

SECTION 33 05 16
PRECAST CONCRETE UTILITY STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work under this Section includes furnishing and installing precast concrete units for manholes, wet wells, valve vaults, and chemical feed piping pull boxes as indicated on the Drawings and specified herein.

1.02 SUBMITTALS

- A. See Section 01 33 00 for a complete description of submittal requirements.
- B. Shop drawings of the concrete units, including bottom and top slabs showing details of construction, reinforcing and joints shall be submitted to and approved by the Engineer prior to the manufacture of the units. The shop drawings shall include structural design calculations for all slabs and walls which do not have reinforcement detailed on the Drawings. The design calculations shall demonstrate compliance with the specified standards and shall be signed and sealed by a professional engineer licensed in the State of Alabama.
- C. Manufacturer's data sheets and shop drawings shall be submitted on the following:
 - 1. Joint mastic and gaskets.
 - 2. Grout material.
 - 3. Pipe connections.
 - 4. Castings.
 - 5. Reinforcement.
 - 6. Hatches.

1.03 INSPECTION

- A. The quality of all materials, the process of manufacture and the finished sections shall be subject to inspection and approval by the Engineer. Such inspection may be made at the place of manufacture or at the site after delivery, or at both places and the sections shall be subject to Specification requirements; even though sample sections may have been accepted as satisfactory at the place of

manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All sections which have been damaged after delivery will be rejected and, if already installed, shall be removed and replaced entirely at the Contractor's expense.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A48 - Standard Specification for Gray Iron Castings
2. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
4. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).
5. ASTM C150 - Standard Specification for Portland Cement.
6. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
7. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
8. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
9. ASTM D4101 - Standard Specification for Propylene Plastic Injection and Extrusion Materials.

B. American Concrete Institute (ACI)

1. ACI 318 - Building Code Requirement for Structural Concrete.

C. American Association of State Highway and Transportation Officials (AASHTO)

D. Occupational Safety and Health Administration (OSHA)

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 STRUCTURES

- A. Circular precast concrete structures shall conform to the requirements of ASTM Designation C-478, Precast Reinforced Concrete Manhole Sections, except as otherwise specified or as shown on the Drawings. All circular precast concrete structures, including bottom slabs, walls, and top slabs, shall be designated to support an AASHTO H-20 loading plus all other soil and hydrostatic loads. Signed and sealed design calculations demonstrating compliance with these requirements shall be submitted in accordance with Paragraph 1.02. Details of precast sections shown on the Drawings shall supersede ASTM C-478 when such details are more stringent than ASTM C-478. The structures shall meet the following additional requirements.
1. Minimum wall thickness shall be as indicated on the Drawings.
 2. Cement shall be Type II Portland Cement conforming to ASTM Designation C150.
 3. Sections shall have tongue and groove joints. Joints shall be filled with preformed flexible plastic joint sealer. The sealer shall be "Ram-Nek" as manufactured by the K.T. Snyder Co. or equal.
 4. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
 5. The tops of bases shall be suitably shaped to mate with the precast barrel section.
 6. Lift rings or non-penetrating lift holes shall be provided for handling precast sections. Non-penetrating lift holes shall be filled with non-shrinking grout after installation of the structure.
 7. Barrel and base sections shall be constructed with preformed openings properly located for making gravity sewer line connections. The diameter of such openings shall not be more than two inches larger than the outside diameter of the pipe or pipe bell to be connected. The distance between the crown of such openings and the shoulder of the barrel joint shall be six inches minimum.
 8. Gravity pipe connections to manholes and wet well shall conform to ASTM C923 and be Kor-N-Seal Model WS, Atlantic Rubber A-Lok, or an approved equal.

9. Where force main and drain piping penetrates a wall of a wet well, a Type 316 stainless steel wall sleeve, with intermediate wall collar, shall be provided. The annular space between the carrier pipe and sleeve shall be sealed with a compression type wall seal with Type 316 stainless steel hardware.
- B. Rectangular precast concrete structures shall comply with ASTM C-913-79 and ASTM C-890-78 except as otherwise specified or shown on the Drawings. All rectangular precast concrete structures including bottom slabs, walls, and top slabs, shall be designed to support an AASHTO H-20 loading plus all other soil and hydrostatic loads. Signed and sealed design calculations demonstrating compliance with these requirements shall be submitted in accordance with Paragraph 1.02. Details shown on the Drawings shall supersede the stated ASTM standards when such details are more stringent than the referenced standards. The structures meet the following additional requirements.
1. Minimum wall thickness shall be as indicated on the Drawings.
 2. Cement shall be Type II Portland Cement conforming to ASTM Designation C150.
 3. Sections shall have tongue and groove joints. Joints shall be filled with preformed flexible plastic joint sealer. The sealer shall be "Ram-Nek" as manufactured by the K.T. Snyder Co. or equal.
 4. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
 5. The tops of bases shall be suitably shaped to mate with the precast wall section.
 6. Lift rings or non-penetrating lift holes shall be provided for handling precast sections. Non-penetrating lift holes shall be filled with non-shrinking grout after installation of the structure.
 7. Where force main or chemical feed piping penetrates a valve vault or pull-box wall, a Type 316 stainless steel wall sleeve, with intermediate wall collar, shall be provided. The annular space between the carrier pipe and sleeve shall be sealed with a compression type wall seal with Type 316 stainless steel hardware.
- C. Interior and exterior surfaces of all precast concrete structures shall have a protective coal tar epoxy coating equal to Carbolite Bitumastic 300-M. The coating shall be applied in two (2) coats to provide a dry film thickness of at least 24 mils.

2.02 CASTINGS

- A. Castings for manhole and air release valve vault frames, covers, adjustment rings, and other items shall be of gray cast iron and conform to ASTM Designation A48, Class 30. The castings shall be true to pattern in form and dimensions and free of pouring faults and other defects which would impair their strength, or otherwise make them unfit for the service intended. The sealing surfaces between the frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the covers. Casting patterns shall conform to those shown on the Drawings. All frames and covers shall be traffic bearing to accommodate AASHTO H-20 loadings. Frames shall be suitable for the future addition of a cast iron ring for upward adjustment of the top elevation. Manhole and air release valve vault frames and covers shall be manufactured by U.S. Foundry, Vulcan or an approved equal.

2.03 CEMENT MORTAR

- A. Cement mortar shall be one part cement and three parts clean sharp sand to which may be added lime in the amount of not over ten percent volume of cement. It shall be mixed dry and then wetted to proper consistency for use. No mortars that have stood for more than one (1) hour shall be used.

2.04 HATCHES

- A. Aluminum access hatches shall be provided for pump station valve vaults and chemical feed piping pull boxes. Hatches shall conform to requirements set forth in Division 05.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All openings for gravity sewer pipes shall be sealed watertight.
- B. Precast structures shall be constructed to the dimensions shown on the Drawings and as specified herein. Install at elevations and locations shown on the Drawings or as otherwise directed by the Engineer.
- C. Place the precast base unit on a thoroughly compacted gravel subbase. Drain all water from the bottom of the excavation before placing base.
- D. Construct the floor of the wetwell and valve vault using cement mortar to the requirements of the Drawings.

- E. Set precast concrete sections so that the sections are vertical and in true alignment with a 1-14-inch maximum tolerance allowed. Fill the outside and inside joint with a comparatively dry mortar (one part cement to two parts sand) and finish flush with the adjoining surfaces. Backfill in a careful manner, bringing the fill up evenly on all sides. The Contractor shall install precast sections in a manner that will result in a watertight joint.
- F. Plug holes in the concrete sections made for handling or other purposes with a non-shrinking grout or by grout in combination with concrete plugs.
- G. Manhole flow channels shall be as shown on the Drawings, with smooth and carefully shaped bottoms, build up sides, and benching constructed using cement and brick. Channels shall conform to the dimensions of the adjacent pipes and provide changes in size, grade, and alignment evenly. Cement shall be Portland Cement Type II.
- H. Castings shall be fully bedded in mortar with adjustment brick courses placed between the frame and manhole. Bricking shall include a minimum of two (2) and a maximum four (4) courses. Mortar shall conform to ASTM C-270, Type M, and the bricks shall be clay and conform to ASTM C-216, Grade SW, size 3 1/2" (w) X 8" (l) X 2 1/4" (h).
- I. The tops of manhole castings located in pavement, shouldered areas, and sidewalks shall be set flush with grade. The tops of manhole castings located outside paved areas shall be placed two (2) inches above grade.
- J. Coatings shall be touched up after installation.

3.02 LEAKAGE TESTS

- A. Test each manhole and wet well for leakage. Engineer shall observe each test. Perform exfiltration test as described below:
 - 1. Assemble manhole or wet well in place. Fill and point all lifting holes and exterior joints with an approved nonshrink mortar. Test before filling and pointing the horizontal joints. Lower ground water table below bottom of the structure for the duration of the test. Plug all pipes and other openings into the structure and brace to prevent blow out.
 - 2. Fill manhole or wet well with water to the top of the section. If the excavation has not been backfilled and no water is observed moving down the surface of the structure, it is satisfactorily watertight. If the test, as described above is unsatisfactory as determined by the Engineer, or if the excavation has been backfilled, continue the test. A period of time may be permitted to allow for absorption. Following this period, refill structure to the top, if necessary, and allow at least 8 hours to pass. At the end of the

test period, refill the structure to the top again, measuring the volume of water added. Extrapolate the refill amount to a 24-hour leakage rate. The leakage for each structure shall not exceed 1 gallon per vertical foot for a 24-hour period. If the structure fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as directed by the Engineer. If leakage due to a defective section or joint exceeds 3 gallons per vertical foot per day, the structure shall be rejected. Uncover the rejected structure as necessary and disassemble, reconstruct or replace it as directed by the Engineer. Retest the structure and, if satisfactory, fill and paint the interior joints.

3. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete.
- B. An infiltration test may be substituted for an exfiltration test if the ground water table is above the highest joint in the structure. If there is no leakage into the structure as determined by the Engineer, it will be considered watertight. If the Engineer is not satisfied, testing shall be performed as described herein before.

3.03 CLEANING

- A. Thoroughly clean all structures of all silt, debris, and foreign matter of any kind prior to final inspections.

END OF SECTION

SECTION 33 13 00
DISINFECTING OF WATER UTILITY STRUCTURES AND PIPING

PART 1 – GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American WaterWorks Association (AWWA):
 - a. B300, Hypochlorites.
 - b. B301, Liquid Chlorine.
 - c. B302, Ammonium Sulfate
 - d. B303, Sodium Chlorite.
 - e. C651, Disinfecting Water Mains.
 - f. C652, Disinfection of Water Storage Facilities.
 - g. C653, Disinfection of Water Treatment Plants.
 2. Standard Methods for the Examination of Water and Wastewater, as published by American Public Health Association, American Water Works Association, and the Water Environment Federation.

1.02 SUBMITTALS

- A. Action Submittals:
1. Plan describing and illustrating conformance to appropriate AWWA Standards and this Specification.
 2. Procedure and plan for cleaning system.
 3. Procedures and plans for disinfection and testing.
 4. Proposed locations within system where samples will be taken.
 5. Type of disinfecting solution and method of preparation.
 6. Method of disposal for highly chlorinated disinfecting water.

PART 2 PRODUCTS

2.01 WATER FOR DISINFECTION

- A. Clean, uncontaminated, and potable.
- B. Owner will supply potable quality water. Contractor shall convey in disinfected pipelines or containers.

2.02 CONTRACTOR'S EQUIPMENT

- A. Furnish chemicals and equipment, such as pumps and hoses, to accomplish disinfection.
- B. Water used to fill pipelines may be supplied using a temporary connection to existing distribution system. Provide protection against cross-connections as required by AWWA C651.

PART 3 EXECUTION

3.01 GENERAL

- A. Disinfect the following items installed or modified under this Project, intended to hold, transport, or otherwise contact potable water:
 - 1. Disinfectant contact basin/clearwell
 - 2. Finished water and backwash supply pumps
 - 3. Elevated backwash water storage tank
 - 4. Chemical feed lines carrying chemicals to the finished water static mixer
 - 5. Finished water main
 - 6. On-site piping that will contain finished water
- B. Prior to application of disinfectants, clean facilities of loose and suspended material.
- C. Allow freshwater and disinfectant solution to flow into pipe or vessel at a measured rate so chlorine-water solution is at specified strength. Do not place concentrated liquid commercial disinfectant in pipeline or other facilities to be disinfected before they are filled with water.

3.02 SEQUENCING AND SCHEDULING

- A. Commence disinfection after completion of following:
 - 1. Completion and acceptance of internal painting of system(s).
 - 2. Hydrostatic and pneumatic testing, pressure testing, functional and performance testing and acceptance of pipelines, pumping systems, structures, and equipment.
 - 3. Cleaning and flushing.

3.03 PIPING AND PIPELINES

A. Cleaning:

1. Before disinfecting, clean all foreign matter from pipe in accordance with AWWA C651.
2. If the continuous feed method or the slug method of disinfection as described in AWWA C651 is used, flush pipelines with potable water until clear of suspended solids and color. Provide hoses, temporary pipes, ditches, and other conduits as needed to dispose of flushing water without damage to adjacent properties.
3. Flush service connections and hydrants. Flush distribution lines prior to flushing hydrants and service connections. Operate valves during flushing process at least twice during each flush.

B. Disinfecting Procedure: In accordance with AWWA C651, unless herein modified.

C. Pipelines larger than 60 inches may be disinfected by spraying in accordance with the method described in AWWA C652.

3.04 PUMPS

A. Disinfecting Solutions: Minimum free chlorine concentration of 200 ppm.

B. Application:

1. Inject disinfecting solution into pump and associated piping and circulate for a minimum 2-hour period of time. At end of 2-hour period, solution shall have a strength of at least 100 ppm free chlorine.
2. Operate valves and pump appurtenances during disinfection to ensure that disinfecting solution is dispersed into all parts of pump and lines.
3. If disinfecting solution contained in pump has a residual free chlorine concentration less than 100 ppm after the 2-hour retention period, reclean pump, reapply disinfecting solution, and retest until a satisfactory test result is obtained.
4. After chlorination, flush water from pump until water through the unit is chemically and bacteriologically equal to permanent source of supply.

3.05 TANKS AND RESERVOIRS

A. Cleaning:

1. Clean interior surfaces using water under pressure before sterilizing. Isolate reservoir from system to prevent contaminating materials from entering the distribution system. Cleaning shall:

- a. Remove all deposits of foreign nature.
 - b. Remove all biological growths.
 - c. Clean the slopes, walls, top, and bottom.
 - d. Avoid damage to the structure.
 - e. Avoid pollution or oil deposits by workers and equipment.
 2. Dispose of water used in cleaning in accordance with applicable regulations before adding disinfecting solution to reservoir.
- B. Disinfecting Procedure: Perform in accordance with AWWA C652, unless herein modified. Parts of structures, such as ceilings or overflows that cannot be immersed, shall be spray or brush disinfected.

3.06 DISPOSAL OF HEAVILY CHLORINATED WATER

- A. Do not allow flow into a waterway without neutralizing disinfectant residual.
- B. See the appendices of AWWA C651, C652, and C653 for acceptable neutralization methods.

3.07 TESTING

- A. Collection of Samples:
 1. Coordinate activities to allow samples to be taken in accordance with this Specification.
 2. Provide valves at sampling points.
 3. Provide access to sampling points.
- B. Test Equipment:
 1. Clean containers and equipment used in sampling and make sure they are free of contamination.
 2. Obtain sampling bottles with instructions for handling from Owner's laboratory.
- C. Chlorine Concentration Sampling and Analysis:
 1. Collect and analyze samples in accordance with AWWA Standards.
 2. Sampling Frequency for Disinfecting Solution: 2 Samples per 24 hours.
 3. Residual Free Chlorine Samples: 2 Samples per 24 hours.
 4. Dechlorinated Disinfecting Wastewater Residual Samples: 2 Samples per hour.
 5. Sampling Locations: As defined in Contractor's sampling plan.
 6. Analysis to be performed by Owner's laboratory. Samples will be analyzed using amperometric titration method for free chlorine as described in latest edition of Standard Methods for Examination of Water and Wastewater.

- D. After the various components requiring disinfection have been cleaned, disinfected, and refilled with potable water, Owner will take water samples and have them analyzed for conformance to bacterial limitations for public drinking water supplies.
1. Samples shall be collected in accordance with applicable AWWA Standards.
 2. Samples shall be analyzed for coliform concentrations in accordance with latest edition of Standard Methods for the Examination of Water and Wastewater.
 3. A minimum of two (2) samples on each of 2 consecutive days from each separable structure and every 1,000 feet of pipeline shall be obtained and analyzed by standard procedures outlined by State and Local regulatory agencies.
 4. Sampling points shall be representative and accepted by Engineer.
- E. If samples required above are bacterially positive, disinfecting procedures and bacteriological testing shall be repeated until bacterial limits are met.

END OF SECTION

SECTION 33 16 19
ELEVATED MULTI-COLUMN STEEL WATER STORAGE TANK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. The work to be performed under this Section consists of the furnishing of all materials, tools, equipment, labor and incidentals necessary for the design, manufacture, delivery, erection, painting, disinfection and testing of a welded steel cross braced, column-supported elevated water storage tank. The tank is to be complete with all accessories specified herein, and is to be erected on foundations to be designed by the Tank Manufacturer. The tank shall meet all requirements of AWWA D100 Standard for Welded Steel Elevated Water Storage Tanks.

1.02 QUALITY ASSURANCE

- A. The company responsible for designing and constructing the elevated tank (Tank Manufacturer) shall own their fabrication facilities. Divided responsibilities between design, erection and fabrication will not be allowed.
- B. A qualified supervisor employed by the Tank Manufacturer shall be on site at all times during construction of the foundation and support structure.
- C. The Tank Manufacturer shall have completed at least five (5) welded steel elevated storage tanks supported on steel columns and cross bracing with capacity equal to or greater than the capacity of the tank included in this project.
- D. Approved Manufacturers: Equipment shall be designed, fabricated and installed in accordance with the manufacturer's recommendations. The elevated water storage tank shall be manufactured by Phoenix Tanks or Caldwell Tanks.
- E. Welder Qualifications
 - 1. The specification for each welding procedure shall be qualified in accordance with the rules in ASME Boiler and Pressure Vessel code.
 - 2. Welder shall be qualified by tests in accordance with AWWA D100-11 Section 8.3.2.
 - 3. Welder's qualification papers shall be required from a qualified testing laboratory. Qualifications shall be within one (1) year from the beginning of construction.
 - 4. Engineer, at Engineer's discretion, may accept evidence of previous qualification.

1.03 SUBMITTALS

- A. Shop Drawings: Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of the Section 01 33 00: Submittal Procedures. Submittals shall include at least the following:
 - 1. Drawings showing the general plan of the structure including all major dimensions such as the tank diameter, the height to low and high water capacity levels, support tower, thickness of all plates, principal members, arrangements of members, and size of the tank foundation, including quantities of concrete and rebar.
 - 2. Design of tank foundations with column reactions and concrete mix design.
 - 3. Design of tank structures showing size of plate, members, details of all connections, special details and member loads, piping, painting and other pertinent information as required per the Drawings and Specifications.
 - 4. These drawings shall be sealed by a registered Professional Engineer in the State of Alabama.
- B. Operations and Maintenance Instructions:
 - 1. Six (6) copies of an operating and maintenance manual shall be furnished in accordance with Section 01 78 23: Operation and Maintenance Data. The manual shall be prepared specifically for this installation and shall include all required catalog cuts, drawings, equipment lists, descriptions, and necessary information required to instruct operating and maintenance personnel unfamiliar with all of the equipment specified herein. A complete, corrected and approved copy of the shop drawing submittal shall be included with each manual provided.
- C. Equipment Certification: The Contractor shall submit to the Engineer six (6) copies of a certified report from the factory service representative certifying that the elevated water storage tank has been properly installed and operates satisfactorily under the specified operating conditions.

1.04 WARRANTY AND GUARANTEES

- A. The Tank Manufacturer and Contractor shall guarantee the structure against any defects in design, material or workmanship for a period of one (1) year from the date of final completion. If any defect is discovered and reported during the guarantee period, the necessary repairs shall be made or components replaced at no expense to the Owner.
- B. The Tank Manufacturer's warranty period shall be concurrent with the Contractor's warranty period. No exception to this provision shall be allowed.

PART 2 PRODUCTS

2.01 TANK FOUNDATIONS

- A. Foundation design shall be based on the allowable soil bearing pressure provided in the Geotechnical Report. The Contractor shall retain the services of the geotechnical consultant to verify the adequacy of the bearing stratum after the Contractor has carried out the excavation and before any concrete or reinforcement is placed. The design of the foundation shall be in accordance with the requirement of ACI 301, 318 and Section 03 30 00. Minimum concrete compressive strength shall be 4,000 psi at 28 days.
- B. The Tank Manufacturer shall design and prepare construction plans and details for the foundations in accordance with the requirements of the Specifications. The foundation construction drawings shall be sealed by a registered Professional Engineer in the State of Alabama and submitted to the Engineer for review and final approval.
- C. The Contractor shall furnish and install all materials, labor and equipment necessary to complete the tank foundations, complete with anchor bolts, reinforcing steel and concrete per Tank Manufacturer's recommendations.
- D. All testing of materials concerning the foundations and support structure shall be performed by an independent testing laboratory satisfactory to the Engineer.

2.02 TANK DESIGN AND MATERIALS

- A. Material, design, welding, shop fabrication, erection, testing and inspection of the proposed elevated water storage tank shall be in compliance with the latest revision of the American Water Works Association AWWA Standard for Welded Carbon Steel Tanks for Water Storage (AWWA D100), and the American Concrete Institute Building Code Requirements for Structural Concrete (ACI 318).
- B. The following design parameters shall apply, and the structure shall safely withstand the following loads acting separately or in combination, according to the provisions of ASCE 7-10.
 - 1. Weight of the structure.
 - 2. Weight of the water in the tank.
 - 3. Wind design per design data listed in the structural general notes
 - 4. Seismic design per design data listed in the structural general notes.
 - 5. Snow load shall be 10 PSF.
 - 6. Roof live load shall be 20 PSF.
 - 7. Stairs and exitway live load shall be 100 PSF or 300 pounds.

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8. Elevated walkway live load shall be 60 PSF or 300 pounds.
 9. Minimum thickness of plate in contact with water is ¼ inch.
- C. All steel in the structure shall be manufactured, rolled, or shaped in accordance with the current AWWA D100 Standard (AWWA D100).
 - D. Steel Plate: ASTM A283 GR. C / A36
 - E. Structural Steel Shapes: ASTM A36
 - F. Brace Rods and Stay Rods: ASTM A36
 - G. Ladder Rungs: ASTM A706
 - H. All interior lap joints shall be sealed by means of continuous seal welding. The interior lap joints shall be defined to include roof plate laps. All penetrations of roof accessories inside the tank shall be seal welded also.

2.03 EQUIPMENT DESCRIPTION

- A. The tank shall have a minimum capacity of 1,100,000 gallons.
- B. The tank shall have a maximum operating head range of 38 feet between low and high water levels.
- C. The low water level (LWL) shall be at an elevation of 663.00 feet.
- D. The tank shall have a maximum inside diameter of 80 feet.

2.04 ACCESSORIES

- A. Riser Pipe
 1. The steel riser pipe for the elevated tank shall be not less than 96 inches in diameter, wet and not less than ¼ inch steel plate.
 2. The riser manway shall be a minimum 24 inches in diameter and located at approximately 36 inches above the riser base plate.
 3. A safety grate shall be provided at the top of the riser.
- B. Tank Identification Plate
 1. One bronze identification plate shall be mounted on the center riser pipe above the riser manway listing the following information.
 - a. Tank contractor name.
 - b. Year erected.

- c. Tank capacity in US gallons.
- d. Tank head range.
- e. Tank style.
- f. Contractor's serial number or project number.
- g. Tank contractor's erection foreman.

C. Balcony

- 1. The tank shall be provided with a balcony at least 24 inches wide and handrail of not less than 42 inches high in accordance with AWWA D100. The floor plate shall be of at least ¼ inch steel plate perforated to permit drainage of rain water.

D. Tank Vent

- 1. The tank shall have one 24-inch diameter vent located near the center of the tank roof to address the maximum flow rates established herein. The maximum flow into the tank shall be 3,000 GPM and the maximum flow out of the tank shall be 21,100 GPM. The overflow pipe shall not be considered a tank vent.
- 2. The vent shall be designed to prevent the ingress of birds, insects, or animals and minimize condensation on the underside of the roof. There shall be provisions in the vent design to release differential pressures caused by clogging of the vent screen.

E. Tank Openings

- 1. The tank shall have one 24 inch diameter weatherproof steel access hatch on the roof of the tank to provide access to the interior of the tank. The hatch shall be located above high water level (HWL) with a hinged cover and hasp to permit locking. The opening shall have curb of at least 4 inches high, and the cover shall have a downward overlap of at least 2 inches.
- 2. The tank shall have one 24-inch diameter shell manway with a watertight steel access hatch on a davit and located on the shell of the tank above the balcony.
- 3. A second roof hatch shall be provided. It shall be 24-inch diameter and flanged with a removable cover constructed so that an exhaust fan may be connected for ventilation during painting operations. The opening shall have a minimum 4-inch curb.

F. Ladders

- 1. Ladders shall have side rails not less than 2 inches x 3/8 inch, with a spacing between the side rails of not less than 16 inches and rungs not less than 3/4 inch round or square, spaced 12 inches on center. Ladders shall

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not in any place have a backward slope. Skid-resistant rungs shall be provided.

2. All ladders and safety devices shall comply with OSHA Standards.
3. A Saf-T-Climb Ladder Fall Protection system shall be provided on all ladders with all accessories required to meet OSHA standards. Exterior vertical ladder(s) shall be provided with a 3/8" galvanized cable safety climb system. Cable system shall be manufactured by Trylon, or alternate approved by Owner, and shall be furnished with four Trylon sliders. The system shall be supplied complete with safety harnesses, lanyards and accessories for two persons.
4. Tank shall be provided with ladders in the following locations:
 - a. A steel ladder for the elevated tank shall be provided on one (1) tower column extending from a point approximately 8 feet above the supporting foundations to the balcony rail.
 - i. One (1) removable ladder section 8 feet long shall be furnished to permit access to tower ladder. A lockable storage area shall be provided on the riser to accommodate the ladder when it is not in use.
 - ii. A lockable Ladder Gate Climb Preventive Shield manufactured by RB Industries or alternate approved by Owner shall be furnished and installed to control unauthorized access.
 - b. A fixed steel ladder shall be provided for the elevated tank, extending from the balcony to roof manway and near other roof accessories.
 - c. A steel ladder inside the tank shall be provided extending from the roof manway to the bottom of the tank.
 - d. A steel ladder inside the riser extending from 36 inches above the base of the riser to the top of the riser shall be provided.

G. Handrail shall be provided around the top of the tank as shown on the Drawings.

H. Instrumentation

1. Provide one (1) pressure (level) transmitter installed near the bottom of the riser as shown on the Drawings. Pressure (level) transmitter shall be furnished in accordance with Section 40 91 23.36.
2. Provide high level float switch.
3. Provide low level float switch.
4. Provide level float switches as specified in section 40 91 23.36 and install as shown on the Drawings.

I. Provide antenna mounts on top of the elevated storage tank.

2.05 PIPING

A. Inlet/Outlet Pipe

1. Provide one (1) welded carbon steel flanged pipe inlet/outlet connection 30 inches in diameter. The inlet/outlet pipe shall extend down from center of the riser plate to a base elbow placed in the center of the foundation. Provide appropriate transition from the carbon steel pipe to the ductile iron base elbow.
2. The inlet/outlet pipe shall extend up into the riser 12 inches above the riser base.
3. The inlet/outlet pipe shall be protected against the entry of foreign materials dropping from above. This shall be done by terminating the inlet/outlet pipe with a removable protective discharge cap.

B. Overflow

1. A suitable weir shall be provided inside the tank with the crest located at the specified high water level.
2. The Tank Manufacturer shall verify that the overflow pipe and weir shall have a capacity to handle a 3,000 GPM fill rate with a maximum water level not more than 6 inches above the top of the weir box.
3. One (1) carbon steel overflow pipe 10 inches in diameter (Schedule 20) with welded connections and suitable brackets shall originate at the weir box. Pipe supports for the overflow shall be designed and provided by the Tank Manufacturer.
4. Overflow shall terminate in a precast concrete drainage box which drains into the stormwater drainage system.
5. The outlet of the overflow pipe shall be provided with a flanged flap valve.

PART 3 EXECUTION

3.01 INSTALLATION

A. Safety

1. The Contractor shall strictly comply with all applicable statutes, regulations, orders, rules, requirements and standards of all governmental authorities having jurisdiction with respect to the project, including without limitation, Federal, State, Local, OSHA, and health regulations as well as the latest professional practices.
2. The Contractor shall, at its own expense, protect its employees and other persons from risk of injury, bodily harm, or death arising out of or in any way connected with work performed.
3. Prior to commencing work, all personnel on the jobsite will have a minimum ten (10) hours of OSHA safety training within the previous year.

3.02 FIELD PAINTING

- A. Surface preparation and coating of all steel surfaces shall be in accordance with AWWA D102 and Section 09 90 01, Elevated Storage Tank Painting.

3.03 INSPECTION AND TESTING

- A. Inspection of shop and field welds shall be in accordance with AWWA D100, Section 11, Inspection and Testing. All inspection shall be performed prior to interior and exterior field painting. Radiographic inspection shall be performed by an independent testing agency with all costs included in the Contractor's bid and paid by the Contractor.
- B. The structure shall be tested by filling the tank with water. Any leaks or defects which may appear shall be repaired.

3.04 DISINFECTION

- A. Prior to acceptance, the Contractor shall disinfect the tank in accordance with AWWA C-652.

END OF SECTION