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ADDENDUM NO. 1
CSP # 19-0047

Date: August 05, 2019

To: All Interested Parties

From: Elton D. Brock, MBA, CTPM, CTCM, CPSM, C.P.M.
Purchasing Manager

Re: **CSP No. 19-0047 Ground Storage Tank No. 2 at Water Plant No. 4**

The following additions, deletions, changes or clarifications to CSP No. 19-0047 are hereby made a part of the originally issued documents for the above referenced project as fully and as completely as though the same were included therein.

CSP #19-0047

1. **The Proposal Response Due Date has changed from August 12, 2019 to August 15, 2019. The due time of submission (11:00 AM) is still in effect.**

2. **33 16 14 – RESERVOIR: PRESTRESSED CONCRETE** – Replace entire document to address change on Page 9.

3. **00 21 13.03 – STATEMENT OF QUALIFICATIONS** – The .docx (Microsoft Word) version of this document is provided with this Addendum.

Question: In several places in the specs it talks about the dome being shotcrete. One line says shotcrete is not allowed. What is the intent for the dome? Is it to be constructed using shotcrete?

Answer: The different sections of the specification, 33 16 14, referred to below are not in conflict with each other. In summary, shotcrete cannot be used for the dome roofs and tank construction but could be used to fill the precast concrete wall slot joints or to encase the prestressing steel.

- Section 2.3.A.9.c - The intent is to not allow shotcrete corewalls which would be a AWWA D110 Type II (Shotcrete) Tank Construction. The vertical wall slot joints

between the precast concrete wall panels are allowed to be filled with Cast-In-Place (CIP) concrete or shotcrete.

- Section 3.2.C. - The vertical wall slot joints between the precast concrete wall panels are allowed to be filled with CIP concrete or shotcrete.
- Section 3.2.E.3.a. - The ½" of shotcrete over the diaphragm is installed so that the prestressing steel is not in direct contact with the steel diaphragm in accordance with AWWA D110-13 Section 3.5.4.2.
- Section 3.2.E.4. - Shotcrete cover of the prestressing steel is used to encase the prestressing steel and is in accordance with AWWA D110 5.3.3.3.
- Section 3.2.G.1 - Does not allow for shotcrete dome or Flat Slab Roofs - Only allows concrete dome roofs.

We could not find anywhere in the specifications that references a shotcrete dome. The dome is intended to be precast or CIP concrete.

Question: Section 00 72 00, Page 29, Article 6.01: This requires full-time supervision. Please confirm that the tank manufacturer's subcontractor superintendent may be assigned by the tank builder as their superintendent representative when the tank manufacturer is not on site.

Answer: This is acceptable.

Question: Section 00 72 00, Page 37, Article 6.06: This indicates that the Contractor is responsible for permits. Please provide which permits the Contractor is responsible for along with the associated fees of those permits.

Answer: This facility is on SJRA property and is not a structure meant for occupation. No permits are required.

Question: Section 01 14 19, Page 3, Article 1.5.B: This indicates that the Contractor is responsible for construction water. Please provide the nearest source of construction water to the proposed tank site and associated fees with using it.

Answer: Potable water is available via a 3-inch flanged connection and hose bib on the existing ground storage tank, and also the contractor can tie into the 1-inch water line in the meter box near the gate. The contractor is to provide a back-flow prevent and meter.

Question: Section 33 16 14, Page 19, Article 2.3.A.2.e: This indicates a top of tank dome elevation as 222.40-feet. Please note that the apex of the dome roof and the center of the dome vent will exceed this elevation. It is not feasible to limit the tank dome roof to this elevation based on the allowable dome rise to span ratios in accordance with AWWA D110. Please confirm the dome roof shall be designed in accordance with AWWA D110.

Answer: The reference to a dome elevation of 222.40 feet in Section 33 16 14 is incorrect. We will remove that elevation from the specification and mark the height to be per Manufacturer's recommendation.

Question: Section 33 16 14: Please confirm the design overflow rate for this tank.

Answer: Maximum filling rate for the tank is equivalent to 1,000 cfm or 7,480 gallons per minute (gpm). This amount equals the maximum discharge rate of the roof vent.

Question: Plans - Sheet 01C101: Indicates finish grade elevation around the proposed ground storage tank as 193.00 which is below the tank finish floor elevation. Please confirm the finish grade around the tank perimeter may be raised to finish floor elevation or 1' above (recommended) in order to promote positive drainage away from the tank and protect the shallow footing from potential erosion from rainwater off the dome.

Answer: Sheet 01C1010 indicates final grade in the area near the tank, not at the tank base or wall. It also shows that 193.00 is the high point with the ground sloped down and away from the tanks. If you look at the detail sheets for the tank, where elevations are mentioned they are greater than 193.00 (Section A on Sheet 02D301 shows an elevation of 193.67). Section B on Sheet 02D301 calls for a 1% slope away from the base of the tank. Based on this, we do not see a problem with positive drainage being achieved away from the tank. However, we have no problem with the ground being sloped up to the tank with the final elevation being equal to the floor elevation, but the ground elevation will not be allowed to go higher than the exposed slab around the tank.

Question: Paragraph 2.3.A.2.e of Section 33 16 14 specifies a "Top of tank dome" elevation of 222.4 feet. Sheets 02X101, 02D101 and 02D302 show an Overflow Weir elevation of 219.0 feet. Sheet 02D302 shows a minimum 12-inch distance between the Overflow Weir elevation and dome spring line (underside of dome at wall). This allows for only a 2.4 ft difference in elevation between the dome spring line and Top of tank dome. When taking into account the dome thickness, the resulting dome rise is just slightly over 2.0 ft. This very small vertical dome rise falls far outside the rise-to-span ratio limits specified in the ANSI/AWWA D110 Standard and represents impractical design criteria. Paragraph 3.2.G.4.b of Section 33 16 14 specifies a rise-to-span ratio of 1:10 to 1:14, which is within the range specified in the ANSI/AWWA D110 Standard. A rise-to-span ratio of 1:10 equates to a dome rise of 12.4 ft. Our questions are as follows:

a. Can the "Top of tank dome" elevation as specified in Paragraph 2.3.A.2.e of Section 33 16 14 be changed to 232.7 ft, to allow for a rise-to-span ratio of 1:10?

   Answer: The reference to a dome elevation of 222.40 feet in Section 33 16 14 is incorrect. We will remove that elevation from the specification and mark the height to be per Manufacturer's recommendation.

b. Can it be confirmed that the "Top of tank dome" elevation applies to the dome only and that the roof vent and it's curb can extend above that elevation?

   Answer: As stated above, the reference to a dome elevation of 222.40 feet in Section 33 16 14 is incorrect. We will remove that elevation from the specification and mark the height to be per Manufacturer's recommendation. As such, this height only referred to the roof not to the vent and curb.

Question: There appears to be no specified maximum filling rate for the tank to be used in designing the Overflow Weir. However, Paragraph 2.4.D.5 of Section 33 16 14 regarding Roof Vent(s) specifies a "Maximum air flow into tank" of 1,500 cfm. Can it be confirmed that the maximum filing rate is also 1,500 cfm?

Answer: Maximum filling rate for the tank is equivalent to 1,000 cfm or 7,480 gallons per minute (gpm). This amount equals the maximum discharge rate of the roof vent.

Question: Per the bid docs, it indicates SJRA would provide a Microsoft Word File for the SOQ that is required in this bid. I don't believe it has been provided. Can you provide?

Answer: The .docx (Microsoft Word) version of the Statement of Qualifications (00 21 13.03) has been attached with this Addendum.

All provisions which are not so amended or supplemented remain in full force and effect.

Please acknowledge receipt of this addendum with signature and date and return with completed Proposal/Quotation. Failure to do so may cause your Proposal to be considered non-responsive.

Receipt of this Addendum No. 1 is hereby acknowledged

_____ _____

Authorized Signature ***Date***

_____

Company Name

SECTION 33 16 14

RESERVOIRS: PRESTRESSED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: design and installation of one (1) 2.0 MG Type III circular prestressed concrete ground storage tanks (GST No. 2). In the cast of conflict between this and other sections, the requirements of this section shall govern. Tank shall be in compliance with AWWA D110.

B. Related Specification Sections include, but are not necessarily limited to the following specifications. In the case of dispute between this specification and those referenced below, this specification, Section 33 16 14 – Reservoirs: Prestressed Concrete will govern.

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 05 05 - Testing
4. Section 03 21 00 - Reinforcement
5. Section 03 31 30 - Concrete Materials and Proportioning
6. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing
7. Section 03 31 32 - Concrete Finishing and Repair of Surface Defects
8. Section 31 23 00 - Earthwork
9. Section 05 50 00 - Metal Fabrications
10. Section 40 20 13 - Pipe: Miscellaneous Steel
11. Section 40 20 16 - Pipe: Ductile
12. Specification Section is applicable to WD-GWP04-GST-GST1-01-001 and WD-GWP04-GST-GST2-02-001.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

C. Provide Bid Prices for base bid and all alternatives.

1. Base bid: The base bid shall consist of the design and installation of a 2.0 MG ground storage tank, all appurtenances included in this specification,

and shown on drawings 02D101, 02D301, 02D302 and 02D303. The base bid does not include the improvements of GST No.1.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

The publications listed below form a part of this specification to the extent referenced. The publications are referred in the text by basic designation only. The latest revision of each publication shall be used.

1. American Association of State Highway and Transportation Officials (AASHTO)
   a. AASHTO T-99, Standard for the Moisture - Density Relations of Soils Using a 5.5 lb (2.5 Kg) Rammer and a 12-inch (305 mm) Drop (Eighteenth Edition).
2. American Concrete Institute (ACI):
   a. 301, Specification for Structural Concrete
   b. 305R, Hot Weather Concreting.
   c. 306R, Cold Weather Concreting
   d. 350, Environmental Engineering Concrete Structures
   e. 350.3, Seismic Design of Liquid Containing Concrete Structures and Commentary
   f. 372R, Design and Construction of Circular Wire and Strand-Wrapped Prestressed Concrete Structures
   g. 506R, Guide to Shotcrete.
   h. 506.2 Specification for Structural Concrete
3. American Society of Civil Engineers (ASCE):
   a. 7-10, Minimum Design Load for Buildings and Other Structures.
4. ASTM International (ASTM):
   a. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   b. A320, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.
   c. A416, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
   d. A475, Standard Specification for Zinc-Coated Steel Wire Strand
   e. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

f. A821, Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Tanks.

g. A1008, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

h. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

i. B241, Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

j. C31/ C31M, Standard Practice for Making and Curing Concrete Test / Specimens in the Field

k. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

l. C138, Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

m. C173, (Rev. A) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

n. C192 / C192M, Standard Practice for Making and Curing Concrete / Specimens in the Laboratory.

o. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

p. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

q. C881, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

r. D1056, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

s. D1752, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

t. D2000, Standard Classification System for Rubber Products in Automotive Applications.

u. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

v. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

5. American Water Works Association (AWWA):

   a. C652, Standard for Disinfection of Water-Storage Facilities.

b. D110, Standard for Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks.

6. American Welding Society (AWS).
7. Corps of Engineers (COE):
   a. CRD-C572, Specifications for Polyvinylchloride Waterstops.
8. Federal Specification (FS)
   a. FS-TT-S-00227E, Sealing Compound Elastomeric Type, Multi-Component (For Caulking, and Glazing in Buildings and other Structures)
9. Geotechnical Reports
   a. Geotechnical Engineering Report, The Woodlands Water Plant No. 4, Ground Storage Tank No. 2, The Woodlands, Texas, Terracon Consultants, Inc.
10. National Sanitation Foundation International (NSF)
    a. 61, Standard for Drinking Water System Components or Latest Edition or Revision Thereto
11. Occupational Safety and Health Administration (OSHA)
12. Texas Commission on Environmental Quality (TCEQ)
    a. Rules and Regulations for Public Water Systems Latest Edition or Revision Thereto
13. Building code:
    a. International Code Council (ICC):
       1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.

B. Singular Responsibility:

It is the intent of the specification to create singular responsibility for the design and construction of the prestressed concrete tank and appurtenances. The design and construction of all aspects of the foundation, floor slab, wall, prestressing, shotcrete, and dome roof of the prestressed concrete tank must be performed by the tank contractor.

C. Qualifications:

1. The company designing and constructing the tank (Tank Contractor):
   a. At least ten (10) years experience in design and construction of wire-wound circular prestressed composite tanks, AWWA D110, Type III precast concrete with a steel diaphragm.
   b. Have skill, reliability, and financial stability to build and guarantee the tank in accordance with the Contract Documents.

c. Has constructed, in the past ten (10) years, in its own name or under one of its divisions, and is presently responsible for a minimum of twenty (20) AWWA D110 Type III dome covered prestressed composite tanks of 2 MG capacity or greater, which meet these Specifications and have been in successful service for a minimum of five (5) years.

d. Experience in the design and construction of AWWA D110 Type I, Type II, or Type IV tanks will not be considered as a qualification for designing a Type III tank.

2. Professional engineer in responsible charge of engineering work:

a. Minimum ten (10) years experience in design and field construction of circular prestressed composite tanks, AWWA D110, Type III precast concrete with a steel diaphragm.

b. In responsible charge of engineering work to be done for tank design, construction, and testing.

c. Registered in Texas.

D. Certifications:

1. Drawings for the tank to be signed and sealed by a professional engineer licensed in the State of Texas.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:

a. Manufacturer's installation instructions.

3. Mill tests indicating ultimate and yield strength of all reinforcing bars, prestressing and post tensioning wires and cables, and any other steel components.

B. Furnish applicable "Affidavits of Compliance" to Building Codes and OSHA Standards.

C. Dimensioned, easily read full size (22" x 34") drawings of concrete ground storage tank, including foundation and all associated earthwork, location of wall and roof penetrations, piping, piping appurtenances, details of connections, pipe supports, roof vent details, ladder details, architectural finish details, and coating system, signed and sealed by a professional engineer registered in the State of Texas.

D. Design certificate signed and sealed by professional engineer licensed in the State of Texas that calculations have been performed in accordance with project criteria and standard engineering practices.

E. All concrete design mixes.

F. Acknowledgement that piping products submitted meet requirements of specifications and standards referenced.

G. Guarantee Document as specified in the following WARRANTY Article.

H. Stormwater Pollution Prevention Plan.

I. Detailed construction drawings.

J. Test reports for settlement, leakage, pipe pressure tests, and disinfection.

K. Operation and Maintenance Manuals:

1. See Specification Section 01 33 00 for requirements for:

a. The mechanics and administration of the submittal process.

b. The content of Operation and Maintenance Manuals.

1.5 WARRANTY

A. The tank constructor will warrant workmanship and materials on the complete structural portion of the tank for a one (1) year period from date of Substantial Completion of the Work.

1. In case leakage or other defects appear within the one (1) year period, the tank constructor to promptly repair the tank at its own expense upon written notice by the Owner that such defects have been found.

2. Leakage is defined as a flow of liquid appearing on the exterior of the tank, the source of which is from the inside of the tank.

B. The Owner's or Engineer's review of the bidder's design, or the Owner's acceptance and final payment for the work is not to relieve the Tank Contractor of design responsibility. The Owner is to be the direct beneficiary of the warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - TANK CONSTRUCTORS

A. Subject to compliance with the Contract Documents, the following tank constructors are acceptable:

1. DN Tanks, Inc.; Grand Prairie, TX.

2. Preload Company; Garland, TX.

2.2 MATERIALS

A. Concrete:

1. Concrete to conform to ACI 301.

2. Cement to be Portland Cement Type I or Type II.

3. Admixtures, other than air-entraining and water reducing admixtures, will not be permitted unless approved by the Owner's representative.

4. Concrete for tank wall and dome construction to have a minimum compressive strength of 4,000 psi at 28 days. All precast wall concrete to be air-entrained.
5. Concrete for the tank floor, footings, pipe encasement, and all other work shall have a minimum compressive strength of 4,000 psi at 28 and days shall not be air-entrained. The coarse and fine aggregate shall meet the requirements of ASTM C33. Coarse aggregate shall be No. 467 with 100 percent passing the 1 1/2 inch sieve.
6. Superplasticizer and water-reducing admixtures shall be incorporated into the floor concrete. Fibers shall be Microfiber by Grace, Stealth Fibers by Synthetic Industries, or equal. Fiber lengths shall be a maximum of 3/4 inches. The amount of polypropylene fibers added to the concrete mix shall conform to the manufacturer's recommendations.
7. Proportioning for concrete to be in accordance with ACI 301.
8. Concrete used in precast, prestressed, concrete tank construction not to contain free chloride ions in excess of 0.06 percent of the weight of the cement in the mix.
9. Concrete for tank wall construction to be placed at a slump of 3-inches "+/- 1-inch, but not to exceed 4 inches. Concrete for floor (and dome if applicable) to be placed at a slump of 4 inches "+/-1-inch. Higher slumps are allowable with the use of a high range water reducer. Admixtures to be accomplished in accordance with the requirements of Specification Section 03 31 30 - Concrete Materials and Proportioning and Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.

B. Shotcrete:

1. 28 day compressive strength not less than 4500 psi.
2. Cement: Conform to Specification Section 03 31 30.
3. Conform to ACI 506.2
4. Shotcrete for tank construction not to contain chloride ions in excess of 0.06 percent of the weight of the cement in the mix.
5. Shotcrete used for encasing prestressing wire to consist of not more than three parts sand to one part Portland cement by weight; shotcrete used for diaphragm cover, and additional coat for shotcrete, to consist of not more than four parts sand to one part Portland cement by weight.
6. Polypropylene fibers shall be included in the shotcrete used for the finish covercoat. Fibers shall be Fibercast 500 by Propex, or equal. Fiber length shall be ¼". The amount of the fibers added to the shotcrete used for the finish covercoat shall conform to the manufacturer's recommendation.

C. Prestress Wire:

1. Cold drawn, high-carbon wire.

2. Conform to ASTM A821.
3. A minimum ultimate tensile strength of 210,000 psi.
4. Splices of horizontal prestressed reinforcement to be ferrous material compatible with the reinforcement and to develop the full strength of the wire. Wire splice and anchorage accessories not to nick or otherwise damage the prestressing.

D. Reinforcing Bars, Wire Mesh:

1. ASTM A615, Grade 40.
2. ASTM A185.
3. Nonprestressed reinforcement shall conform to the requirements of ACI 350, Grade 60. Strand for seismic cables shall be galvanized and shall conform to the requirements of ASTM A416 prior to galvanizing, and ASTM A475 after galvanizing.
4. Conform to Specification Section 03 21 00.

E. Steel Diaphragm:

1. Provide vertically ribbed steel sheets with adjacent and opposing channels that provide a mechanical bond to the concrete.
2. Diaphragm to have vertical channels with reentrant angles spaced not more than 3 inches apart and with depth of 3/8 inch. Individual sheets within wall panel to be roll seamed.
3. Conform to ASTM A1008.
4. Minimum thickness: 0.017 IN.
5. Provide a minimum of 4 inches of concrete on inside face of diaphragm.

F. Elastomeric Materials:

1. Waterstops that are polyvinyl chloride conforming to COE CRD-C572.
2. Bearing pads conforming to ASTM D2000.
3. Sponge filler conforming to ASTM D1056.
4. Epoxy: ASTM C881, Type III, Grade I.

2.3 DESIGN REQUIREMENTS

A. Ground Storage Tank No. 2:

1. Design in conformance with
   a. AWWA D110, Type III, Precast concrete with steel diaphragm.
   b. Most recent OSHA Standards.
   c. Texas Commission on Environmental Quality Rules and Regulations for Public Water Systems, latest revision.

d. ACI Standard Specifications for Structural Concrete for Buildings, designation ACI 301.

e. ACI Standard Building Code Requirements for Reinforced Concrete, Designation ACI 318/318R.

f. ACI 350 Code Requirements for Environmental Engineering Concrete Structures and Commentary

g. ACI 350.3 Seismic Design of Liquid Containing Concrete Structures and Commentary

h. ACI 372R Design and Construction of Circular Wire- and Strand Wrapped Prestressed Concrete Structures

2. Characteristics: All dimensions and elevations to be field verified to match existing tank.

   a. Liquid volume: 2.0 MG.

   b. Inside diameter: 124.0 FT.

   c. Finished floor elevation: 194.0 FT MSL.

   d. High water level: 218.0 FT MSL.

   e. Top of tank dome: per manufacturer's recommendation.

   f. Minimum thickness of composite wall at base: 4 IN.

   g. Minimum thickness of floor: 4 IN.

   h. Minimum thickness of dome: 4 IN.

3. Design Loads:

   a. Design for earthquake resistance based on requirements for Seismic Site Class D of the International Building Code or based on requirements of Zone 0 of AWWA D110 whichever requirements are more stringent.

   b. Design Load:

      1) Shall be as required by ASCE 7

      2) Base design on dead load of reservoir plus water load inside and 25 psf, uniform load on entire roof area.

   c. Wind loads:

   d. Design loads for full roof dead load plus the following live load conditions:

      1) Design for wind loading for exposure C with a 134 MPH 3 second gust in accordance with the provisions of ASCE 7.

   e. Snow Load: as required by ASCE 7.

4. Design reservoir walls, foundations, sumps, and bottoms in accordance with the allowable soil bearing pressures, equivalent fluid pressures and other recommendations of the geotechnical report, unless otherwise indicated.

5. Design foundations with the centroids of superimposed loads in their actual locations.
6. Design for lowest mean ambient temperature of 32 DegF and for temperature differential of 80 DegF.
7. Design to be in accordance with Texas Administrative Code Title 30 Chapter 290 “Public Drinking Water”.
8. Discontinuous prestressing tendons not permitted.
9. Design prestressed tank wall as composite concrete wall using embedded mechanically bonded steel diaphragm in combination with vertical reinforcement.
    a. Continuous mechanically bonded steel diaphragm can be taken as effective vertical reinforcing.
    b. Prestressed concrete wall to be precast construction.
    c. Shotcrete core walls not permitted.
10. Settlement: Tank is to be designed to accommodate the anticipated settlement as defined in the project geotechnical report by Terracon Consultants, Inc.

2.4 ACCESSORIES

Ground Storage Tank No. 2:

A. Wall Manway and Covers:
    1. Number required: Three (3) per tank.
    2. Location: As shown on PLANS.
    3. Material: Stainless Steel, ASTM Type 316.
    4. Minimum size: 42 IN diameter.
    5. Hatch Centerline Elevation: As shown on PLANS.

B. Ladders:
    1. Requirements: ladder, interior, and exterior, and safety device to be OSHA approved rigid rail system. Provide Two (2) belt assemblies, complete with all accessories.
    2. Location
        a. Exterior Ladders: As shown on PLANS.
        b. Interior Ladders: As shown on PLANS.
    3. Material:
        a. Interior Ladder: Stainless Steel, ASTM316
        b. Exterior Ladder: Stainless Steel, ASTM316
    4. Refer to section 05 50 00 for additional details.

C. Roof Hatches:
   1. Number required: Three (3) per tank.
   2. Location: as shown on PLANS
   3. Material: Coated anodized aluminum
   4. Minimum Opening Size: 42 IN x 42 IN.
   5. Hatch to overlap curb and terminate in a downward direction for at least 2 inches to comply with TCEQ requirements.
   6. Sufficient space shall be provided between hatch lid and hatch base to allow for a 1 IN. conduit to penetrate through the curb while not interfering with hatch operation. Hatch to be tapped and conduit to be provided by others.
   7. Hatch to have arrangements for keeping it locked in place.
   8. Opening to have raised curbing of at least 4 inches in height.

D. Roof Vent(s):
   1. Number required: One (1)
   2. Size and Configuration: In accordance with TCEQ Regulations and as shown on PLANS.
   3. Material: Stainless Steel, ASTM 316
   4. Maximum air flow out of tank: 1,000 cfm
   5. Maximum air flow into tank: 1,500 cfm
   6. Vent Manufacturer: US Underwater Services.
   7. Vent to be vandal resistant model
   8. Vent to have easily replaceable #16 mesh stainless steel insect screen.
   9. Minimum vent throat diameter: 24 IN.
   10. Maximum pressure drop: 0.5” wg across each vent.
   11. Vent system to be designed by Tank Manufacturer.

E. Pipe Penetrations (Surface Water) in Roof:
   1. Number Required: One (1)
   2. Location: As shown on Plans.
   3. Required Air Gap: 32 IN per TCEQ regulations

F. Nozzles on Tank Roof:
   1. Number Required: Four (4).
   2. Ultrasonic Level Indicator Location: As shown on PLANS.
   3. Spare Nozzle Location: As shown on PLANS.

G. Pipe Penetrations (Overflow) through Tank Wall:

1. Number Required: One (1)
2. Location and Elevation: As shown on Plans.

H. Pipe Penetrations (Aeration Suction Piping Nozzle) through Tank Wall:
1. Number Required: One (1)
2. Location and Elevation: As shown on PLANS.

I. Instrumentation Connections through Tank Wall:
1. Number Required: One (1).
2. Location and Elevation: As shown on PLANS.

J. Sample Tap Connections on Tank Wall:
1. Number Required: One (1).
2. Location and Elevation: As shown on PLANS.

K. Spare Wall Nozzle on Tank Wall:
1. Number Required: One (1).
2. Location and Elevation: As shown on PLANS.

L. Waterstops:
1. Materials:
   a. Extruded virgin polyvinyl chloride compound.
   b. Conform to COE CRD-C572.
2. Fuse together butted joints of waterstops to ensure water tightness.

M. Silt Stops: Provide removable silt stop(s) at discharge pipes as shown on drawings.

N. Aluminum Railings and Toe Boards:
1. Refer to Specification 05 52 02 for additional details.
2. Provide railings and toe boards for entire circumference of tank as shown on PLANS.
3. Comply with AWS for welding.
4. Use gas-tungsten-arc (TIG) procedure.
5. Comply with the Building Code.
6. Comply with OSHA requirements.
7. Provide all anchorage systems for mounting on tank roof.
8. Color to match existing tank.

O. Piping:

1. The GST piping system consists of water piping within and under the tanks not extending beyond seven feet from the tank foundation.
2. Piping shall be in conformance with Specification 40 20 13 and 40 20 16.
3. All materials used in the GST piping system shall meet or exceed pressure test requirements specified herein.
4. Support system for the 16” SWL inlet and overflow pipes shall be the responsibility of the Contractor.

PART 3 - EXECUTION

3.1 GENERAL

A. Site Preparation

1. Site preparation shall be done in accordance with the project specific geotechnical report, which shall be provided to the CONTRACTOR prior to the public bidding of the project.
2. Construction areas for staging operations shall be stripped of all vegetation, loose/soft topsoil, and any other debris/unsuitable material. Care shall be taken to replace or re-compact all soil removed or loosened by removal of tree roots that might exist at this site.
3. The existing fill soil below the existing water tank shall be removed to a full-depth of six feet minimum, or greater as directed by the geotechnical engineer. The Owner’s representative (Soils Engineer) shall be on-site during removal of the fill soils to evaluate the exposed subgrade.
4. Once removal of the existing fill is completed and final subgrade cut or over-excavation elevations are achieved, the exposed subgrade shall be carefully proof rolled with a 20-ton pneumatic roller or equivalent equipment, such as a fully-loaded dump truck, to detect weak zones in the subgrade. Weak areas detected during proof rolling, as well as zones of fill containing organic matter and/or debris shall be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in-situ soils. Proof rolling shall be performed under the direct observation of the geotechnical engineer or his/her representative.
5. Provide positive surface drainage away from the location of all excavations to prevent surface water runoff from flooding the prepared site and excavations. Contractor shall develop a plan to prevent water from pooling on exposed subgrade and submit plan to Owner’s Representative prior to beginning excavation.
6. Subsequent to proof rolling, and just prior to placement of fill, the exposed subgrade within the construction area shall be evaluated for moisture and density. The moisture and density of the upper 6 inches of native soils shall

meet the requirement of at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content within 3 percent of the material's optimum moisture content. Exposed subgrade may require treatment in accordance with TxDOT Standard Specification Item 265 for lime-fly ash treated subgrade, upon geotechnical engineer's approval.

7. All traffic, including proof rolling, shall be avoided during extended periods of wet weather.

B. Fill

1. Excavation and fill shall be done in accordance with the project specific geotechnical report and the subsurface utility investigation, which shall be provided to the CONTRACTOR prior to the public bidding of the project.

2. In order to achieve 2,900 psf bearing pressure for the perimeter thickened slab, select fill and listed on-site soils for grading and to construct the pad below the thickened edge must be chemically treated. The chemically treated select fill and listed on-site soils should extend a minimum of 3 feet beyond the edges of the thickened-edge footing. The select fill and listed on-site soils should be treated with 10 percent lime-fly ash applied as 3 percent lime and 7 percent fly ash. The percentages are given as application by dry weight of soil and are equivalent to about 12 pounds per cubic foot of lime-fly ash. The soils should be treated in accordance with TxDOT Standard Specification Item 265 for lime-fly ash treated subgrade. If preferred, cement treated sand may be used in place of the chemically treated select fill or on-site soils below the perimeter thickened edge. If cement treated sand is used, cement should be applied at a rate of 1.5 sacks per ton of sand. For additional details, see Geotechnical Engineering Report, Revision 1, dated February 20, 2019.

3. Fill required to achieve the design grades for the proposed tank shall be select fill that meets the following criteria:

a. Select Fill

1) See specification 31 21 33 for material and compaction requirements.

2) Location of placement as shown on Drawings and described in geotechnical report.

b. On-site Soils

1) See specification 31 21 33 for material and compaction requirements. Additionally, on-site soils will only be approved for use if they meet a USCS classification of CL and/or SC and have a $10 \leq PI \leq 20$.

2) Location of placement as shown on Drawings and described in geotechnical report.

c. Crushed Stone Leveling Base (Aggregate Base Material)

1) Per the tank manufacturer's standard practice, but shall meet, as a minimum, the requirements of ACI 372.

4. If blended or mixed soils are intended for use, the geotechnical engineer of record shall be contacted to provide additional recommendations. Blended or mixed soils do not occur naturally. These soils are a blend of sand and clay and will require mechanical mixing with a pulvimixer at the site. If these soils are not mixed thoroughly to break down the clay clods and blend-in the sand to produce a uniform soil matrix, the fill material may be detrimental to the slab performance. If blended soils are used, additional samples of the blended soils, as well as the clay clods, must be obtained prior to and during earthwork operations to evaluate if the blended soils can be used in lieu of select fill. The actual type and amount of mechanical mixing at the site will depend on the amount of clay and sand, and properties of the clay.

5. Compaction

a. Fill Lift Thickness

1) The fill soils shall be placed on prepared surfaces in lifts not to exceed 8 inches loose measure, with a compacted thickness not to exceed 6 inches.

b. Compaction Requirements

1) The select fill and on-site soils (and chemically treated soils) shall be compacted to at least 95 percent of the Standard Effort (ASTM D698) maximum dry density.

2) Select fill and on-site soils (and chemically treated soils) shall be moisture adjusted to within 2 percent of the optimum moisture content.

6. Wet Weather and Soft Subgrade Considerations

a. Construction operations may encounter difficulties due to wet/soft surface soils becoming a general hindrance to equipment, especially following periods of wet weather. If the subgrade cannot be adequately compacted to the minimum densities as described previously, one of the following measures will be required:

1) Removal and replacement with select fill

2) Chemical treatment of the soil to dry and improve the stability of the subgrade, or

3) Drying by natural means.

7. Grading and Drainage

a. All grades must provide effective drainage away from the proposed ground storage tank during and after construction. The tank

foundation performance described in the geotechnical report is based on effective drainage for the life of the structure and cannot be relied upon if effective drainage is not maintained.

b. Exposed ground shall be sloped away from the structure for at least 6 inches of fall over 10 feet (5 percent slope) beyond the perimeter of the structure. After construction, tank manufacturer to verify final grades to document that effective drainage has been achieved.

c. All utility trenches that penetrate beneath the structure must be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the structure. An effective clay "trench plug" that extends at least 5 feet out from the face of the structures' exteriors must be constructed. The plug material to consist of clay compacted at a water content at or above the soils optimum water content. The clay fill shall be placed to completely surround the utility line as shown in Drawings. Material and compaction requirements are defined in section 31 21 33.

3.2 CONSTRUCTION

A. General

1. Do not use curing compounds on surfaces to which mortar or shotcrete is to be applied.

B. Floor:

1. Concrete floors minimum of 4 IN thick (or greater) as required per design by tank manufacturer.
   a. A minimum thickness of 12 IN of concrete required over all pipe encasements in concrete floor.
   b. Minimum reinforcement in each direction: 0.5 percent of the concrete area.
   c. Use a clean, well-compacted granular base with a minimum thickness of 6 IN.
   d. Compact to a relative density of 75 percent per ASTM D4253 and ASTM D4254.
      1) See Specification Section 31 23 00.
2. Floor slab shall be placed monolithically.
3. Cure floor slab by flooding with water.
   a. Keep saturated throughout construction to the maximum extent possible and for a period of seven (7) days minimum after being poured.
   b. Curing floor flood water will be supplied by the owner.
4. Vibrate and consolidate the floor slab so no air pockets or voids are present.
5. Provide a troweled finish as noted in Specification Section 03 31 32.

6. No construction joints will be permitted in floor unless otherwise approved by Owner's representative.

C. Precast Core Wall:

1. Construct core wall of precast panels and vertical joints filled with shotcrete or cast-in-place concrete.
2. Provide a full length continuous waterproof steel diaphragm with no horizontal joints throughout and within the tank wall, located between the stored tank contents and the prestressing wires
   a. Mechanically seam vertical diaphragm joints except where located between wall panels, where either mechanical seaming or sealing with epoxy may be employed.
   b. Seal all vertical diaphragm joints to be full watertight.
   c. Piercing of the diaphragm is not permitted except by design. Completely seal punctures with polysulfide sealant.
   d. Do not allow form ties to pierce the diaphragm.
3. Fabricate precast panels to the curvature of the tank radius.
   a. Tolerance in panel wall thickness: Minus 0 to plus 1/4 IN.
   b. Place concrete for each panel in one (1) continuous operation.
4. Locate bearing pads and hold them in proper position prior to erection of wall panels.
   a. Do not nail pads.
5. Properly secure sponge filler pads.
   a. Calk all voids around bearing pads and sponge with a non-toxic sealant to prevent mortar seepage.

D. Horizontal Prestressing:

1. Place prestressing wire on the wall with a wire winding machine capable of consistently producing a stress in the wire within a range of 0 percent to plus or minus 2 percent of the stress required by the design.
   a. No circumferential movement of the wire along the tank wall will be permitted during or after stressing the wire.
   b. Stressing may be accomplished by drawing the wire through a die or by other means that result in uninterrupted elongation, thus assuring uniform stress throughout its length and over the periphery of the tank.
2. Temporarily anchor each coil of prestressing wire at sufficient intervals to minimize the loss of prestress in case a wire breaks during wrapping.
3. Minimum spacing (center to center) of prestressing wires is 3/8 IN and a minimum clear space between wires of 5/16 IN or 1.5 wire diameters, whichever is greater.

a. Replace any wires not meeting the spacing requirements.

b. Do not place prestressing closer than 3 IN from the base of walls or floors where radial movement may occur.

4. Displace the band of prestressing normally required over the height of an opening into circumferential bands immediately above and below the opening to maintain the required prestressing force.

   a. Bundling of wires is prohibited.

5. Joint ends of individual coils by suitable steel splicing devices capable of developing the full strength of the wire.

6. A properly designed stress plate to be used at all permanent wall penetrations equal to or greater than 12 inches in height. The stress plate is to accommodate a portion of the prestressing wires normally required for the height of the opening. The remaining prestress wires normally required to be displaced into circumferential bands immediately above and below the penetration. The effect of banded prestressing to be taken into account in the design.

7. Use a calibrated stress recording device, which can be recalibrated, in determining wire stress levels on the wall during and after the prestressing process.

   a. Take at least one (1) stress reading per foot or one (1) stress reading for every roll of wire, whichever is greater, immediately after the wire has been applied on the wall.

   b. Record readings referring to the applicable height and layer of wire for which the stress is being taken.

   c. Contractor to keep a written record of stress readings and then deliver said record to the Owner.

   d. Make all stress reading on straight lengths of wire.

   e. If applied stresses fall below the design stress in the steel, provide additional wire to bring the stress up to the required design stress.

   f. If the stress in the steel is more than 7 percent over the required design stress, the wrapping operation shall be discontinued and adjusted.

E. Shotcrete:

1. Weather limitations:

   a. Comply with AWWA D110.Shotcrete is not to be placed in freezing weather without provisions for protection of the shotcrete against freezing. Shotcrete placement can start without special protection when the temperature is 35 degrees Fahrenheit and rising, and must be suspended when the temperature is 40 degrees Fahrenheit and falling. The surface to which the shotcrete is applied must be free from frost. Cold weather shotcreting to be in accordance with ACI 301 and ACI 306R.

b. Hot weather shotcreting to be in accordance with the requirements of ACI 301 and ACI 305R.

2. Placement:

a. Comply with ACI 506.2.

b. Shotcrete to be applied with the nozzle held at a small upward angle not exceeding five degrees and constantly moving during application in a smooth motion with the nozzle pointing in a radial direction toward the center of the tank. The nozzle distance from the prestressing to be such that shotcrete does not build up or cover the front face of the wire until the spaces behind and between the prestressing elements are filled.

c. Total cover coat thickness to be controlled by shooting guide wires. Vertical wires to be installed under tension and spaced no more than 3-ft 0-inch apart to establish uniform and correct coating thickness. Wires of 18 or 20 gauge high tensile strength steel or a minimum 100 lb. monofilament line to be used. Wires to be removed after placement of the cover coat and prior to finishing.

3. Coating of steel diaphragm:

a. Cover steel diaphragm with a layer of shotcrete at least 1/2 IN thick prior to prestressing.

b. Total minimum coating over the steel diaphragm: 1-1/2 IN including diaphragm cover, wire cover and finish cover coat.

4. Coating over prestressing wire:

a. Individually encase each prestress wire in shotcrete of a thickness sufficient to provide a clear cover over the wire of at least 1/4 IN.

b. Apply a finish coat of shotcrete as soon as practicable after the last application of wire coat.

1) Total thickness of shotcrete: Not less than 1 IN over the wire.

c. Provide a natural gun finish.

F. Tolerances:

1. Out-of-plumb in total wall height: Plus or minus 1/2 IN.

2. Out-of-round in diameter: Plus or minus 1 IN.

G. Dome Roof:

1. Construction to be cast-in-place or precast construction. Shotcrete dome construction not permitted.

2. Columns or interior supports will not be allowed.

3. Minimum shell thickness to be proportioned for buckling, but not less than 3-inches for cast-in-place and 4-inches for precast and its associated joints.

4. Construct dome roof to proper spherical curvature.

a. Locate and configure construction joints to result in adequate strength.

b. Dome design to be based upon elastic spherical shell analysis with a rise to span ratio within the range of 1:10 to 1:14.

5. Design dome forms to resist all forces acting with respect to its sloped surface.

6. Do not remove any portion of formwork for domes until the concrete is of sufficient strength and until the full circumferential prestressing force has been applied to the dome ring.

7. Apply a coat of curing compound conforming to ASTM C309 to the exterior dome surface of cast-in-place concrete immediately after completion of the final finishing operation.

a. See Specification Section 03 31 31.

3.3 FINISHES

A. The tank to receive following finishes.

1. Concrete Floor Slab: Bull float and/or Fresno Finish.

2. Precast Wall Panels: Internal - Broom Finish.

3. Precast Dome Slots: Light Broom Finish.

4. Exterior Pneumatic Mortar or Nozzle Finish.

5. Cast - in - Place Dome Roof, Soffit: Form Finish.

6. Cast - in - Place Dome Roof, Surface: Broom Finish with non-skid surface in select areas shown on PLANS.

B. Non-skid surface to be created by embedding 5 lbs of 50 mesh dry silica sand per gallon into acrylic texture coating. A broom finish is not considered a non-skid coating.

C. Exterior wall and dome concrete to be a uniform color and texture.

3.4 DECORATIVE COATING

A. All exposed exterior precast dome surfaces shall be given a two-coat finish consisting of one coat of damp-proofing product such as “Tamoseal with AKKRO-7T” or equal, and one coat of “Tammscoat Smooth” or equal. All exterior exposed cast-in-place dome and all exterior exposed wall surfaces shall be given a two-coat finish of a non-cementitious 100% acrylic such as “Tammscoat Smooth”, Tnemec Envirocrete 156 or equal. Work shall be performed by workmen skilled in the application of these types of products. The Manufacturer’s application instructions shall be submitted to the Engineer for approval. The Tank Contractor shall confer with the Manufacturer’s representatives regarding application techniques and shall follow the Manufacturer’s instructions.

B. Surfaces to be coated to be clean, free of all laitance, dirt, grease, and foreign material. All defective surfaces to be filled and/or repaired before coating.

C. OWNER shall select color.

3.5 FIELD QUALITY CONTROL

A. Testing Reservoir Construction and Materials:

1. Foundation soil support: Place no fill until subgrade has been proofrolled and approved by Owner's representative.
2. Concrete:
   a. For precast wall and dome panels: One (1) set of five (5) cylinders for each concrete truck (approximately 10 CY), or fraction thereof placed in one (1) day, required.
   b. For cast-in-plane components like the monolithically poured floor and dome: One (1) set of five (5) cylinders for each 60 CY, or fraction thereof placed in one (1) day, required.
   c. Test one (1) cylinder at seven (7) days and two (2) at 28 days; hold two (2).
   d. With each set of cylinders:
      1) Make one (1) test for air-entrainment.
      2) One (1) test for slump.
3. Concrete testing: Comply with Specification Section 03 05 05.
4. Shotcrete:
   a. Test in accordance with ACI 506.2.
   b. Make tests from the shotcrete as it is being placed.
5. Prestressing: Test prestressing per requirements of 3.2.D.7 by Contractor.

B. Testing:

1. Upon completion of the tank, clean tank of any excess debris, and fill tank according to recommendations in the Geotechnical Report. Provision of water specified in section 01 30 00. Raw water may not be utilized for leak testing or disinfection unless approved by TCEQ. Approval shall be in the form of a written variance to Texas Administration Code Title 30 Chapter 290. Initial tank fill water will be supplied by the owner. If resting is required after initial test, Contractor shall pay for additional water used.
   a. Tank to remain filled for a period of at least 48 HRS to allow for absorption and initial settlement.
   b. After the initial period, add makeup water as required and continue to monitor tank settlement per recommendations in the Geotechnical Report.
2. Net drop in liquid level not to exceed the maximum allowable of 1/10th of 1 percent of the capacity per 24 HR period.

3. If the net drop in liquid level exceeds the maximum allowable, extend the liquid level test to a total of five (5) days.
   a. If at the end of five (5) days, the average net drop in liquid level does not exceed the maximum allowable, the test is considered satisfactory.
   b. If the net liquid loss exceeds the maximum allowable, the test is considered unsuccessful.
      1) Correct source of leakage and retest tank at the Contractor's expense.
      2) If there are defects in the tank, the repair procedure to be reviewed by Owner’s representative prior to implementation by Contractor.
4. Damp spots on the exterior wall surface are not permitted.
   a. Damp spots are defined as spots where moisture can be picked up on a dry hand.
   b. Locate the source of water movement through the wall and permanently seal.
   c. No leakage that includes visible flow through the wall-floor joint is permitted.
   d. Dampness on the top of the footing will not be construed as leakage.
5. Disinfection
   a. Prior to testing for leakage, thoroughly clean and flush tank interior. Remove all foreign matter from tank.
   b. Disinfect tank and all associated piping included in PLANS using Chlorination Method 1, Method 2, or Method 3 described in AWWA C652. Disinfection process to meet TCEQ regulatory requirements.
   c. Water for tank construction initial test to be provided by Owner. Contractor shall pay for any subsequent test as a result of an unsatisfactory test result. Raw water may not be utilized for leak testing or disinfection unless approved by TCEQ. Approval shall be in the form of a written variance to Texas Administrative Code Title 30 Chapter 290.
   d. Comply with the requirements of AWWA C652, Chlorination Method 1, Method 2, or Method 3 for the disposal of disinfection water (paragraphs 4.1.5 and 4.1.5.1).
   e. Coordinate with Owner the collection of water samples for bacteriological analysis. Owner to identify and hire independent testing lab to conduct collection of water samples and bacteriological analysis. Contractor to notify Owner when tank is ready for testing and coordinate with testing lab. Three consecutive, satisfactory water samples required. A satisfactory water sample is a sample analyzed and determined to meet State Department of Health criteria for bacterial analysis.

f. Repeat disinfection and water sampling procedures, if necessary, until three consecutive water samples meet State Department of Health criteria for bacterial analysis.

g. Water samples to meet TCEQ requirements for bacterial analysis for potable water systems before tank will be accepted.

END OF SECTION

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