



**E-54 Regional Lift Station - RFCSP**  
**Solicitation Number: CO-00537**  
**Job No.: 22-2502**

**ADDENDUM 1**  
**October 18, 2022**

To Respondent of Record:

This addendum, applicable to project referenced above, is an amendment to the proposal, plans and specifications and as such will be a part of and included in the Contract Documents. Acknowledge receipt of this addendum by entering the addendum number and issue date on the space provided in submitted copies of the Respondent Questionnaire.

**CHANGES TO THE SPECIFICATIONS**

1. Insert Technical Specifications Table of Contents after Page Contracting Documents Table of Contents and before the Request for Competitive Sealed Proposal.
2. Insert Specification Section 16921: Supervisory Control and Data Acquisition (SCADA) and Location Station Control and Monitoring.
3. Insert Specification Section 17600: Communication Towers.

**ADDENDUM**

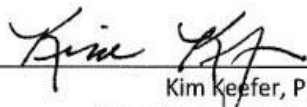
This Addendum, including this one (1) page, is twenty-five (25) pages with attachments in its entirety.

Attachments:

Table of Contents (3 pages)

Section 16921 – Supervisory Control and Data Acquisition (SCADA) System and Local Control and Monitoring (13 pages)

Section 17600 – Communication Towers (8 pages)

  
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**END OF SECTION**

**SECTION 16921**  
**SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM**  
**AND LOCAL STATION CONTROL AND MONITORING**

PART 1 GENERAL

1.01 SCOPE

- A. Contractor shall furnish all labor, materials, and components, and shall provide all design, assembly, licensing and start-up services, as specified herein and as shown on the Contract Drawings.
1. Contractor will be responsible for HMI SCADA System, programming, at the Owner's Production Control Center (PCC).
  2. Contractor will be responsible for programming the Local PLC System.
  3. Contractor to provide latest version of RS Studio 5000 Logix Designer, Standard Edition, Part number 9324-RLD300ENE.
  4. SCADA panel to be designed and certified to UL 508A standards.
- B. Contractor General Qualifications
1. Have a local office within one hundred (100) miles of the City of San Antonio.
  2. Be able to provide resumes, project experience history and references for all employees that will be qualified to work on the SCADA system.
  3. Have a local full time staff of employees that have developed and commissioned a minimum of three new Allen Bradley based systems within the past twelve months. Must have a minimum five years' experience designing, installing and commissioning SCADA systems.
  4. Have a minimum of three local full time employees qualified to perform the SCADA system configuration work.
  5. All proposals submitted to the San Antonio Water System must be accompanied by documentation supporting the qualifications of the Contractor as detailed above. The San Antonio Water System reserves the right to reject any proposal if the above qualifications are not met.
- C. The control, monitoring and SCADA system shall include, but is not limited to, the following component equipment:
1. SCADA PLC Panel to include:
    - a. PLC Processor.
    - b. PLC modules, chassis, and power supplies.
    - c. 24Vdc power supply.
    - d. Surge protection.
    - e. UPS
    - f. Heater

- g. All local indication and local control devices specified herein or indicated on the Contract Drawings.
  - 2. Raco Verbatim Autodialar
    - a. Autodialer
      - b. All local indication and local control devices specified herein or indicated on the Contract Drawings.
  - 3. Radio Transceiver and accessories
  - 4. Communication Panel to include
    - a. Industrial Grade Router
    - b. Radio Transceiver System.
    - c. Cambium POE Injector
    - d. SMA-JE to THCFE adaptor
    - e. All local indication and local control devices specified herein or indicated on the Contract Drawings.
- D. The Application Service Provider (ASP) shall schedule and conduct separate workshops as further defined in this specification section.
- E. The SCADA system shall be furnished in accordance with the requirements stated herein to assure compatibility with Owner's existing facilities and systems. No deviation from specified equipment will be allowed.

## 1.02 SUBMITTALS

- A. Pre-submittal Conference
  - 1. Prior to the Submittal Process, the Application Services Provider (ASP) shall hold a workshop, in which the Engineer and Owner may observe the displays and control strategies prior to submitting database, trends, graphics, reports, and control strategies. No display generation, programming, etc. shall begin until standards have been approved.
  - 2. Prior to commencement of any applications work, the ASP shall submit and receive approval from the Owner and Engineer for all required I/O Lists.
- B. The manuals shall contain all illustrations, detailed drawings, wiring diagrams, and instructions necessary for installing, operating, and maintaining the equipment. The illustrated parts shall be numbered for identification. All information contained therein shall apply specifically to the equipment furnished and shall only include instructions that are applicable. All such illustrations shall be incorporated within the printing of the page to form a durable and permanent reference book.
- C. If the Process Control Systems Integrator (PCSI's) transmits any documentation or other technical information which he considers proprietary, such information shall be designated. Documentation or technical information which is designated as being proprietary will be used only for the design, construction, operation, or maintenance of the System and, to the extent permitted by law, will not be published or otherwise disclosed.
- D. CONTRACTOR shall submit the following in addition to the information in item A:

1. Bill of Materials
  2. Catalog Cuts
  3. Component Data Sheets
  4. Panel Construction Drawings, including wiring and component layout
  5. List of Labels and Tags
  6. Include power supplies, network switches, signal isolators and other equipment as listed in this specification.
  7. CONTRACTOR shall submit control loop drawings complete with rack, card slot and point configuration.
  8. CONTRACTOR shall submit calculations as required.
  9. Proposed HMI SCADA System Screens.
- 1.03 OPERATION AND MAINTENANCE MANUAL
- A. CONTRACTOR shall provide the final O & M manual which shall contain a complete set of as-built control loop and wiring drawings in "11x17" format. Manual shall be submitted to OWNER electronically in PDF format on a CD.
  - B. Complete and tested PLC Programs will be provided by CONTRACTOR to be inserted in the final O&M manual.
- 1.04 PLC INPUT/OUTPUT POINT LIST
- A. The Input/Output (I/O) Point List is attached to this specification as Appendix "A" and indicates nomenclature, and signal functions, and defines the scope of interface requirements for this project. All analog I/O shall be 4-20ma.
  - B. The quantity of Input/Output modules furnished shall not be less than shown in the PLC I/O capacity summary in Appendix "A". Input/Output modules shall have the capacity to accommodate for an additional 25% spare I/O points. Otherwise an additional input/output module is required.
  - C. Field wiring to complete all interconnections listed in the I/O are included in the Contractor's scope of work whether or not shown on the Contract Drawings.
  - D. All spare points to be wired to terminal blocks.
- 1.05 PLC SYSTEM PROGRAMMING
- A. Programming of the PLC CPU will be provided by CONTRACTOR. CONTRACTOR shall coordinate with SAWS Inspector regarding witnessed SCADA testing.
- 1.06 HMI SYSTEM PROGRAMMING
- A. Programming of the HMI will be provided by CONTRACTOR. CONTRACTOR shall coordinate with SAWS Inspector regarding witnessed SCADA testing.
- 1.07 AUTO DIALER INPUT/OUTPUT POINTS
- A. The Input/Output (I/O) Points are shown on contract drawings
  - B. Field wiring to complete all interconnections for the I/O shown on plans are included in the

Contractor's scope of work whether or not shown on the Contract Drawings.

**1.08 AUTO DIALER SYSTEM PROGRAMMING**

- A. Programming of the Auto Dialer will be provided by contractor. CONTRACTOR shall provide coordinate with SAWS Inspector regarding witnessed SCADA testing.
- B. Contractor shall provide programmed auto dialer and shall document all I/O terminations. Contractor will provide field tracing for any programmed loop that does not function.

**PART 2 PRODUCTS****2.01 SCADA PANEL****A. General:**

- 1. Install PLC, 24Vdc power supply, interposing relays, power supplies and interface wiring terminals.
- 2. Provide mounting hardware, terminal blocks, circuit breakers, electrical wiring, communications wiring and all other items required for a complete operational system.
- 3. Panel layout and fabrication shall allow for convenient maintenance and removal of all equipment after installation.
- 4. Provide switched LED interior panel light and receptacle. Also provide one single non-GFCI receptacle dedicated to UPS.
- 5. Provide an enclosed thermostat controlled space heater with fan rated at 120Vac and sized to prevent condensation within the SCADA panel. Locate heater to avoid overheating electronic hardware or producing large temperature fluctuations on the hardware. The thermostat shall have an adjustment range of 40 degrees Fahrenheit to 90 degrees Fahrenheit. Heater shall have circuit breaker as shown on the contract drawings shall be Hoffman type DAH or equal.
- 6. Provide an enclosed thermostat controlled file fan rated at 120Vac. Filter fan to vent the heat out of the SCADA enclosure into the Electrical Building.
- 7. Provide UL508A certification label on panel.

**B. Wiring:**

- 1. Internal wiring for control and low voltage power circuits shall be flame retardant NFPA 70, Type SIS, single conductor, Class B, stranded copper, rated 600 volts. Minimum wire size shall be #14 AWG.
- 2. Analog signal wiring shall be #16 AWG twisted shielded pairs with drain wire and outer jacket. Refer to section 16120.
- 3. Segregate signal wiring from control wiring, group functionally and arrange to facilitate tracing of circuits.
- 4. Arrange wiring on terminal blocks to segregate field incoming conductors on a common side separate from internal wiring.
- 5. Wire routing and bundling shall utilize wiring duct and plastic wire wrap, secured to the structure and with spare space.
- 6. Color code wiring as follows:



- a. AC power at line voltage ..... Black
  - b. AC switched power ..... Red
  - c. Ground/earth ground ..... Green or green w/ yellow tracer
  - d. Ungrounded DC power ..... Blue
  - e. DC grounded common ..... Blue w/ white stripes or white w/ blue stripes
  - f. 4-20mA Twisted shielded pair ..... Red+/Black-
- C. Terminal Blocks:
- 1. Provide screw type 600 volt terminal blocks with pressure plate and marking strip. Do not use miniature terminal blocks.
  - 2. Provide a minimum of 25 percent spare terminals.
  - 3. Group interface terminals together.
- D. Grounding:
- 1. Provide a ground bus connected to rack structure ground for grounding shields, cabinet, and components.
  - 2. DC signal common shall be ungrounded.
- E. Enclosure:
- 1. Enclosure shall be a NEMA 12 cabinet.
  - 2. Doors shall have three-point latch with lockable hasp, and shall have full length hinges with stainless steel pins. Lock to be keyed for Owner's key.
  - 3. Fabricate using mild steel. Grind and sand welds to a smooth finish. Surfaces shall be free of ridges, nuts, and boltheads.
  - 4. Internal structural framing to provide enclosure bracing and equipment support.
  - 5. Provide removable lifting lugs, with plugs for use after installation is complete.
  - 6. Enclosure shall be complete with interior back panels, as required for component mounting. Interior shall be white.
  - 7. Provide a print pocket on inside of each door.
  - 8. Provide laminated wiring schematics of the entire panel.
  - 9. Provide a foldable lap top table installed inside the SCADA panel door.
- F. Devices:
- 1. Reference is made to Section 16050, BASIC ELECTRICAL MATERIALS AND METHODS, for devices not specified in this Section or on the Contract Drawings.
  - 2. Interposing relays, auxiliary relays, and selector switches shall be as indicated on Contract Drawings. Interposing relays used for isolation purposes only shall be SPDT type.
  - 3. Surge protective device for power main shall be Phoenix contact EMC filter surge protection device mounted using DIN-rail assembly in the SCP, P/N 2856702.

4. Temperature sensor shall be Ultra Electronics model # 753-PC-X4-(0°F to 150°F) transmitter with RTD.

G. Nameplates, Labels and Tags:

1. Furnish face-of-panel mounted nameplates to identify systems and equipment. Use plastic laminate nameplates having white letters on red background for 120V system equipment, and white letter on blue background for 24V system equipment. Center lettering on each line.
2. Use plastic tags with letters on a red (120V) and blue (24V) background in the panel interior to identify each device mounted on the panel exterior and interior. Place the tags adjacent to, but not on, the device. Do not obstruct visibility by wire bundles or other equipment.

2.02 PROGRAMMABLE LOGIC CONTROLLER (PLC) SYSTEM

A. Subject to compliance with the Contract Documents, the following manufacturer is acceptable:

1. Rockwell Automation Allen Bradley CompactLogix 5370 Controller with Studio 5000 Logix software (or latest version currently in use by SAWS).
2. PLC processor
3. PLC modules, chassis, and power supply
4. Connection bases
5. All connection cables
6. 25% spare capacity on all I/O modules

B. Approved Products – NO SUBSTITUTIONS

DESCRIPTION	MANUFACTURER	PART NUMBER
Power Supply Module	Allen Bradley	1769-PA4
CPU	Allen Bradley	1769-L33
Analog Input Cable	Allen Bradley	1492-ACAB025EE69
Digital Input Cable	Allen Bradley	1492-CAB025RTN32I
32 Channel Digital Input Module	Allen Bradley	1769-IQ32
8 Channel Analog Input Module	Allen Bradley	1769-IF8
CPU Battery	Allen Bradley	1769-BA
Right End Cap/Terminator	Allen Bradley	1769-ECR
Left End Cap/Terminator	Allen Bradley	1769-ECL
Right to Right bank interconnection	Allen Bradley	1769-CRR3
Right to Left bank interconnection	Allen Bradley	1769-CRL3

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions.

C. Programming – Local PLC:

1. The PLC shall use Studio 5000 Logix (or latest version) software for programming the CPU.
2. Software license shall be relinquished to SAWS.
3. PLC Programming shall be performed by Process Control Systems Integrator (PCSI).

4. Recommended PCSIs:

a. Prime Controls

Office Park Circle  
Lewisville, Texas 75057  
Attn: Gary McNeil  
Phone: 972.221.4849

b. Control Panels USA

16310 Bratton Lane, Suite 100  
Austin, Texas 78728  
Attn: Martin Salyer  
Phone: 512.863.3224

c. Richardson Logic Control

8115 Hicks Hollow  
McKinney, Texas 75071  
Attn: Michael Cunningham  
Phone: 972.542.7375

D. Programming Languages

1. The PLC program shall utilize function blocks that are compatible with Rockwell PlantPAX system.
2. Shall adhere to SAWS Standards for Tagging, etc.

E. Programming – Owner’s Production Control Center:

1. Programming of the Rockwell Automation system at the Owner’s Production Control Center (PCC) shall be performed by the Applications Services Provider (ASP). Contractor shall coordinate with SAWS Inspector in order to notify SAWS Programming Manager about the programming of SCADA HMI graphics 15 calendar days prior to submitting the actual construction drawings of the SCADA Panel.
2. The ASP shall perform all work necessary to configure, customize, debug, install, connect, and place into operation HMI and SCADA software specified within this Division and other related divisions. The PCSI shall coordinate with the ASP all scheduling, installation, and startup services. The PCSI shall be on site at all times when the ASP is working on site.

3. The ASP shall be the following:
    - a. Recommended PCSI from above.
  - F. Programming Languages
    1. The PLC program shall be Function Block Diagram (FBD).
    2. Refer to SAWS Standards for Tagging, etc.
  - G. Input / Output Capacity
    1. Physical Input / Output capacity shall not be less than the following:
      - a. Analog – 256
      - b. Discrete – 1024
- 2.03 120 VAC UNINTERRUPTIBLE POWER SUPPLY (UPS)
- A. Provide power conditioning during normal power operation.
    1. Lightning and surge protection: Tested to ANSI/IEEE C62.41 Category A.
    2. RF noise isolation: EMI/RFI suppression.
    3. On-Line input range: 100-142 Vac, output 112-128 Vac.
  - B. Upon loss of feeder power to UPS, maintain power to the load for a minimum of 2 hours with 4 msec transfer time at 125% of constant load. Contractor to submit load calculation of proposed components and indicate the size of UPS needed for a 2 hour run time.
  - C. Ratings:
    1. Volt – Ampere Capacity: UPS to be sized to run devices in SCADA panel including PLC, Radio, Auto Dialer and DC Power Supplies located in the SCADA panel for 2 hour run time.
    2. Nominal Input Voltage: 120 Vac.
    3. On-Battery Output Voltage: 120 Vac +/- 10%.
    4. On-Battery Frequency: 60 Hz. Stepped sine wave.
    5. Ambient Operating Temperature: 0-40 degrees C.
  - D. Battery shall be a sealed maintenance-free lead acid type with 3-year minimum life.
  - E. UL Compliance: UPS shall conform to UL Standards and have an applied UL listing.
  - F. UPS shall have Ethernet connectivity. Provide Network Card-MS for communications. UPS memory registers shall be configured by Contractor to work with SCADA system.
  - G. Manufacturer: Contractor to verify that the UPS will have a minimum runtime capacity of 2 hours at 125% of constant load in watts for the SCADA panel.
    1. Powerware 5PX 1000 RT with extended battery module 5PXEBM48R or larger based on VA calculation as specified above. Contractor to verify that the UPS will have a minimum runtime capacity of 2 hours with SCADA panel fully loaded.
    2. Tripp Lite SmartOnline SU/\*750/1000/1500/2200/3000 XLCD
      - a. UPS shall be provided with an

- (i) SNMPWEBCARD card
- (ii) Model BPV2470. Extended Runtime Batteries for 2 hours runtime at 125% of constant load in watts.

\*Size determined by contractor based on 2 hour runtime at 125% constant load.

#### 2.04 DC POWER SUPPLY

- A. 24 Vdc Control Power shall be provided by a single-output DC Power Supply.
- B. Ratings:
  - 1. Input Voltage: 120 Vac, + 10% voltage adjustment
  - 2. Output Voltage: 24 Vdc single output.
  - 3. Current range  $\geq 8$  A, overload protected.
  - 4. Rated power  $\geq 200$ W
  - 5. Voltage adjust range: 22V-26.4V
  - 6. Frequency range: 47-63 hz
  - 7. Efficiency: 85%
  - 8. Ambient Operating Temperature: -10-60 degrees C.
- C. UL Compliance: Power Supply shall conform to UL Standards and have an applied UL listing.
- D. Manufacturer:
  - 1. IDEC, Model PS5R-SC24
  - 2. MEAN WELL, Model SP-200-24
  - 3. POWER-ONE, Model HN24-3.6-A.

#### 2.05 COMMUNICATION PANEL

- A. Panel shall be American Products AM-202822-9RU beige color, NEMA 3R Enclosure. Must have UL 94 compliant bulb gasket. Panel to include the following.
  - 1. Wall mounting hardware shall be American Products AM-2418-WM.
  - 2. Backpanel shall be American Products AM-202822-WB.
  - 3. Isolated Ground Bar shall be American Products AM-2X6-RB. Exhaust fan shall be American Products AM-2418-FP-115.
  - 4. Telecommunication 19" Rack Grounding bus bar shall be Harger TRGBHKIT14119.25 or American Product AM-2X6RB
- B. Provide mounting hardware, terminal blocks, circuit breakers, electrical wiring, communications wiring and all other items required for a complete operational system.
- C. Panel layout and fabrication shall allow for convenient maintenance and removal of all equipment after installation.
- D. Provide switched LED interior panel light. Also provide One duplex receptacle.
- E. Provide UL508A certification label on panel.

- F. Industrial Grade Router (Communications Cabinet)
  - 1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
    - a. Cisco model IR829GW-LTE-VZ-AK9
- G. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
- H. Environmental:
  - 1. Operating temperature in sealed NEMA Cabinet with no air flow: -40°F to 140°F
  - 2. Operating altitude: 13,800 ft.
  - 3. Mounting Options: Must be 19" self supporting.
- I. Physical:
  - 1. Enclosure: Fully Modular construction to allow for field upgrades for existing and/or future technologies without requiring a platform replacement. Refer to section 2.1.D for additional requirements.
  - 2. Provide an enclosed thermostat controlled file fan rated at 120Vac. Filter fan to vent the heat out of the enclosure into the Electrical Building.
  - 3. Power supply: 120VAC from UPS in SCADA Panel.
  - 4. Microprocessor based managed type.
  - 5. 19 inch rack mountable where shown in plans.
- J. Options and Accessories Required:
  - 1. Provide twenty (20) percent spare port capacity for each port type.
  - 2. Provide redundant power supply module Cisco PWR-125W-AC
  - 3. WPA Antenna WMMG-7-27-5SP.
  - 4. Female Adapter SMA-TNC.
  - 5. Lighting Arrestor CGR-LA-NF-NF
  - 6. Provide two (2) year extended maintenance: CON-SNT-IR82VZAK

## 2.06 RADIO TRANSCIEVER SYSTEM

- A. Contractor shall furnish and install the 5GHz broadband type radio system with the following features.
  - 1. Integrated High Gain 5GHz PMP450i Subscriber:
    - a. Manufacturer: Cambium Networks
    - b. Part number: C050045C002C
  - 2. Tilt Bracket Assembly:
    - a. Manufacturer: Cambium Networks

- b. Part number: N000045L002A.
- 3. Power Injector:
  - a. Midspan DC power 60w
  - b. Manufacturer: Microsemi
  - c. Part number: PD-9501GI/DC
- 4. Power cord:
  - a. Manufacturer: Cambium Networks
  - b. Part number: C0000065L007
- 5. Lightning Protection:
  - a. Manufacturer: Cambium Networks
  - b. Part number: C000065L007
- 6. Pole Mounting Kit:
  - a. Manufacturer: PolyPhaser
  - b. Part number: IX-POLE-KIT
- 7. Surge Protection:
  - a. Manufacturer: Transector
  - b. Part number: ALPU-F140
- 8. POE Injector:
  - a. Manufacturer: Cambium Networks
  - b. Part number: N000065L001B
- 9. Grounding Kit:
  - a. Manufacturer: Cambium Networks
  - b. Part number: C00006L007
- B. Feedline:
  - 1. Broadband: TIA/EIA 568B OSP CAT 6, #23 AWG Ethernet Outdoor, UL Listed, 23 AWG with waterproof watertight rated IP67 rated RJ45 connectors at each ends. (Not to exceed 300 feet) cabling will be Superior ESSEX Type BBDGe cable, copper clad cabling, Part number Enduragain OSP Shielded Superior ESSEX 04-001-64, NO SUBSTITUTIONS.
- C. Waterproof- all connections must be waterproof as per IEC 60529 IP67 2.6 ANTENNA MAST
- D. Refer to specification 17600, ANTENNA TOWER for details
- E. Programming:
  - 1. Radio programming shall be performed by contractor. SAWS Information Services will program-Security Risk.

**2.07 AUTODIALER**

- A. Contractor shall provide and install a new complete and operational new autodialer system. Autodialer System to be a Verbatim Gateway Series VPLC Autodialer with an expandable 32 digital input module. The autodialer is to use a standard rotary pulse or touch-tone “dial-up” phone line (installed by contractor) and is to be F.C.C. approved. Connection to the telephone is through 4-pin modular jack (RJ-11).
- B. Contractor to coordinate with the phone company to get communication lines to the electrical building for the autodialer.
- C. NEMA 12 Control panel for Autodialer to be mounted to the wall as shown on plans. Refer to section 2.1.D for additional requirements
- D. Manufacturer:
  - 1. Raco Verbatim Gateway Series VPLC Autodialer with expandable 32 digital input monitoring module.

**PART 3 EXECUTION****3.01 COORDINATION MEETING**

- A. The ASP shall be responsible to coordinate the work with the PCSI and/or the Contractor. The ASP shall schedule and administer a minimum of two mandatory control system coordination meetings. The ASP shall make arrangements for meetings and prepare/distribute an agenda a minimum of one week before the scheduled meeting date.

**3.02 INSTALLATION**

- A. General
  - 1. SCADA PLC Panel shall be a freestanding enclosure mounted to a wall with bolts of sufficient size and number for load conditions. Contractor shall install all interconnect wiring from the SCADA PLC Panel to field equipment and devices, except where the field device is future and has no provision for wiring termination.
- B. Follow procedures, instructions, and check sheets provided by the manufacturers for proper installation of their equipment.

**3.03 FIELD QUALITY CONTROL**

- A. In accordance with Section 16950 – ELECTRICAL TESTING.FUNCTIONAL TEST
- B. PLC program shall be installed on the PLC by CONTRACTOR. Programmers shall provide assistance with testing the I/O from the field to the SAWS SCADA system once the field I/O and the communications systems have been fully checked out
- C. Contractor shall be responsible for testing the field I/O to the PLC panel.

**3.04 STARTUP AND COMMISSIONING**

- A. Contractor shall coordinate the startup and commissioning efforts. Contractor shall develop the startup and commissioning plans and the check out forms.
- B. Contractor shall coordinate with SAWS (startup and commissioning phases).



## 3.05 TRAINING

## A. Programmable Logic Controller (PLC) Hardware and Software and HMI System Software:

1. Provide 32-40 hours of manufacturer's standard training course for five (5) of the Owner's personnel in the operation, configuration, programming, installation, and maintenance of the HMI System software, SAWS Programmer staff will provide the Rockwell course number at a later date.
2. The hardware and software courses shall not be concurrent.
3. The following hardware training shall be provided as a minimum:
  - a. Hardware maintenance for the PLC equipment provided
  - b. Test, adjustment, and calibration procedures
  - c. Troubleshooting and diagnosis
  - d. Component removal and replacement
  - e. Periodic maintenance
4. The following software training shall be provided as a minimum:
  - a. System configuration
  - b. Application specific program development/programming
  - c. Uploading/downloading programs
  - d. Documenting program/configuration
  - e. System backups and reload procedures
  - f. TCP/IP addressing procedures
  - g. Network communications configuration

END OF SECTION

**SECTION 17600**  
**COMMUNICATION TOWERS**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

**A. General**

Furnish all labor, materials, tools, equipment and services as indicated in accordance with provisions of Contract Documents.

It is the intent of the Contract Documents to describe a functionally complete project. Furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, complete, and functional installation.

**1.02 RELATED WORK**

- A. The work shall include furnishing, installing and testing the equipment and materials detailed in the following sections:

Section 16451 - Grounding and Lightning Protection

Section 16921– SCADA System and Local Control and Monitoring

- B. The Work of this Contract generally includes the following:

Design and provide new foot lattice tower at the following site: a. E-54 Regional Lift Station

**1.03 SUBMITTALS**

- A. Refer to Division 01 for general submittal requirements. Following are submittal requirements specific to this Section.
- B. CONTRACTOR shall be required to supply construction grade design drawings stamped by an engineer registered in the state of Texas. Construction grade design drawings must consist of a site plan, tower profile and antenna mount design with antenna elevations and azimuth details and all foundation and grounding details. Construction grade design drawings must be approved by the OWNER prior to fabrication and installation. Tower profile drawings must show the following:
1. Tower geometry, configuration, member sizing and connections in a chart format.
  2. Antenna mount configuration
  3. Wind velocity pressures
  4. Twist and tilt at the initial antenna locations
  5. Width at the tower bottom and top
  6. Ladder with safety rail and fall arrest system
  7. Material specifications for the tower members, mounts and ladders
  8. Antenna loading (initial and future)
  9. Erection drawings indicating the dimensions and arrangement of the tower components.
  10. Specification sheets or details for all tower components.

11. Tower grounding and bonding details.
  12. Site plans showing the proposed tower location and its orientation.
  - C. Foundation drawings must be submitted for review prior to construction. Foundation drawings must show foundation geometry, configuration, concrete type, rebar sizing, soil report reference (if required), foundation anchor bolts and noting the loading applied to the foundation.
  - D. Submit 28 day concrete test results as soon as they are available.
  - E. CONTRACTOR shall be responsible for adhering to OSHA requirements and guidelines for the duration of the installation and must submit a safety plan for review by OWNER safety department prior to construction. The work areas must be properly marked to prevent OWNER personnel and outside parties from potential hazards.
  - F. Submit photographs of the work performed in jpeg format as sites are completed.

Photographs shall include as a minimum the site, the tower foundation prior to, during and following concrete pouring, the tower, cable routes, Network panel, conduit, grounding, trenching and each antenna at the top of the tower (taken from eye level).

For each site, submit photographs taken from the top of the tower in the direction of each aligned azimuth. Photo resolution shall be sufficient to identify corresponding antenna support structure. All obstructions in the wireless path, if any, must be photographed and identified. If visible, take pictures of other sites
  - G. Submit the earth ground resistance test results as sites are completed.
  - H. Submit redlined annotated working drawings to clearly document the as-built network including details related to: tower, antenna installation, location, cabling.
  - I. As part of the Operations and Maintenance Manual submit as-built drawings in AutoCAD format (latest version). Submit electronic files in both CAD and PDF format.
- 1.04 REFERENCE STANDARDS (NOT USED)
- 1.05 QUALITY ASSURANCE
- A. All installations and modifications shall be performed by qualified contractors. The contractors must show that they have proper liability insurance of not less than \$5,000,000.00.
  - B. The tower and foundation shall be certified by a Professional Engineer Licensed in the State of Texas with experience in tower and foundation design.
  - C. CONTRACTOR shall have a minimum of five years of recent experience on structures of similar type and size.
  - D. Tower climbers shall produce Fall Protection, Tower Climbing and Tower Rescue Certification completed within the previous five years.
- 1.06 SYSTEM DESCRIPTION/DESIGN REQUIREMENTS (NOT USED)
- 1.07 DELIVERY, HANDLING AND STORAGE (NOT USED)
- A. Preparation for Delivery

Packaging: All materials shall be packaged to provide protection from damage during shipment.

Marking: All equipment shall be appropriately marked regarding function, handling and storage.

**B. Shipping**

All equipment shall be shipped in a manner that assures timely delivery and protection of materials. Any equipment damaged during shipping or delivery shall be rejected and repaired or replaced by the CONTRACTOR, at the OWNERS discretion and at no additional cost to the OWNER.

No materials, goods, or equipment shall be received or stored at the work site nor installed or incorporated into the work without a successfully reviewed shop drawing submittal.

**C. Delivery**

Upon delivery to the site, the equipment in this section shall be carefully unloaded and properly stored until installation. The equipment shall be handled and stored in strict accordance to the manufacturer's recommendations.

**1.08 MAINTENANCE/SPARE PARTS (NOT USED)**

**1.09 WARRANTY/EXTENDED WARRANTY (NOT USED)**

**1.10 SPECIAL REQUIREMENTS**

- A. The design for the tower and foundation must be prepared by the manufacturer and sealed by a P.E. Registered in the State of Texas. These shall be submitted to Owner before construction starts.
- B. Geotechnical Engineering Studies included in the contract documents shall be used for tower foundation design. Contractor is responsible for the cost of more detailed studies, if needed, for the design of the tower and foundation.
- C. Tower design and construction shall meet standards contained in the latest revisions of ANSI/TIA/EIA-222.
- D. Grounding system shall be designed and installed by the Contractor.
- E. Contractor is responsible for performing a TOWAIR Determination and filing the FAA notification. Contractor shall provide paperwork to Owner. Owner will submit application to FAA.
- F. Contractor is responsible for registering the tower with the FCC. Contractor shall provide paperwork to Owner. Owner will submit application to FCC.
- G. Contractor is responsible for providing all marker lighting, if required, by the FAA. This will be determined by the FAA after submitting the application in item E.
- H. Contractor shall be responsible for obtaining all required construction and/or installation permits and licenses including the San Antonio Building Inspection Department at his expense.
- I. Contractor shall be responsible for obtaining all required construction and/or installation permits and licenses including City of San Antonio, Bexar County or other authority having jurisdiction at his expense

- J. Contractor shall be responsible for adhering to OSHA requirements and guidelines for the duration of the installation and must submit a safety plan for review by Owner safety department prior to construction. The work areas must be properly marked to prevent OWNER personnel and outside parties from potential hazards.
- K. Contractor must comply with ALL applicable code (building, electrical, etc.) requirements.
- L. The equipment manufacturer or vendor shall provide a two (2) year warranty for all parts associated with the equipment defined by this Specification and the labor associated with repair and/or replacement of the parts. The warranty must be submitted during the shop drawing phase. Approval of the shop drawings will be contingent on the receipt of the warranty. If any part of the equipment should fail during the warranty period, it shall be replaced and restored to an operative level at no expense to the Owner. This warranty shall also cover any and all parts that show signs of corrosion during the warranty period. The warranty shall commence at final acceptance of the facility.
- M. Must comply with all pertinent Ordinances of the City of San Antonio (COSA) including Section 35-385, RADIO, TELEVISION ANTENNA, AND WIRELESS COMMUNICATION SYSTEMS.
- N. CONTRACTOR is responsible for all construction notifications
- O. Refer to drawings for additional requirements.

#### 1.11 WORK SEQUENCE

- A. The proposed Work sequence shall be submitted to the ENGINEER in the Schedule of Construction.
- B. General tower location shall be as shown on the Contract Drawings; however, the tower shall be located such that obvious obstructions are avoided along the bearings specified. The tower location shall be subject to the approval of the OWNER. This approval shall be obtained after the site layout has been completed and prior to the installation of the tower foundation.
- C. All tower foundations and excavations shall be scheduled and approved in advance to allow for OWNER or their representative to be present.
- D. The OWNER may schedule third party inspections of the towers and foundations. Inspections and climbing of towers will be coordinated in advance with the CONTRACTOR.

#### 1.12 TOWER ANALYSIS AND DESIGN

- A. The structure shall be designed to support the future antennas specified in this specification and to hold antenna on path within the twist, sway and displacement limits of the ANSI/TIA-222 standard.
- B. Tower deflection limits shall be held both vertically and horizontally. Deflection shall be determined at each specific point on the tower where an antenna is attached. The twist and sway of the tower at all antenna-mounting elevations shall be determined by analytical methods and shall be noted on the formal stress analysis.
- C. The tower and its foundation, when fully loaded with antennas, waveguide and other appurtenances, shall be designed to meet the minimum requirements as specified by the ANSI/TIA-222 and ANSI /TIA/EIA-607-B standards.
- D. Grounding system shall be designed and installed by the CONTRACTOR. Comply with Section 16451 – Grounding and Lightning Protection

## 1.13 SELF-SUPPORTING LATTICE ANTENNA TOWER

## A. Description: Antenna Tower that meet the following minimum requirements:

Self-supporting lattice style

Triangular in design utilizing tubular hot dip galvanized steel

TIA-222-H compliant

Manufactured by a firm specializing in antenna tower fabrication

Made of hot dip galvanized steel sections.

DBI-Sala fall safety system

Step bolts

Waveguide ladder

Maximum height of 50 feet above grade.

Designed to support the following equipment load:

- a. One 450 MHz 9dbi 6 Element Yagi Antenna with Coaxial Cables at 60 foot height, expandable to 80 ft.

The wind loads and weights of all antenna mounts shall be considered in addition to the wind loads and weights of the antennas and transmission lines in the design of the towers/poles.

Tower shall be designed to withstand a minimum 110 mph, 3 second gust.

Anti-Climb Panels shall extend from base to 8 feet above base.

## B. Acceptable Products

Sabre Model S3TL or OWNER-approved equal.

## 1.14 TOWER ENCLOSURE

## A. Description: Antenna Tower Enclosure that meet the following minimum requirements:

NEMA 4X Enclosure

Dimensions: 26" H x 22" W x 10" D

Approximate Weight: Raw 35lbs.

1/2 inch Plywood Removable Back Plate

2 Quarter Turn Screwdriver Locks

Out of .125 ALUMIFLEX Continuously welded on all seams

Polished unpainted aluminum

1.1/4 " x 2" x 12" Ground bus bar with Plexiglass Cover. Accommodates 'A' spaced and 'C' spaced two hole compression lugs.

## B. Tower Enclosures shall be DDB Unlimited, Inc. SOD series SB-262210, or approved equal.

## C. Grounding Busbars shall be HARGER part no. TGBI14212TGBKT or approved equal.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

## 3.01 GENERAL

- A. The tower must be installed by a Contractor with a minimum of one (1) employee that is ComTrain certified in Basic Tower Construction, and a minimum of four (4) employees that are ComTrain certified in Tower Climbing. Contractor shall submit proof of certification to Owner, prior to commencement of work.
- B. Contractor will provide a final tower inspection and provide to Owner a written report sealed by a professional engineer licensed in the State of Texas verifying the tower was installed per approved design drawings. Should it be determined that flaws exist in the installation, a punch-list will be developed for the Contractor to resolve and the tower again must be re-inspected at the Contractor's cost.
- C. Contractor shall adhere to all tower manufacturer construction recommendations and make available to the Owner the manufacturer recommendations at both pre-and post-installation for approval.
- D. Contractor shall supply three (3) hard copies and electronic as-built documentation at completion of project to include: as-built plans, the details of the warranty on the tower, grounding system information, photos of construction milestones, copy of any permits received, and other requirements per Section 01300. No field welding of tower members shall be allowed without the OWNER's approval and certification by an independent laboratory.
- E. Towers shall be spaced from all residential structures, at a minimum equal to one hundred fifteen (115) percent of the height of the tower, measured from the base of tower to the nearest residential structure.

A 50 foot tower shall be located 58 feet away from the nearest residential structure.

## 3.02 TOWER FOUNDATIONS

- A. Tower foundation and excavation shall be provided by the CONTRACTOR.
- B. The CONTRACTOR shall prove the location of utilities and shall be responsible for adequate protection from damage.
- C. Concrete curing time shall be a minimum 28 days.
- D. The top of the foundation shall be sloped to drain with a floated finish. Exposed edges of the concrete shall be chamfered 1" x 1".
- E. All materials shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter. Deteriorated material shall not be used in the work.
- F. No freestanding water shall be allowed within the foundation excavation before and during the placement of concrete.

## 3.03 SELF-SUPPORTING TOWER ERECTION

- A. The CONTRACTOR shall furnish all necessary personnel, supervision, tools, equipment, and transportation required to complete the installation and erection of all items specified herein.
- B. Any tower members that sustain damage shall be reported to the OWNER.

- C. Correction of damage shall not be done by the CONTRACTOR without approval of the OWNER.
- D. After materials have been unloaded, the CONTRACTOR shall inventory all parts per the bill of material and report immediately to the OWNER that: a) materials received agree with bill of materials, or b) there are shortages and damaged materials, listing all such items.
- E. The actual location of the tower and its orientation shall be approved by the OWNER.
- F. All necessary local construction permits shall be obtained by the CONTRACTOR before construction begins. All costs for the permits shall be borne by the CONTRACTOR.
- G. Set structural members accurately to lines and elevations indicated on the erection drawings. Align and adjust the various members forming each tower bay before permanently fastening.
- H. The CONTRACTOR shall maintain a check of tower plumbness during all phases of the erection work. Plumbness shall be measured by means of a transit placed so that the sight elevation angles are less than 45 degrees. At least two sights shall be made for each check, oriented at right angles to each other and taken within the shortest practical time interval. At all times the tower shall be plumb within the tolerance specified in drawings. After completion of tower construction, with all joints tight, and all appurtenances installed, the CONTRACTOR shall make a final check of tower plumbness in the manner prescribed above.
- I. Field modifications including welding or burning of holes in members is not allowed.
- J. All towers shall have an identification plate of resilient, benign, survivable material (aluminum/stainless steel) attached to the base/leg showing tower contractor/supplier, tower type/model, height, contractor job/file number, design and date of original fabrication.
- K. All 'U'-bolt assemblies shall consist of one U-bolt, two flat washers, and four hex nuts (that is c/w a lock nut) to prevent the assembly from working loose.
- L. No completely closed pipe or bottom capped hollow-round members shall be acceptable at any time.

### 3.04 GROUNDING

- A. Telecommunication bonding and grounding of tower must comply with ANSI/TIA/EIA-60D and TIA/EIA-222 latest edition.
- B. A lightning rod shall be mounted on top of the tower and a vertical copper earth wire run down the side of one leg to ground and connected to the earth. The lightning rod shall provide a 45 degree of protection for all antennas.
- C. Provide a minimum one ground rod for each leg of the tower. Ground rods shall be installed in parallel and the distance between ground rods shall be equal to their length.
- D. At ground level, bury ground rods and conductors a minimum 6 inches below finished grade.
- E. Follow Cambium Standards and Guidelines for Communications Sites, for External Grounding and Internal Grounding, SAWS Standards and the Contract Drawings for the grounding requirements.
- F. Towers, masts and equipment shall be grounded, and the earth resistance measured at the earth terminal block shall be less than 5 Ohms. Add additional grounding as necessary.

Grounding system and testing shall comply with SPECIFICATION 16451 - Grounding and Lightning Protection



G. Perform test as indicated in SPECIFICATION 16950 – Electrical Testing.

**3.05 TOWER ENCLOSURE**

A. For each tower, provide one Tower Enclosure on the side of the tower approximately 4 feet above grade.

B. Tower Enclosure will house Grounding Busbars, Broadband POE Surge Arrestors, and Narrowband feedline cable grounding kits.

C. Bond Tower Enclosure ground bus bar to tower ground.

D. All cables shall enter and exit the Tower Enclosure through the bottom of the panel.

**3.06 SITE ACCEPTANCE TESTING**

A. In accordance with Division 1.

END OF SECTION