Project Manager

Attn: Lourdes Borrego-O'Brien

August 22, 2024



Gregory L. E. Burr, P.E., R.G.
Geotechnical Department Manager



Craig P. Wiedeman, P.E.
Senior Geotechnical Engineer

GEOTECHNICAL

ENVIRONMENTAL

INSPECTIONS

NDT

MATERIALS

2400 East Huntington Drive
Flagstaff, Arizona 86004

(928)-774-8700

rma-western.com

August 22, 2024

Lake Havasu City
2330 McCulloch Boulevard North
Lake Havasu City, Arizona 86403

Attn: Mr. Jason C. Hart, Project Manager
Attn: Lourdes Borrego-O'Brien

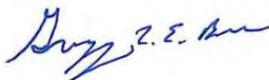
Re: Geotechnical Evaluation
Welded Steel Ground Storage Tank
34.561138° N; -114.355844° W
Lake Havasu City, Arizona

Job No. 25-224186-0

Western Technologies Inc. has completed the geotechnical evaluation for the new water storage tank to be located in Lake Havasu City, Arizona. This study was performed in general accordance with our proposal number 25-224186-P dated May 30, 2024. The results of our study, including the boring location diagram, laboratory test results, boring logs, and the geotechnical recommendations are attached.

We have appreciated being of service to you in the geotechnical engineering phase of this project and are prepared to assist you during the construction phases as well. If design conditions change, or if you have any questions concerning this report or any of our testing, inspection, design and consulting services, please do not hesitate to contact us. We look forward to working with you on future projects.

Sincerely,
WESTERN TECHNOLOGIES, INC.
Geotechnical Engineering Services



Gregory L. E. Burr, P.E., R.G.
Geotechnical Department Manager

Copies to: Addressee (emailed)

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APPENDIX B

Laboratory TestsB-1 to B-7

**GEOTECHNICAL EVALUATION
WELDED STEEL GROUND STORAGE TANK
34.561138° N; -114.355844° W
LAKE HAVASU CITY, ARIZONA
JOB NO. 25-224186-0**

1.0 PURPOSE

This report contains the results of our geotechnical evaluation for the proposed new water storage tank to be located north and west of Whelan Drive in Lake Havasu City, Arizona. The purpose of these services is to provide information and recommendations regarding:

- foundation design parameters
- lateral earth pressures
- earthwork
- drainage
- corrosivity

Results of the field exploration, field tests, and laboratory testing program are presented in the Appendices.

2.0 PROJECT DESCRIPTION

Based on information provided by Lourdes Borrego-O'Brien, the proposed project will consist of a 750,000 gallon above-ground storage tank that will be about 75 feet wide and 25 feet tall supported on a ringwall foundation with a center column and compacted aggregate. Maximum wall and column loads for the structure are assumed to be 1.0 kip per linear foot and 55 kips, respectively. We anticipate that the finished bottom of tank level will be within 2 to 3 feet of the existing site grades. Should any of our information or assumptions not be correct, we request that the Client notify Western Technologies (WT) immediately.

3.0 SCOPE OF SERVICES

3.1 Field Exploration

Three borings were auger drilled to depths of about 28 to 40 feet below the existing site grades in the proposed new tank location. The borings were at the approximate locations

shown on the attached boring location diagram. Logs of the borings are presented in Appendix A.

Subsoils encountered during drilling were examined visually and sampled at selected depth intervals. A field log was prepared for each boring. These logs contain visual classifications of the materials encountered during drilling as well as interpolation of the subsurface conditions between samples. Final logs, included in Appendix A, represent our interpretation of the field logs and include modifications based on laboratory observations and tests of the field samples. The final logs describe the materials encountered, their thicknesses, and the locations where samples were obtained.

The Unified Soil Classification System was used to classify soils. The soil classification symbols appear on the boring logs and are briefly described in Appendix A. Local and regional geologic characteristics were used to estimate the seismic design criteria.

3.2 Laboratory Analyses

Laboratory analyses were performed on representative samples to aid in material classification and to estimate pertinent engineering properties of the on-site materials for preparation of this report. Testing was performed in general accordance with applicable ASTM and Arizona methods. The following tests were performed and the results are presented in Appendix B.

- Water content
- Dry density
- Compression
- Remolded expansion potential
- Maximum density/optimum moisture
- Shear strength
- Gradation
- Plasticity
- Soluble salts/sulfates/chlorides
- Corrosivity (ASTM A674)

Test results were utilized in the development of the recommendations contained in this report.

3.3 Analyses and Report

This geotechnical engineering report includes a description of the project, a discussion of the field and laboratory testing programs, a discussion of the subsurface conditions, and design recommendations as appropriate to the purpose. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site, discovery of underground storage tanks or other underground structures, or identification of contaminated or hazardous materials or conditions. If there is concern about the potential for such contamination, other studies should be undertaken. We are available to discuss the scope of such studies with you.

4.0 SITE CONDITIONS

4.1 Surface

At the time of our field exploration, the site was a developed water recovery and storage facility. Previous development on the site consisted of two existing water tanks and a metal frame maintenance building with exteriors that appeared to be in good condition. The site is bordered on the south and west by Whelan Drive, on the east by the Lake Havasu City Airport, and on the north by undeveloped land. The ground surface was relatively flat and contained a sparse growth of native grasses and weeds. Surface drainage on the site appeared to be fair to poor with some evidence of previous surface water ponding.

4.2 Subsurface

As presented on the boring logs, surface and subsoils that extend to the full depth of exploration in the borings consisted of non-plastic, dense to very dense Silty SANDS and medium dense to very dense, low plasticity Silty, Clayey SANDS, both with variable amounts of gravel, cobbles, and boulders. Groundwater was not encountered in any boring at the time of exploration. The logs in Appendix A show details of the subsurface conditions encountered during the field exploration.

The boring logs included in this report are indicators of subsurface conditions only at the specific location and date noted. Variations from the field conditions represented by the borings may become evident during construction. If variations appear, we should be contacted to re-evaluate our recommendations.

5.0 GEOTECHNICAL PROPERTIES

5.1 Laboratory Tests

Laboratory test results (see Appendix B) indicate that on-site subsoils located near and below anticipated shallow foundation level exhibit moderate compressibility at existing water contents. Low additional compression occurs when the water content is increased.

Near-surface soils are non-plastic to low plasticity and exhibit low expansion potential when recompacted, confined by loads approximating floor loads and saturated in accordance with standard Arizona test methods. Slabs-on-grade supported on recompacted native soils have a low potential for heaving if the water content of the soil increases.

5.2 Field Tests

Existing subsoils located near and below anticipated shallow foundation level exhibited moderate to high resistance to penetration using test method ASTM D3550. The penetration resistance values exhibited variability between test locations and with depth. This represents a potential for differential movements within a structure supported on the existing soils in their present condition.

6.0 RECOMMENDATIONS

6.1 General

Recommendations contained in this report are based on our understanding of the project criteria described in Section 2.0, **PROJECT DESCRIPTION**, and the assumption that the soil and subsurface conditions are those disclosed by the borings. Others may change the plans, final elevations, number and type of structures, foundation loads, and tank floor level during design or construction. Substantially different subsurface conditions from those described herein may be encountered or become known. Any changes in the project criteria or subsurface conditions shall be brought to our attention in writing.

6.2 Design Considerations

The existing site soils are not considered suitable for support of the tank in their present state and should be partially overexcavated and replaced as recommended in the **EARTHWORK** section of this report. Proper drainage should be provided to help prevent infiltration of moisture below the tank.

6.3 Tank Pad/Ringwall/Center Column Foundation

If the recommendations contained in this report are followed, the tank shell may be supported, as planned, on a perimeter ringwall foundation. The ringwall element and the center column foundation should be supported by a conventional shallow spread footing bearing on a minimum thickness of 2 feet of low expansive on-site soils removed and recompacted as engineered fill and/or properly compacted, imported, low expansive, engineered fill. The ringwall footing and the center column foundation should bear at least 3 feet below the lowest adjacent finished grade. The footings may be designed to impose a maximum dead plus live-load pressure of up to 2500 pounds per square foot. The overall tank pad, prepared as recommended in the **EARTHWORK** section of the report, will be suitable to support a maximum dead plus live-load pressure of up to 3000 pounds per square foot. We anticipate that total and differential movements of the proposed tank structure, supported as recommended, should be within tolerable limits of the tank manufacturer, typically uniform settlement of less than 2 inches and differential settlement less than 0.5-inch per 32 feet of circumference. Additional foundation movements could occur if water from any source infiltrates the foundation soils. Therefore, proper drainage should be provided in the final design and during construction.

We recommend that the geotechnical engineer or his representative observe the tank pad, the perimeter ringwall excavation and the center column foundation excavation before reinforcing steel and concrete are placed. It should be determined whether the soils exposed are similar to those anticipated for support of the footing. Any soft, loose or unacceptable soils should be undercut to suitable materials and backfilled with either lean mix or structural concrete.

6.4 Lateral Design Criteria

Lateral loads can be resisted by soil friction and by the passive resistance of the soils. A coefficient of friction of 0.35 can be used between the tank and the supporting soils. The passive resistance of natural soils or properly compacted fill can be approximated by the

pressure developed by a fluid with a density of 225 pounds per cubic foot (psf/ft). The passive pressure and the frictional resistance of the soils can be combined without reduction in determining the total lateral resistance.

6.5 Seismic Considerations

Structures should be designed in accordance with applicable building codes. The seismic design parameters presented in the following table, in accordance with the 2018 International Building Code and ASCE 7-16, are applicable to the project site:

Seismic Design Parameters International Building Code 2018, ASCE 7-16	
Soil Site Class	C
Mapped Spectral Response Acceleration at 0.2 sec period (S_s)	0.190g
Mapped Spectral Response Acceleration at 1.0 sec period (S_1)	0.112g
Site Coefficient for 0.2 sec period (F_a)	1.3
Site Coefficient for 1.0 sec period (F_v)	1.5
Design Spectral Response Acceleration at 0.2 sec period (S_{DS})	0.164g
Design Spectral Response Acceleration at 1.0 sec period (S_{D1})	0.112g

The soil site class is based upon conditions identified in shallow exploratory borings and local knowledge of the geotechnical conditions in the vicinity of the site. Conditions extending beyond the depth of our borings to a depth of 100 feet were assumed for the purposes of providing the information presented in the table. Based upon the density of the on-site soils, the potential settlement and lateral spread due to liquefaction is not considered to be a significant concern on the site.

6.6 Drainage

The major cause of problems in this vicinity is moisture increase in soils below structures. Therefore, it is extremely important that positive drainage be provided during construction and maintained throughout the life of the proposed tank. Infiltration of water into utility or foundation excavations must be prevented during construction. No surface features which could retain water adjacent to the tank should be constructed.

6.7 Corrosivity

Based on the laboratory test results, the on-site soils exhibit a low to moderate corrosive potential to ductile iron piping. This information should be used as an aid in choosing the construction materials that will be in contact with these soils and that will need to be resistant to various corrosive forces. Manufacturers' representatives should be contacted regarding the specific corrosivity resistance for their particular product.

The chemical test results indicate that the soils at the site classify as moderately corrosive to concrete (Class S1 in accordance with Table 19.3.1.1 of ACI 318-19). Concrete should be made with a cement that provides sulfate resistance and that has a maximum water-cementitious materials ratio and minimum compressive strength set forth in Table 19.3.2.1 of ACI 318-19.

7.0 EARTHWORK

7.1 General

The conclusions contained in this report for the proposed construction are contingent upon compliance with recommendations presented in this section. Any excavating, trenching, or disturbance which occurs after completion of the earthwork must be backfilled, compacted and tested in accordance with the recommendations contained herein. It is not reasonable to rely upon our conclusions and recommendations if any future unobserved and untested trenching, grading or backfilling occurs.

7.2 Site Clearing

Strip and remove any remaining vegetation, debris, and any other deleterious materials from the tank pad area. The tank pad area is defined as that area within the tank footprint plus 5 feet beyond the perimeter of the footprint. All exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.

7.3 Excavation

We anticipate that excavations into the site soils for shallow foundations and utility trenches for the proposed construction can be accomplished with conventional equipment. The site soils are granular and may be susceptible to caving and sloughing. Excavations may need to be braced or sloped to stabilize sidewalls.

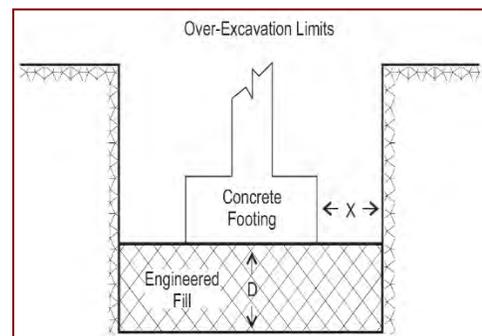
The soils to be penetrated by the proposed excavations may vary significantly across the site. Our soil classifications are based solely on the materials encountered in three exploratory test borings. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are found at the time of construction, we should be contacted immediately to evaluate the conditions encountered.

7.3.1 Temporary Excavations and Slopes

Temporary, non-surcharged construction excavations should be sloped or shored. The individual contractor should be made responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. All excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards. OSHA recommends a maximum slope inclination of 0.75:1 (horizontal:vertical) for Type A soils, 1:1 for Type B soils, and 1.5:1 for Type C soils. Slopes may need to be flattened depending on conditions exposed during construction. If there is not enough space for sloped excavations, shoring should be used.

7.4 Tank Ringwall and Center Column Foundation Preparation

In the ringwall and center column foundation areas, remove existing soils to a minimum depth of 2 feet below the bottom of the footing (depth D in the diagram). Removal should extend a minimum of 1 foot beyond the footing edges (length X in the diagram). Replace with engineered fill material.



7.5 Tank Pad Preparation

Remove site soils to a minimum depth of 2 feet below the bottom of the aggregate base layer. Following the removal, scarify, moisten or dry as required, and compact all subgrade soils to a minimum depth of 8 inches. The subgrade preparation should be accomplished in a manner which will result in uniform water contents and densities after compaction. All subgrade preparation in the tank area should extend a minimum of 5 feet beyond the perimeter of the tank. The subgrade preparation should be accomplished in a manner which will result in uniform water contents and densities after compaction.

7.6 Materials

a. Clean on-site native soils with a maximum dimension of 6 inches or imported materials may be used as fill material for the following:

- foundation areas
- tank pad area
- backfill

b. Frozen soils should not be used as fill or backfill.

c. Imported soils should conform to the following:

- Gradation (ASTM C136): percent finer by weight

6"	100
4"	85-100
¾"	70-100
No. 4 Sieve	50-100
No. 200 Sieve	40 (max)
- Maximum expansive potential (%)¹ 1.5

¹ Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged.

- Maximum soluble sulfates (%)..... 0.10

d. Base course should conform to Lake Havasu City specifications.

7.7 **Placement and Compaction**

a. Place and compact fill in horizontal lifts, using equipment and procedures that will produce recommended water contents and densities throughout the lift.

b. Uncompacted fill lifts should not exceed 8 inches.

c. Materials should be compacted to the following:

**Minimum Percent
Material Compaction (ASTM D698)**

- On-site and imported soil, reworked and fill:
Below foundations 95
Below tank 95
- Aggregate base 100
- Backfill:
Structural 95
Nonstructural 90

d. On-site and imported soils with low expansive potential and aggregate base course materials should be compacted with a moisture content in the range of 3 percent below to 3 percent above optimum.

7.8 **Compliance**

Recommendations for structural elements supported on compacted fills or prepared subgrade depend upon compliance with **EARTHWORK** recommendations. To assess compliance, observation and testing should be performed under the direction of a geotechnical engineer.

8.0 ADDITIONAL SERVICES

The recommendations provided in this report are based on the assumption that a sufficient schedule of tests and observations will be performed during construction to verify compliance. At a minimum, these tests and observations should be comprised of the following:

- Observations and testing during site preparation and earthwork;
- Observation of foundation excavations; and
- Consultation as may be required during construction.

Retaining the geotechnical engineer who developed your report to provide construction observation is the best way to verify compliance, and to help you manage the risks associated with unanticipated conditions.

9.0 LIMITATIONS

This report has been prepared assuming the project criteria described in Section 2.0. If changes in the project criteria occur, or if different subsurface conditions are encountered or become known, the conclusions and recommendations presented herein shall become invalid. In any such event, WT should be contacted in order to assess the effect that such variations may have on our conclusions and recommendations.

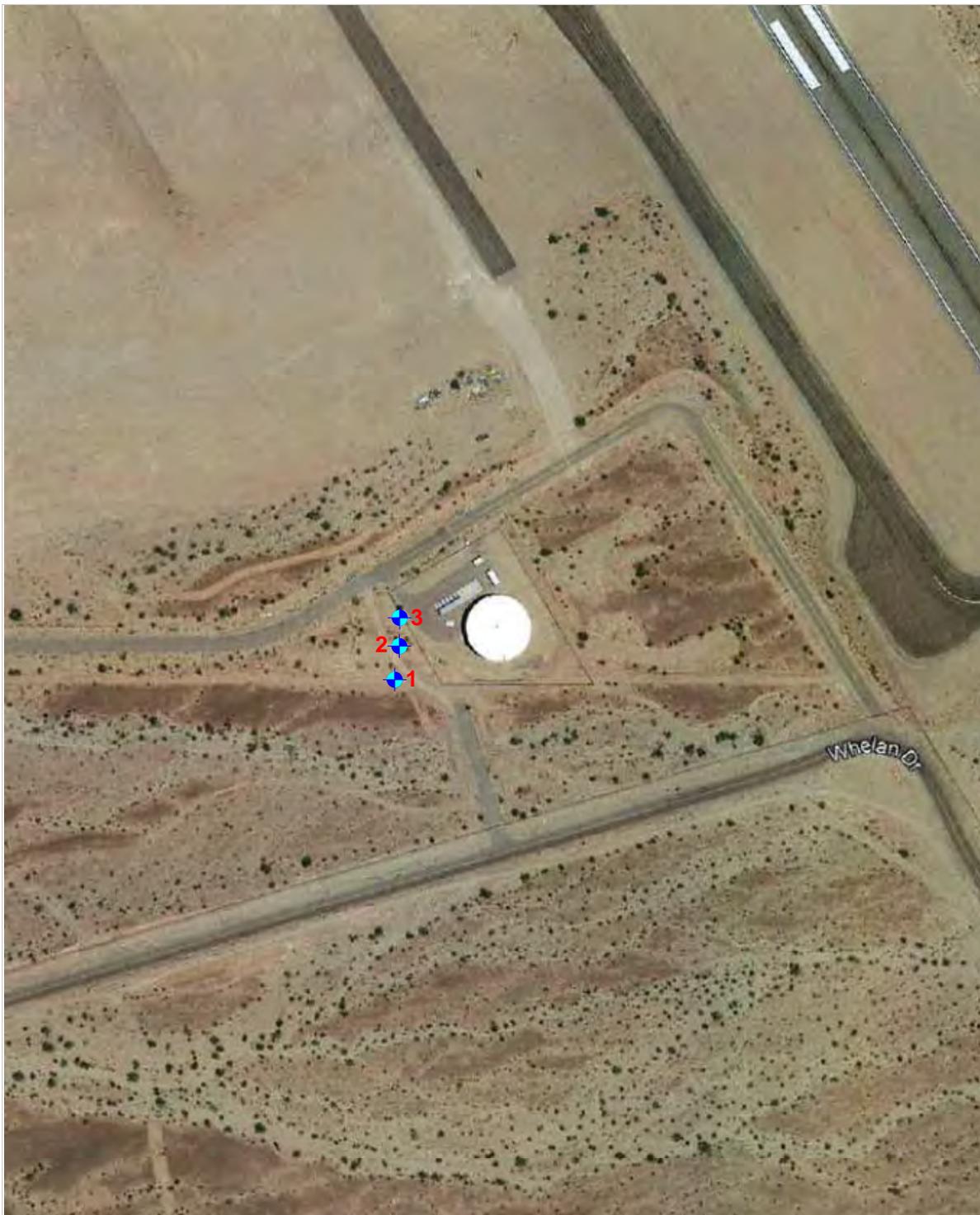
The recommendations presented are based entirely upon data derived from a limited number of samples obtained from widely spaced borings. The attached logs are indicators of subsurface conditions only at the specific locations and times noted. This report assumes the uniformity of the geology and soil structure between borings, however variations can and often do exist. Whenever any deviation, difference or change is encountered or becomes known, WT should be contacted.

This report is for the exclusive benefit of our client alone. There are no intended third-party beneficiaries of our contract with the client or this report, and nothing contained in the contract or this report shall create any express or implied contractual or any other relationship with, or claim or cause of action for, any third party against WT.

This report is valid for the earlier of one year from the date of issuance, a change in circumstances, or discovered variations. After expiration, no person or entity shall rely on this report without the express written authorization of WT.

10.0 CLOSURE

We prepared this report as an aid to the designers of the proposed project. The comments, statements, recommendations and conclusions set forth in this report reflect the opinions of the authors. These opinions are based upon data obtained at the location of the borings, and from laboratory tests. Work on your project was performed in accordance with generally accepted standards and practices utilized by professionals providing similar services in this locality. No other warranty, express or implied, is made.



Not to Scale



Approximate Test Boring Location

WELDED STEEL GROUND STORAGE TANK

Boring Location Diagram

Western Technologies Inc.



Job No.: 25-224186-0

Plate: 1

Allowable Soil Bearing Capacity	The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.
Backfill	A specified material placed and compacted in a confined area.
Base Course	A layer of specified aggregate material placed on a subgrade or subbase.
Base Course Grade	Top of base course.
Bench	A horizontal surface in a sloped deposit.
Caisson/Drilled Shaft	A concrete foundation element cast in a circular excavation which may have an enlarged base (or belled caisson).
Concrete Slabs-On-Grade	A concrete surface layer cast directly upon base course, subbase or subgrade.
Crushed Rock Base Course	A base course composed of crushed rock of a specified gradation.
Differential Settlement	Unequal settlement between or within foundation elements of a structure.
Engineered Fill	Specified soil or aggregate material placed and compacted to specified density and/or moisture conditions under observations of a representative of a soil engineer.
Existing Fill	Materials deposited through the action of man prior to exploration of the site.
Existing Grade	The ground surface at the time of field exploration.
Expansive Potential	The potential of a soil to expand (increase in volume) due to absorption of moisture.
Fill	Materials deposited by the actions of man.
Finished Grade	The final grade created as a part of the project.
Gravel Base Course	A base course composed of naturally occurring gravel with a specified gradation.
Heave	Upward movement.
Native Grade	The naturally occurring ground surface.
Native Soil	Naturally occurring on-site soil.
Rock	A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting or other methods of extraordinary force for excavation.
Sand and Gravel Base Course	A base course of sand and gravel of a specified gradation.
Sand Base Course	A base course composed primarily of sand of a specified gradation.
Scarify	To mechanically loosen soil or break down existing soil structure.
Settlement	Downward movement.
Soil	Any unconsolidated material composed of discrete solid particles, derived from the physical and/or chemical disintegration of vegetable or mineral matter, which can be separated by gentle mechanical means such as agitation in water.
Strip	To remove from present location.
Subbase	A layer of specified material placed to form a layer between the subgrade and base course.
Subbase Grade	Top of subbase.
Subgrade	Prepared native soil surface.



DEFINITION OF TERMINOLOGY

PLATE

A-1

COARSE-GRAINED SOILS
LESS THAN 50% FINES

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
GW	WELL-GRADED GRAVEL OR WELL-GRADED GRAVEL WITH SAND, LESS THAN 5% FINES	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE
GP	POORLY-GRADED GRAVEL OR POORLY-GRADED GRAVEL WITH SAND, LESS THAN 5% FINES	
GM	SILTY GRAVEL OR SILTY GRAVEL WITH SAND, MORE THAN 12% FINES	
GC	CLAYEY GRAVEL OR CLAYEY GRAVEL WITH SAND, MORE THAN 12% FINES	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE
SW	WELL-GRADED SAND OR WELL-GRADED SAND WITH GRAVEL, LESS THAN 5% FINES	
SP	POORLY-GRADED SAND OR POORLY-GRADED SAND WITH GRAVEL, LESS THAN 5% FINES	
SM	SILTY SAND OR SILTY SAND WITH GRAVEL, MORE THAN 12% FINES	
SC	CLAYEY SAND OR CLAYEY SAND WITH GRAVEL, MORE THAN 12% FINES	

NOTE: Coarse-grained soils receive dual symbols if they contain 5% to 12% fines (e.g., SW-SM, GP-GC).

FINE-GRAINED SOILS
MORE THAN 50% FINES

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
ML	SILT, SILT WITH SAND OR GRAVEL, SANDY SILT, OR GRAVELLY SILT	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50
CL	LEAN CLAY OF LOW TO MEDIUM PLASTICITY, SANDY CLAY, OR GRAVELLY CLAY	
OL	ORGANIC SILT OR ORGANIC CLAY OF LOW TO MEDIUM PLASTICITY	
MH	ELASTIC SILT, SANDY ELASTIC SILT, OR GRAVELLY ELASTIC SILT	SILTS AND CLAYS LIQUID LIMIT MORE THAN 50
CH	FAT CLAY OF HIGH PLASTICITY, SANDY FAT CLAY, OR GRAVELLY FAT CLAY	
OH	ORGANIC SILT OR ORGANIC CLAY OF HIGH PLASTICITY	
PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS

NOTE: Fine-grained soils may receive dual classification based upon plasticity characteristics (e.g. CL-ML).

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	Above 12 in.
COBBLES	3 in. – 12 in.
GRAVEL	No. 4 – 3 in.
Coarse	¾ in. – 3 in.
Fine	No. 4 – ¾ in.
SAND	No. 200 – No. 4
Coarse	No. 10 – No. 4
Medium	No. 40 – No. 10
Fine	No. 200 – No. 40
Fines (Silt or Clay)	Below No. 200

NOTE: Only sizes smaller than three inches are used to classify soils

CONSISTENCY

CLAYS & SILTS	BLOWS PER FOOT
VERY SOFT	0 – 2
SOFT	3 – 4
FIRM	5 – 8
STIFF	9 – 15
VERY STIFF	16 – 30
HARD	OVER 30

RELATIVE DENSITY

SANDS & GRAVELS	BLOWS PER FOOT
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

NOTE: Number of blows using 140-pound hammer falling 30 inches to drive a 2-inch-OD (1½-inch ID) split-barrel sampler (ASTM D1586).

PLASTICITY OF FINE GRAINED SOILS

PLASTICITY INDEX	TERM
0	NON-PLASTIC
1 – 7	LOW
8 – 20	MEDIUM
Over 20	HIGH

DEFINITION OF WATER CONTENT

DRY
SLIGHTLY DAMP
DAMP
MOIST
WET
SATURATED



METHOD OF CLASSIFICATION

PLATE

A-2

The number shown in "**BORING NO.**" refers to the approximate location of the same number indicated on the "Boring Location Diagram" as positioned in the field by pacing or measurement from property lines and/or existing features.

"**DRILLING TYPE**" refers to the exploratory equipment used in the boring wherein **HSA = hollow stem auger**, and the dimension presented is the outside diameter of the HSA used.

"**R**" in "**BLOW COUNTS**" refers to a 3-inch outside diameter ring-lined split barrel sampler driven into the ground with a 140 pound drop-hammer dropped 30 inches repeatedly until a penetration of 12 inches is achieved or until refusal. The number of blows required to advance the sampler 12 inches is defined as the "**R**" blow count. The "**R**" blow count requires an engineered conversion to an equivalent SPT N-Value. Refusal to penetration is considered more than 50 blows per foot. An **X** within the symbol indicates no sample recovery. A half-filled **X** within the symbol indicates sample disturbance.

"**SAMPLE TYPE**" refers to the form of sample recovery, in which **R** = Ring-lined sample and **G** = Grab sample.

"**DRY DENSITY (LBS/CU FT)**" refers to the laboratory-determined dry density in pounds per cubic foot.

"**WATER (MOISTURE) CONTENT**" (% of Dry Wt.) refers to the laboratory-determined water content in percent using the standard test method ASTM D2216.

"**USCS**" refers to the "Unified Soil Classification System" Group Symbol for the soil type as defined by ASTM D2487 and D2488. The soils were classified visually in the field, and where appropriate, classifications were modified by visual examination of samples in the laboratory and/or by appropriate tests.

These notes and boring logs are intended for use in conjunction with the purposes of our services defined in the text. Boring log data should not be construed as part of the construction plans nor as defining construction conditions.

Boring logs depict our interpretations of subsurface conditions at the locations and on the date(s) noted. Variations in subsurface conditions and characteristics may occur between borings. Groundwater levels may fluctuate due to seasonal variations and other factors.

The stratification lines shown on the boring logs represent our interpretation of the approximate boundary between soil or rock types based upon visual field classification at the boring location. The transition between materials is approximate and may be more or less gradual than indicated.



BORING LOG NOTES

PLATE

A-3

Project: Welded Steel Ground Storage Tank Project Number: 25-224186-0	BORING NO. 1	 <i>Western Technologies</i> <small>An RMA Company</small>
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Date(s) Drilled 7/18/24	Logged By S. Garcia	Checked By J. Quinlan
Drilling Method HSA	Drill Bit Size/Type 6" HSA	Approximate Surface Elevation Not Determined
Drill Rig Type CME-75	Drilling Contractor Integrity	
Groundwater Level and Date Measured Not Encountered	Location See Location Diagram	

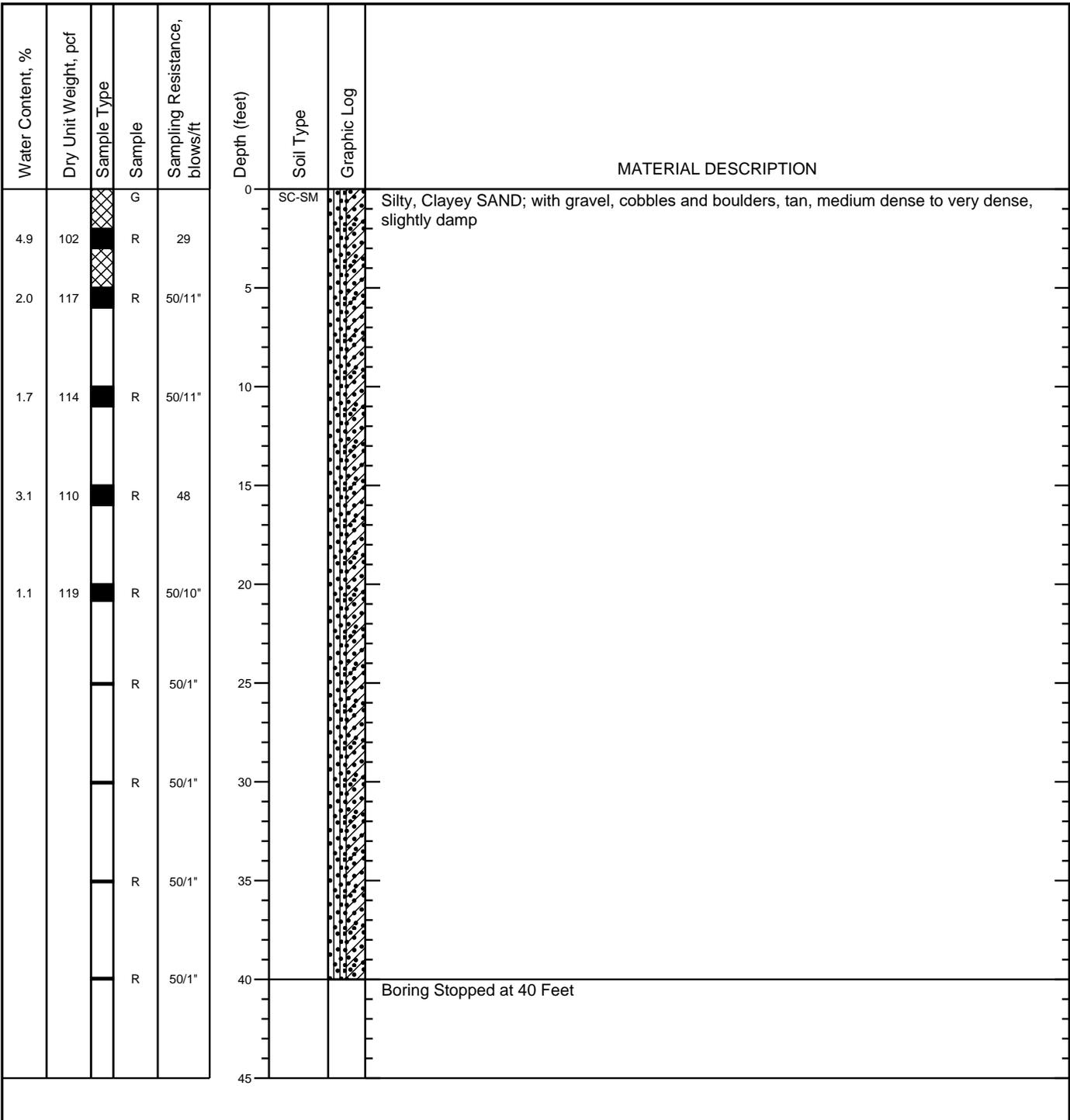


Figure A-4

Project: Welded Steel Ground Storage Tank Project Number: 25-224186-0	BORING NO. 2	
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Date(s) Drilled 7/18/24	Logged By S. Garcia	Checked By J. Quinlan
Drilling Method HSA	Drill Bit Size/Type 6" HSA	Approximate Surface Elevation Not Determined
Drill Rig Type CME-75	Drilling Contractor Integrity	
Groundwater Level and Date Measured Not Encountered	Location See Location Diagram	

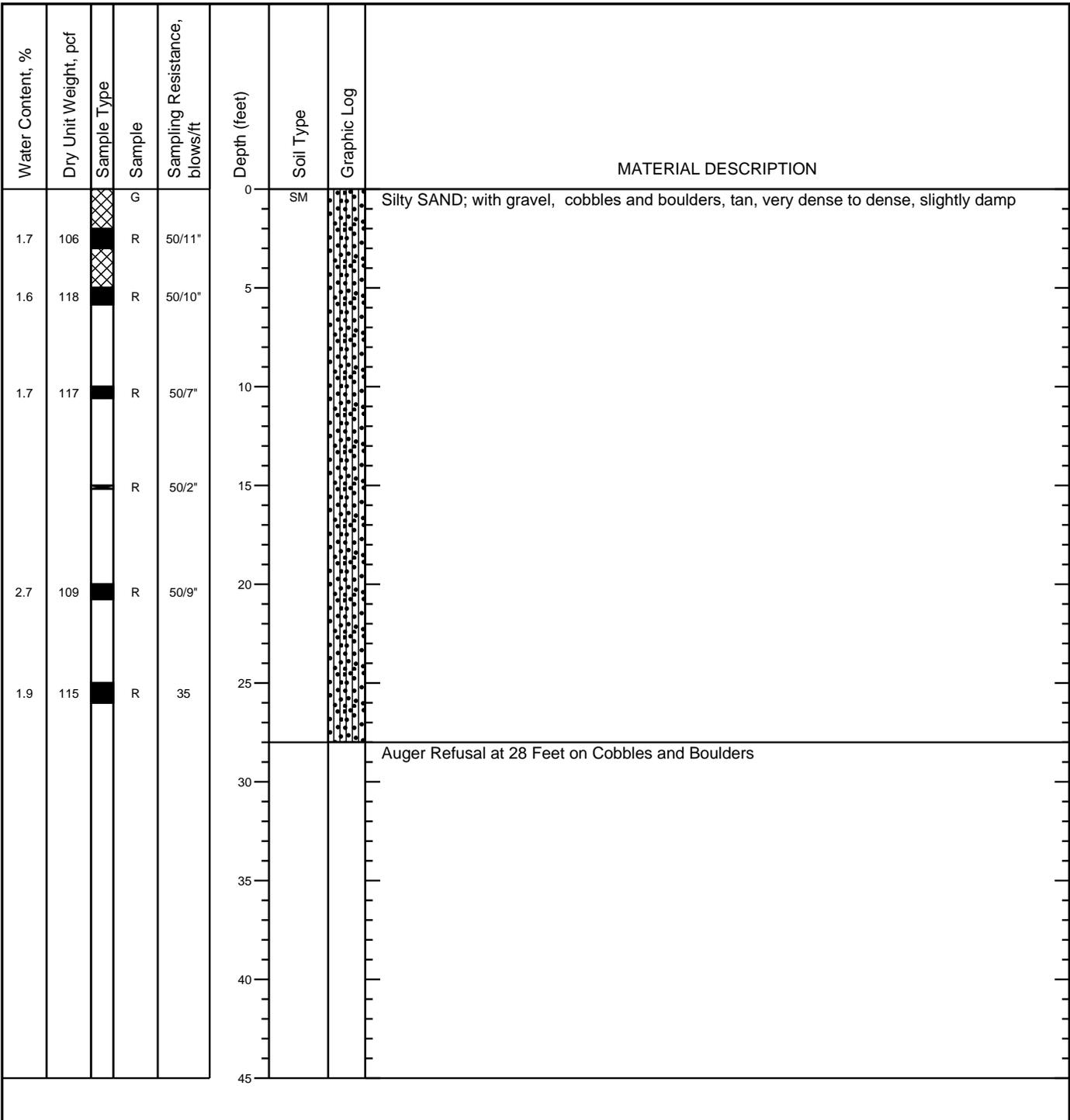


Figure A-5

Project: Welded Steel Ground Storage Tank Project Number: 25-224186-0	BORING NO. 3	
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Date(s) Drilled 7/18/24	Logged By S. Garcia	Checked By J. Quinlan
Drilling Method HSA	Drill Bit Size/Type 6" HSA	Approximate Surface Elevation Not Determined
Drill Rig Type CME-75	Drilling Contractor Integrity	
Groundwater Level and Date Measured Not Encountered	Location See Location Diagram	

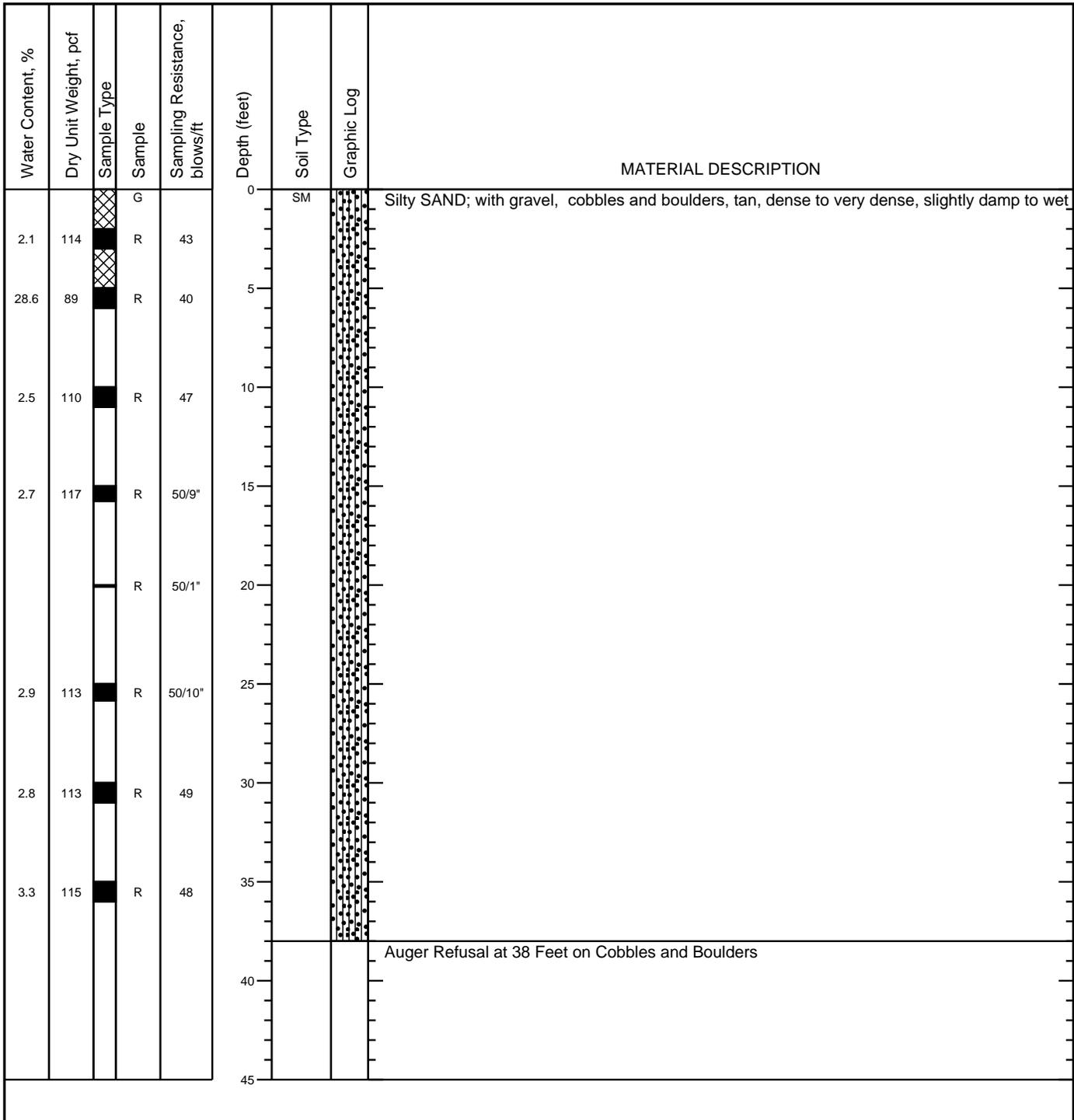


Figure A-6

Boring No.	Depth (ft)	USCS Class.	Particle Size Distribution (% Passing by Weight)							Atterberg Limits		Laboratory Compaction Characteristics			Remarks
			3"	¾"	#4	#10	#40	#200	2μ	LL	PI	Dry Density (pcf)	Optimum Moisture (%)	Method	
1	0-5	SC-SM	100	93	62	50	34	19.5		25	7				2
3	0-5	SM	100	87	60	43	26	13.1			NP				2

NOTE: NP = Non-plastic
μ = microns (2μ = 0.002mm)

REMARKS

Classification / Particle Size / Moisture-Density Relationship

1. Visual
2. Laboratory Tested
3. Minus #200 Only
4. Test Method ASTM D698/AASHTO T99
5. Test Method ASTM D1557/AASHTO T180
6. From the ADOT Family of Curves

	PROJECT: WELDED STEEL GROUND STORAGE TANK JOB NO.: 25-224186-0	PLATE B-1
	SOIL PROPERTIES	

Boring No.	Depth (ft.)	USCS Class.	Initial Dry Density (pcf)	Initial Water Content (%)	Laboratory Compaction Characteristics			Expansion Properties		Plasticity		Soluble		Remarks
					Dry Density(pcf)	Optimum Moisture(%)	Method	Surcharge (ksf)	Expansion (%)	LL	PI	Salts (ppm)	Sulfate (ppm)	
1	0-5	SC-SM	120.4	5.7	127.1	8.9	A	0.1	0.6					1,2,3
3	0-5	SM			130.9	8.3	A							3

Notes: Initial Dry Density and Initial Water Content are remolded.

Remarks

1. Compacted density (approx. 95% of ASTM D698 max. density at moisture content slightly below optimum.)
2. Submerged to approximate saturation.
3. Test Method ASTM D698/AASHTO T99
4. Test Method ASTM D1557/AASHTO T180
5. From the ADOT Family of Curves



PROJECT: WELDED STEEL GROUND STORAGE TANK
 JOB NO.: 25-224186-0

SOIL PROPERTIES

PLATE

B-2

Boring No.	Depth (ft.)	USCS Class.	Initial Dry Density (pcf)	Initial Water Content (%)	Compression Properties			Direct Shear		Plasticity		Percent Passing #200	Soluble Salts (ppm)	Remarks
					Surcharge (ksf)	Total Compression (%)		Cohesion (ksf)	Φ Angle (deg.)	Liquid Limit	Plasticity Index			
						In-Situ	After Saturation							
1	15-16	SC-SM	109.9	3.1				0.43	32.6					2,5
2	20-21	SM	109.4	2.7				0.07	39.1					2,5

Note: Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.
NP = Non-Plastic

Remarks

1. Compacted density (approx. 95% of ASTM D698 max. density at moisture content slightly below optimum.)
2. Submerged to approximate saturation.
3. Slight rebound after saturation.
4. Sample disturbance observed.
5. ASTM D3080 Procedure



PROJECT: WELDED STEEL GROUND STORAGE TANK
JOB NO.: 25-224186-0

SOIL PROPERTIES

PLATE
B-3

CORROSIVITY TEST RESULTS

The procedures for soil survey tests and observations can be found in Appendix X1.1 of ASTM A674-10 and includes five soil properties: earth resistivity • pH • redox potential • sulfides • moisture.

1(0-5):

<u>Analysis</u>	<u>Results</u>	<u>Points</u>
Resistivity (ohm-cm)	1478	10
pH	8.2	0
Redox Potential (mV)	+152	0
Sulfides	trace	2
Moisture	fair	1
Total Points		13

The test procedure states that if the sum of the points is greater than 10, the soil is considered corrosive to ductile iron pipe and special protection against exterior corrosion is necessary. This conclusion is limited to soil corrosion and does not include consideration of stray direct current.



PROJECT: WELDED STEEL GROUND STORAGE TANK
JOB NO. 25-224186-0

PLATE

B-4

SOIL PROPERTIES



Nortest Analytical
An **RMA** Company

Reported: 8/1/2024
Received: 7/30/2024

LABORATORY ANALYSIS REPORT

Project:

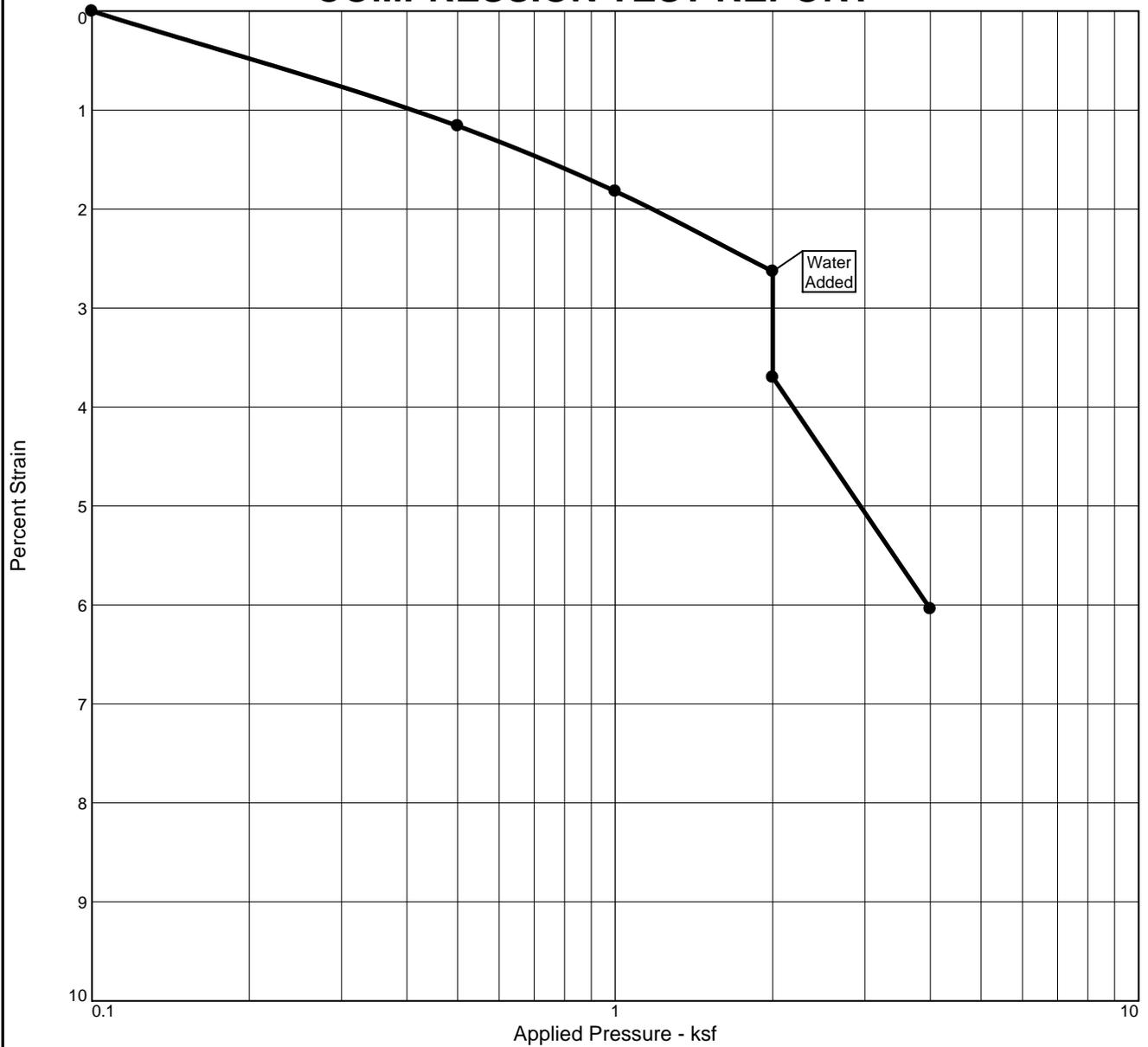
Lab Number

Sample ID

Test Parameter

<i>Test</i>	<i>Method</i>	<i>Result</i>	<i>Units</i>
Soluble Salts	ARIZ 237b	2,697	ppm
Sulfate	ARIZ 733b	330	ppm
Chloride	ARIZ 736b	250	ppm

COMPRESSION TEST REPORT

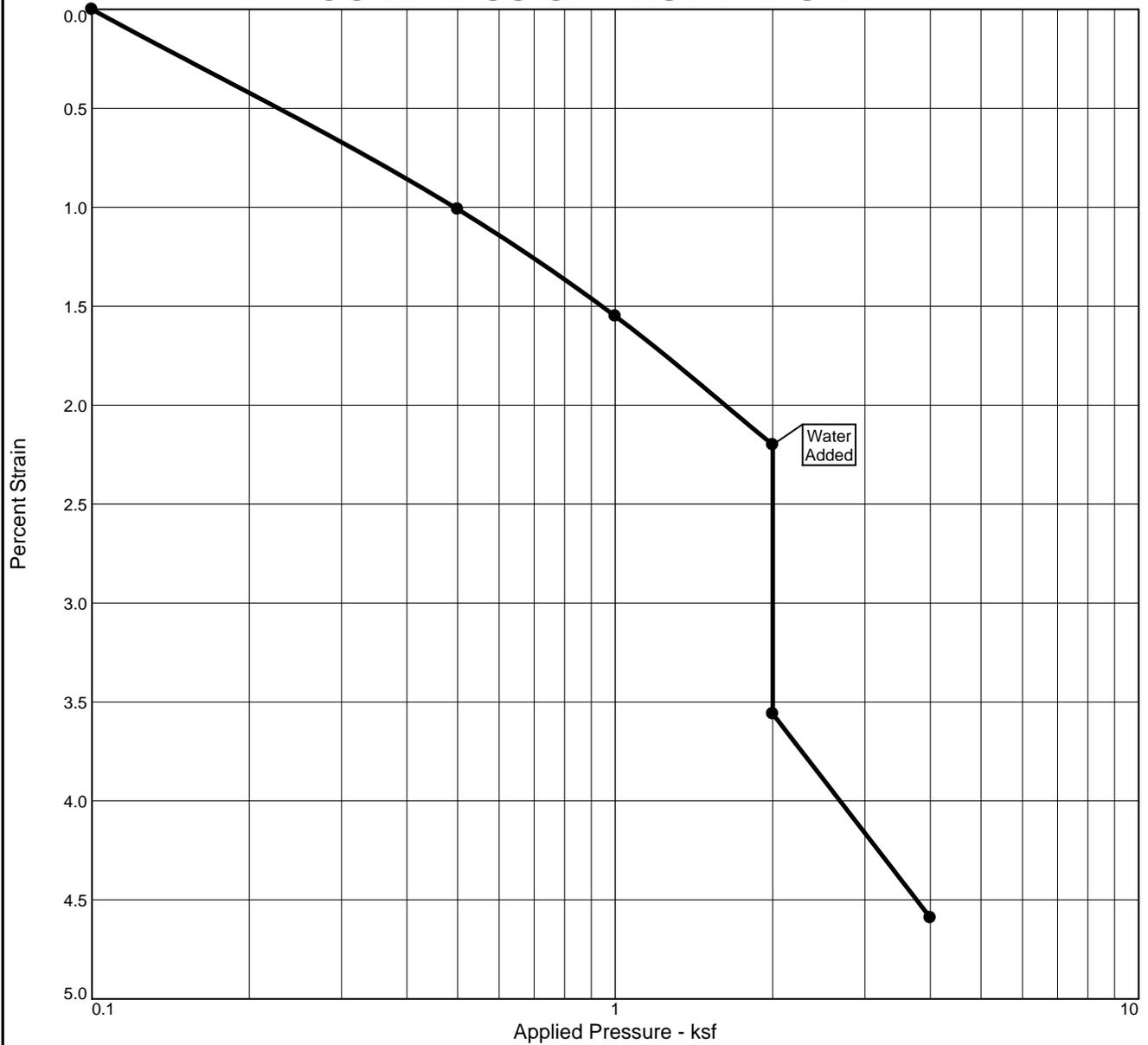


Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P _C (ksf)	C _C	C _r	Swell Press. (ksf)	Clpse. %	e _o
Sat.	Moist.											
20.8 %	4.9 %	102.2			2.65						1.1	0.619

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY, CLAYEY SAND WITH GRAVEL	SC-SM	

<p>Project No. 25-224186-0 Client: LAKE HAVASU CITY</p> <p>Project: WELDED STEEL GROUND STORAGE TANK</p> <p>Source: RING SAMPLE Depth: 2-3 FEET Sample No.: BORING 1</p> <p style="text-align: center;">Western Technologies, Inc.</p> <p style="text-align: center;">Flagstaff, AZ</p>	<p>Remarks:</p> <p style="text-align: right;">Figure B-6</p>
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COMPRESSION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P _C (ksf)	C _C	C _r	Swell Press. (ksf)	Clpse. %	e _o
Sat.	Moist.											
88.0 %	28.6 %	88.9			2.65						1.4	0.862

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND WITH GRAVEL	SM	

<p>Project No. 25-224186-0 Client: LAKE HAVASU CITY</p> <p>Project: WELDED STEEL GROUND STORAGE TANK</p> <p>Source: RING SAMPLE Depth: 5-6 FEET Sample No.: BORING 3</p> <p style="text-align: center;">Western Technologies, Inc.</p> <p style="text-align: center;">Flagstaff, AZ</p>	<p>Remarks:</p>
--	------------------------

Figure B-7