

REQUEST FOR SEALED BIDS

Notice is hereby given that the City of Fort Stockton is requesting sealed bids for:

Belding Water Well #6 Replacement Well Services

Sealed proposals should be mailed to the **City of Fort Stockton, P.O. Box 1000 or 121 W. Second Street, Fort Stockton, Texas, 79735**. The deadline for receiving sealed bids is **4:00 p.m., Friday, August 4, 2023**, in the Office of the City Secretary; at which time they will be opened publicly and read aloud. Sealed bids received after the specified time of closing will be returned unopened.

To obtain a bid packet, please contact City Secretary Marina Cantu @ (432) 336-8525, Fort Stockton City Hall, P.O. Box 1000 or 121 W. 2nd Street, Fort Stockton, Texas 79735.

Sealed bids must be submitted in a sealed envelope & marked:

“Belding Water Well #6 Replacement”

In furthering our goal to preserve and protect the community and surrounding areas' freshwater resources, the City of Fort Stockton seeks to engage a qualified general contractor to assist in the replacement of Belding Water Well #6.

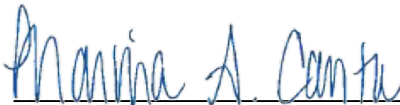
Therefore, it is in the best interest of the City of Fort Stockton to obtain the services of the highest qualified general contractor to assist in providing the City with **pricing specifications, including all materials and labor for the replacement of Belding Water Well #6, owned and operated by the City of Fort Stockton.**

Each Qualified General Contractor will be evaluated only on the quality and experience of the company and its personnel.

The City Council reserves the right to accept the bids which in its judgement is from the most responsible contractor; to reject any or all bids, and to waive irregularities or informalities in any bid submitted.

The City of Fort Stockton is an Affirmative Action/Equal Opportunity Employer.

By order of the City Council at a Regular Meeting held on the 26th day of June 2023.


Marina Cantu, City Secretary

City of Fort Stockton

Belding Well Field, Pecos County, Texas Well Replacement Well #6

Project Plans and Specifications

By

Project Engineer
Raul B. Rodriguez, P.E.

Date

June 26, 2023



ISSUED FOR BID

Bid Proposals

03 13 23 BID PROPOSAL - SIXTEEN INCH SUPPLY WELL

_____, Texas
 _____, 2023

BID PROPOSAL OF _____,
 A Corporation organized and existing under the laws of the State of TX, a partnership consisting of _____,
 _____, the business name of _____, an individual.
 TO: the City of Fort Stockton.

BID PROPOSAL FOR:
Belding Well Field Well Replacement Well #6 (16 inch Design)

The undersigned Bidder has carefully examined the Request for Bids, Instructions to Bidders, this Bid Proposal, the Supplemental Conditions, the form of Contract Agreement and Bonds, the General Conditions of the Agreement, the Specifications, the Drawings, and the site of the work, and will provide all necessary labor, superintendence, machinery, equipment, tools, materials, services and other facilities to complete fully all the work as provided in the Contract Documents; and will execute the contract and bonds in the Contract Documents upon formal acceptance of his Proposal for the following prices:

Item No.	Description	Unit	Quantity	Unit Price	Total Amount Bid
Mob/Demob					
1	<u>Mobilization/Demobilization</u> - including insurance, bid bond, performance bond and move in/move out of drilling, development, and testing equipment and related costs.	LS	1		
SUBTOTAL MOB/DEMOB (Items 1 thru 2, Inclusive)					
Supply Well Construction					
2	<u>Site preparation and cleanup</u> - dig mud pits, backfill pits and regrade site after completion, construction fencing, disposal of excess materials, cleaning up after completion of the work, and incidental items not specifically called out in the bid proposal.	EA	1		
3	<u>Install surface casing</u> - Install 24" OD, Sched 40, low carbon steel surface casing from the surface to depth within a 30" borehole and cement in place. Quantity represents total length furnished and installed.	LF	80		
4	<u>Drill 21" diameter borehole</u> - from below the surface casing to bottom of the Edwards/Trinity Aquifer, collecting cuttings every 10' and taking drift measurements every 100'. Quantity represents total length.	LF	500		
5	<u>Install production casing</u> - Install 16" OD, Sched 40, high strength low alloy steel casing from the surface to depth and cement in place. To include 40' of stainless-steel screen, 0.032" perforations, packed with silage sand and gravel. Quantity represents total length installed.	LF	400		

Item No.	Description	Unit	Quantity	Unit Price	Total Amount Bid
7	<u>Geophysical Logs</u> - Complete specified logs from the surface to total drilled depth.	EA	1		
8	<u>Column Pipe and Pump</u> – Install 10” OD Schedule 40, high strength alloy steel column pipe, pump and shaft to a depth of 340’ to 400’. Pump shall have pumping capacity of 1600 gpm.	LF	400		
9					X
10					
11	<u>Well head completion</u> - concrete sealing block/pump foundation on grade, sanitary seals, vents, and locking well caps.	EA	1		
12					
Supply Well Development and Testing					
13	<u>Zonal Water Sample Collection</u> - Furnish and operate rig to collect a zonal water sample utilizing packers to isolate a specific zone. Quantity represents total to collect one sample.	EA	2		
14	<u>Mud Dispersant and Well Disinfection</u> - Add mud dispersant and chlorine to well as directed, surge/swab, allow dispersant/disinfectant to remain in well for at least 12 hrs. Separate activities as specified.	EA	1		
15	<u>Well development airlift pumping</u> - Furnish and operate development rig using zone airlift methods.	HRS	90		
16	<u>Supply, install, and remove test pumping equipment</u> - Test pump capable of pumping at a rate between 800 and 1,600 gpm from a pumping level of 380 ft. Remove pumping equipment upon completion of testing.	EA	1		
17	<u>Well development pumping</u> - Develop wells by pumping until AWWA standards are met. Includes providing, operating, and maintaining generator and/or drive motor.	HRS	15		

Item No.	Description	Unit	Quantity	Unit Price	Total Amount Bid
18	Test pumping - step test - Operate and maintain pump and generator and/or drive motor during 14 hour test, exclusive of pump setting or removal time, installation of discharge plumbing, or breakdown time. No measurement for recovery time will be allowed.	HRS	14		
19	Test pumping - constant rate - Operate and maintain pump and generator and/or drive motor during 96 hr test, exclusive of pump setting or removal time, installation of discharge plumbing, or breakdown time. No measurement for recovery time will be allowed.	HRS	96		
20	Water quality analysis - Acceptably performed analysis based on the submission of samples within specified holding times and analysis by methods which provide detection limits below the applicable drinking water standards.	EA	6		
21	Video Survey - Survey will be measured and paid on basis of work acceptably performed.	EA	1		
SUBTOTAL SUPPLY WELL BASE BID (Items 3 thru 21, Inclusive)					
TOTAL BASE BID (Items 1 thru 21, Inclusive)					
Dollar Amount in Words				Dollar Amount	
Breakdown of Materials and Labor Incorporated into the Project:					
A. Total Exempt Materials					
Dollar Amount in Words				Dollar Amount	
B. Total Labor, superintendence, and Non-Exempt equipment and supplies as necessary to construct the project					
Dollar Amount in Words				Dollar Amount	
Note: Breakdown of "A" and "B" as shown above: the summation of which must equal the Total Base Bid.					

IT IS UNDERSTOOD THAT QUANTITIES ARE NOT GUARANTEED

The undersigned proposer will execute the Contract Agreement within fifteen (15) calendar days after receiving a Notice of Award and will furnish approved bonds and insurance as required by the Contract Documents for the faithful performance of the Contract. The attached bid security in the amount of five (5) percent of the amount bid is to become the property of the Owner as liquidated damages for the delay and additional work caused by the failure of the proposer to enter into a contract in the event the Contract Agreement and bonds are not executed within fifteen (15) calendar days.

The undersigned agrees to substantially complete all work covered by these Contract Documents within 180 consecutive calendar days from the day established for the start of the work in a written Notice to Proceed. The date established for the start of work will be not less than ten (10) days and not more than thirty (30) days after the date of the Contract Agreement, except by mutual agreement of the Owner and the Contractor.

Receipt is acknowledged of the following addenda:

	DATE	BY
Addendum No. 1	_____	_____
Addendum No. 2	_____	_____
Addendum No. 3	_____	_____
Addendum No. 4	_____	_____
Addendum No. 5	_____	_____

Respectfully submitted,

By _____

(Print Name and Title)

Attested By:

Secretary

Address

(SEAL) If Proposer is a corporation.

CONTRACTOR COMPLIANCE TO TEXAS SALES TAX CODE

Comply with all requirements of the Texas Sales Tax Code. The Contractor hereby certifies that the Contract Amount is divided as follows:

Material incorporated into the Project
(Resold to the Owner as defined in Tax Code) \$ _____

All other charges and costs \$ _____

Total * \$ _____

* The total must equal the total amount of the Contract.

CONTRACTOR:

Company (please print)

By: _____
(signature of authorized person)

Address

Title: _____

City State Zip

THIS FORM SHALL BE EXECUTED AT TIME OF EXECUTION OF CONTRACT AND MADE A PART OF THE CONTRACT.

Note:

1. The Total Amount of Bid for Materials and Services must equal the sum of the Total Amount Bid for Materials and the Total Amount Bid for Services as well as the sum of all individual bid items.
2. Materials are those items which are tax exempt and are physically incorporated into the facilities constructed for the OWNER. Materials include, but are not limited to, purchased items such as casing, pipe, filter pack and concrete, etc.
3. Services are those items which are not tax exempt and are used by the CONTRACTOR but are not physically incorporated into the OWNER'S facilities and/or items that are consumed by construction. Services include, but are not limited to, supplies, tools, concrete forms, the rental of equipment, skill, and labor, etc.

CONFLICT OF INTEREST QUESTIONNAIRE**FORM CIQ**

For vendor or other person doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 1491, 80th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code by a person who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the person meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the person becomes aware of facts that require the statement to be filed. See Section 176.006, Local Government Code.

A person commits an offense if the person knowingly violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor.

OFFICE USE ONLY

Date Received

1 Name of person who has a business relationship with local governmental entity.**2** Check this box if you are filing an update to a previously filed questionnaire.

(The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date the originally filed questionnaire becomes incomplete or inaccurate.)

3 Name of local government officer with whom filer has employment or business relationship._____
Name of Officer

This section (item 3 including subparts A, B, C & D) must be completed for each officer with whom the filer has an employment or other business relationship as defined by Section 176.001(1-a), Local Government Code. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer named in this section receiving or likely to receive taxable income, other than investment income, from the filer of the questionnaire?

 Yes No

B. Is the filer of the questionnaire receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer named in this section AND the taxable income is not received from the local governmental entity?

 Yes No

C. Is the filer of this questionnaire employed by a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership of 10 percent or more?

 Yes No

D. Describe each employment or business relationship with the local government officer named in this section.

4_____
Signature of person doing business with the governmental entity_____
Date

Adopted 06/29/2007

Technical Specifications

01005 DEFINITIONS AND TERMINOLOGY

1.00 GENERAL

1.01 SPECIFICATION TERMINOLOGY

- A. "Engineer" means Raul B. Rodriguez, P.E., City of Fort Stockton, Tx or its designated representative.
- B. "Furnish" means to supply, deliver, and unload materials and equipment at the project site ready to install.
- C. "Install" means the operations at the project site including unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, training and similar operations required to prepare the materials and equipment for use, verify conformance with Contract Documents and prepare for acceptance and operation by the Owner.
- D. "Provide" means to furnish and install materials and equipment.
- E. "Perform" means to complete the operations necessary to comply with the Contract Documents.
- F. "Indicated" means graphic representations, notes, or schedules on drawings, or other requirements in Contract Documents. Words such as "shown", "noted", "scheduled", are used to help locate the reference. No limitation on the location is intended unless specifically noted.
- G. "Specified" means written representations in the bid documents or the technical specifications.
- H. "Regulation" means laws, statutes, ordinances, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of work, whether they are lawfully imposed by authorities having jurisdiction or not.
- I. "Installer" means an entity engaged by Contractor, either as an employee, subcontractor, or sub-subcontractor to install materials and/or equipment. Installers are to have successfully completed a minimum of five projects similar in size and scope to this project, have a minimum of five years of experience in the installation of similar materials and equipment, and comply with the requirements of the authority having jurisdiction.
- J. "Manufacturer" means an entity engaged by Contractor, as a subcontractor, or sub-subcontractor to furnish materials and/or equipment. Manufacturers are to have a minimum of five years' experience in the manufacture of materials and equipment similar in size, capacity and scope to the specified materials and equipment.
- K. "Project site" means the space available to perform the work, either exclusively or in conjunction with others performing construction at the project site.
- L. "Testing laboratory" means an independent entity engaged to perform specific inspections or tests, either at the project site or elsewhere, and to report and interpret the results of those inspections or tests.
- M. "Listed" means equipment is included in a list published by a nationally recognized laboratory which makes periodic inspection of production of such equipment and states that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.
- N. "Labeled" means equipment that embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc., and production is periodically inspected in accordance with nationally recognized standards or tests to determine safe use in a specified manner.
- O. "Certified" used in context with materials and equipment means the material and equipment has been tested and found by a nationally recognized testing laboratory to meet specification requirements, or nationally recognized standards if requirements are not specified, and is safe for use in the specified manner. Production of the equipment must be periodically inspected by a nationally recognized testing laboratory and the equipment must bear a label, tag, or other record of certification.

"Certified" used in context with labor performance or ability to install materials and equipment means that the abilities of the proposed installer have been tested by a representative of the specified testing agency authorized to issue certificates of competency and has met the prescribed standards for certification.

"Certified" used in context with test reports, payment requests or other statements of fact means that the statements made on the document are a true statement as attested to by the certifying entity.

- P. "Contractor", "General Contractor", "Construction Contractor", "Offeror", "Proposer" or "Bidder" means the contractor selected to construct the Raw Water Supply Wells, including the purchase and installation of necessary materials, coordination of all necessary work activities, well development and aquifer testing.

1.02 SPECIFICATION SENTENCE STRUCTURE

- A. Specifications are written in modified brief style. Requirements apply to all work of the same kind, class, and type even though the word "all" is not stated.
- B. Simple imperative sentence structure is used which places a verb as the first word in the sentence. It is understood that the words "furnish", "install", "provide", or similar words include the meaning of the phrase "The Contractor shall..." before these words.
- C. It is understood that the words "directed", "designated", "requested", "authorized", "approved", "selected", or similar words include the meaning of the phrase "by the Engineer" after these words unless otherwise stated. Use of these words does not extend the Engineer's responsibility for construction supervision or responsibilities beyond those defined in the General Conditions.
- D. "At no additional cost to Owner", "With no extra compensation to Contractor", "At Contractor's own expense", or similar words mean that the Contractor will perform or provide specified operation of work without any increase in the Contract Amount. It is understood that the cost for performing all work is included in the amount bid and will be performed at no additional cost to the Owner unless specifically stated otherwise.

1.03 DOCUMENT ORGANIZATION

- A. The contract requirements described in the General Conditions, Supplementary Conditions and Division 1 apply to each and all specification sections unless specifically noted otherwise.
- B. Organization of Contract Documents is not intended to control or to lessen the responsibility of the Contractor when dividing work among subcontractors, or to establish the extent of work to be performed by any trade, subcontractor, or vendor. Specifications or details do not need to be indicated or specified in each specification or drawing. Items shown in the contract documents are applicable regardless of location in the Contract Documents.
- C. Standard paragraph titles and other identifications of subject matter in the specifications are intended to aid in locating and recognizing various requirements of the specifications. Titles do not define, limit, or otherwise restrict specification text.
- D. Capitalizing words in the text does not mean that these words convey special or unique meanings or have precedence over other parts of the Contract Documents. Specification text governs over titling, and it is understood that the specification is to be interpreted.
- E. Drawings and specifications do not indicate or describe all the work required to complete the project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Engineer. Provide any work, materials or equipment required for a complete and functional system even if they are not detailed or specified.

1.04 INTERPRETATIONS OF DOCUMENTS

- A. Comply with the most stringent requirements where compliance with two (2) or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, unless Contract Documents indicate otherwise.

1. Quantity or quality level shown or indicated shall be minimum to be provided or performed in every instance.
 2. Actual installation may comply exactly with minimum quality indicated, or it may exceed that minimum within reasonable limits.
 3. In complying with these requirements, indicated numeric values are minimum or maximum values, as noted, or appropriate for context of requirements.
 4. Refer instances of uncertainty to the Engineer for a decision before proceeding.
- B. Provide materials and equipment comparable in quality to similar materials and equipment incorporated in the project or as required to meet the minimum requirements of the application if the materials and equipment are shown in the drawings but are not included in the specifications.

1.05 REFERENCE STANDARDS

- A. Comply with applicable construction industry standards as if bound or copied directly into the Contract Documents regardless of lack of reference in the Contract Documents. Apply provisions of the Contract Documents where Contract Documents include more stringent requirements than the referenced standards.
1. Standards referenced directly in the Contract Documents take precedence over standards that are not referenced but recognized in the construction industry as applicable.
 2. Comply with standards not referenced but recognized in the construction industry as applicable for performance of the work except as otherwise limited by the Contract Documents. The Engineer determines whether code or standard is applicable, or which of several are applicable.
- B. Consider a referenced standard to be the latest edition with supplements or amendments when a standard is referred to in an individual specification section but is not listed by title and date.
- C. Trade association names and title of general standards are frequently abbreviated. Acronyms or abbreviations used in the Contract Documents mean the recognized name of trade association, standards generating organization, authority having jurisdiction, or other entity applicable in the context of the Contract Documents. Refer to "Encyclopedia of Associations," published by Gale Research Company.
- D. Make copies of reference standards available as requested by Engineer or Owner.

1.06 SUBSTITUTIONS AND EQUAL PRODUCTS

Provide materials and equipment manufactured by the entities specifically listed in each technical specification section. Submit a Contractor's Modification Request per Section 01300, SUBMITTALS for substitution of materials and equipment of manufacturers not specifically listed or for materials and equipment that does not strictly comply with the Contract Documents.

1.07 SUBSTITUTIONS AND EQUAL PRODUCTS

Contractor may provide "equal" products manufactured by manufacturers other than those specifically listed in the technical specification section unless it is specifically stated that only the materials and equipment of the specified manufacturers shall be provided. Provide Submittals for proposed "equal" non-specified products per Section 01300 SUBMITTALS for any materials or equipment not specifically listed. Submit a Contractor's Modification Request for substitution of materials and equipment of other manufacturers or for materials and equipment that does not strictly comply with the Contract Documents. A Field Order or Change Order will be issued if the contract modification is approved.

END OF SECTION

SECTION 03 21 20

16-INCH SUPPLY WELL CONSTRUCTION

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The work covered by this specification includes furnishing all labor, tools, equipment, materials, transportation, security, and performing all operations in connection with the drilling, casing, grouting, testing, and cleaning up after construction of One (1) water supply well for the City of Fort Stockton (Figure 1), located approximately 12 miles southwest of Fort Stockton, Pecos County, Texas. All work will be done in accordance with the administrative rules of the Texas Department of Licensing and Regulation Title 16, Chapter 76 of the TAC relating to Water Well Drillers and Water Well Pump Installers.
- B. The Contractor shall familiarize himself with the local conditions at the well site. Failure to do so shall in no way relieve Contractor of the responsibility for performing any of the work or operations required as a part of this contract.
- C. Local geology is likely comprised of alluvium, limestone, sandstone, evaporites, and base undifferentiated rock representative of the Edwards Limestone, Trinity Sands Formations typically encountered in Pecos County Texas. This information is provided for Contractor use in preparing for anticipated drilling conditions and possible equipment needed for successfully completing the project. Neither the City of Fort Stockton (Owner) nor the Engineer makes any representation as to the accuracy of conditions at the project location.
- D. The scope of work includes completion of the water supply well within the Edwards/Trinity Aquifer based on the standard well designs provided in Figures 2. The general scope of work at each site includes:
1. Mobilization/demobilization - Activities associated with moving drilling, development, and testing equipment, disposal of excess materials, site cleanup, and incidental items required to complete the scope of work.
 2. Construction - Site improvements, drilling, alignment and caliper surveys, well material installation to approximate depths of 400 feet below ground surface (ft bgs).
 3. Development and Testing - Development by flushing, swabbing, airlift, and development pumping; step- and constant-rate pumping tests; and video surveys.
 4. Well head completion - Sanitary seals, concrete wellhead blocks and aprons.

The well design presented here is preliminary and subject to revision once detailed geologic information is gained. These specifications and attached drawings are intended to inform potential contractors about the equipment, materials, and work required to complete the proposed project. Bids will be evaluated based on the information provided

here and any revisions to material amounts, drilling depths, or hourly tasks will be priced at the unit rates provided in the winning bid.

1.2 CONTRACTOR'S LICENSE

- A. The Contractor shall have a valid license for drilling water wells in the State of Texas. The Contractor shall submit record completion forms to the State and provide the Engineer with a copy of the final well record.
- B. Contractor Qualifications: The Contractor shall have prior experience in the construction of at least three (3) reverse circulation mud rotary-drilled wells in similar geologic materials and similar to the dimensions and expected maximum capacity of the well specified herein. The Contractor shall have engaged in the construction of wells of similar design for a period of not less than five (5) years.

1.3 GENERAL PROVISIONS

- A. Warranties: Unless otherwise indicated, the Contractor shall warrant all materials provided and work performed under this contract for a period of 2 years from the date of Final Acceptance. The Contractor shall replace promptly, at the Contractor's own expense, any materials and workmanship that fail during this warranty period as determined by the Owner or Engineer.
- B. Protection of Site: The premises, materials, tools, and drilling equipment shall be maintained to prevent contamination of the groundwater during drilling operations. Except as otherwise provided herein, the Contractor shall protect all existing fences, structures, utilities, roads, trees, etc. During the progress of the work the Contractor shall remove all debris and unused materials and shall, upon completion of the work, restore the site as nearly as possible to its original condition to the satisfaction of the Owner. The restoration shall include the replacement, at the Contractor's sole expense, of any facility or landscapes that are destroyed or damaged beyond restoration.
- C. Site Access: The Contractor shall not enter on or occupy with personnel, tools, equipment, or material, any ground outside the construction area without approval of the Owner. Other contractors, employees, or agents of the Owner may, for business purposes, enter the work site and premises used by the Contractor. The Contractor shall not impede any work being done by others on or adjacent to well sites unless necessary as determined by the Engineer. The Contractor shall implement all means and methods to prevent livestock from entering his work site. This may include temporary electric fencing or other barriers to prevent livestock from migrating into his work zone. The Contractor may incur damage claims from the property owner for injuries or death of livestock as a result of inadequate safeguards or barriers.

- D. Utilities: Unless otherwise indicated in these Specifications, the Contractor shall arrange for and provide any required utilities at his sole cost and expense. This includes, but is not limited to, power for operating the drill rig or equipment (including testing equipment), and personnel sanitation facilities. Water for drilling will be provided by the City from their existing wellfield facilities. The Contractor will be responsible for transporting water to the drilling sites. It shall be the Contractor's responsibility to notify all utility companies involved whenever activities are to occur that have the potential to cut, tap, move, or in any way disturb a utility line from its original placement. Sufficient notice shall be provided to the utility company so that its users can be informed of any disruption of service. Such notice shall be given no less than 24 hours in advance, excluding weekends.
- E. Disposal of Wastewater and Drilling Fluids: The Contractor shall be responsible for disposing of all debris, including but not limited to drilling fluid and water produced by test pumping or other operations, by such methods and to such locations that will not cause damage to, or interference with, structures, roads, or utilities, or with other construction projects. All costs incurred in connection with the disposal of drilling fluid, cuttings, and water shall be incidental to the Contract and shall be included in the contract price. Test water shall be discharged away from the construction area by way of a line or other conveyance supplied by the Contractor.
- F. Safety Requirements: The Contractor shall comply with all pertinent provisions of the Department of Labor "Safety and Health Regulations for Construction (Title 29 Code of Federal Regulations Part 1926 [29 CFR Part 1926])," with additions and modifications thereto, in effect during construction of this project. The following measures or provisions shall be always adhered to during the construction of this project:
1. All heavy construction machinery, such as trenching machines, bulldozers, and backhoes must be equipped with a roll bar meeting the requirements of the above regulation.
 2. Safety helmets, eye protection, and hearing protection shall be worn by all personnel working at the site.
 3. Safety shoes or boots shall be worn by all personnel working at the site.
- Contractor shall inspect the site for the presence of overhead and underground utilities and shall satisfy himself regarding their existence and locations prior to submitting his bid. Contractor shall have utilities spotted prior to beginning any subsurface work. A safe distance shall be maintained between equipment and materials and power lines. The Contractor shall provide temporary fencing, caution signs, or barricades as necessary to ensure the safety of personnel at the site and people adjacent to, or passing by, the site. The Contractor must develop a site-specific health and safety plan that is subject to the Engineer's approval.
- G. Natural Gas Hazard: The Contractor shall determine if and when a natural gas hazard exists during the course of the work and implement methods to prevent health, fire and explosion risks (e.g., no smoking, routing of fluids/gas away from wellhead).
- H. Borehole Control: The Contractor shall be knowledgeable and ready to respond to artesian flow (of water, gas, or oil) from the well borehole. Under such conditions, the Contractor shall take action and provide necessary equipment and materials to control flow as part of the work.

- I. Permitting: Wells will be drilled under approved Middle Pecos Groundwater Conservation District drilling permit obtained by the OWNER. The OWNER will provide a copy of the drilling permit to the Contractor upon issuing Notice to Proceed.
- J. Security: The Contractor shall be responsible for site security of materials, equipment, and protection of the boreholes and wells. The Owner and Engineer cannot be held responsible for security.

The Contractor must protect the boreholes and wells from the entry of undesirable fluids and materials at all times. Any time a site is unoccupied by the Contractor, the borehole or well shall be covered and secured against tampering. This shall require a 3/8-in. thick steel plate to be welded to the top of the production casing and the space between the production casing and surface casing, with continuous welds.

- K. Sanitary Facilities: The Contractor shall provide and maintain portable sanitary toilet facilities for the duration of the project. No temporary toilet facilities shall be maintained within 150 feet of the well being constructed unless they are of a sealed, leakproof type. Facilities shall be maintained at regular intervals. Contractor's costs associated with providing and maintaining sanitary toilet facilities are considered incidental to the project, and no separate payment will be made.
- L. Standard Specifications: When any of the following standards or specifications are referred to in these specifications, the latest edition, publication, standard, or specification should be used:
 - 1. API American Petroleum Institute
 - 2. ASTM American Society for Testing and Materials
 - 3. AWWA American Water works Association
 - 4. EPA Environmental Protection Agency
 - 5. NSF National Sanitation Foundation
 - 6. OSHA Occupational Safety and Health Administration
 - 7. TCEQ Texas Commission on Environmental Quality
 - 8. TDLR Texas Department of Licensing and Regulation

1.4 BID PROPOSAL

- A. The required submittals for this Bid Proposal are as follows:
 - 1. Where called for in these Specifications or on the Drawings (figures and tables)
 - 2. For any item the Contractor proposes to substitute for a specified item as an "or equal"
 - 3. For any proposed design change or deviation from these Specifications or the Drawings (figures and tables).
 - 4. For anything in these Drawings (figures and tables) or Specifications found to conflict with applicable codes and ordinances.
- B. The Bid Sheet and Proposal Form for supply well installation is provided in the Contract Documents. Completed Bid Sheets must be submitted with the Bid Proposal Form. Substitutions or deviations not approved by the Contracting Officer shall risk rejection. Submittals may include drawings, sketches, manufacturer's literature, catalog descriptions, or other descriptions in sufficient detail to allow a decision.

- A. Within ten (10) calendar days of receiving the notice to proceed, the Contractor shall begin work with a crew comparable to the size of the project and will proceed continuously until the final completion of the project.
- B. Continuous operations (24 hours per day) will be permitted during drilling, well completion, and testing. No unnecessary delays or work stoppages will be tolerated. The Contractor will be held responsible for unnecessary delays of the approved project schedule, including reimbursing the Owner for excess time spent in the field by the Engineer.
- C. The methods or combination of methods to be utilized shall be adequate, as determined by the Owner and Engineer, to meet the completion schedule for the work.

1.6 SUBMITTALS

- A. The Contractor shall submit to the Owner and Engineer (or other as noted) with his bid or during the course of the project the following items:
 - 1. At the Time of Receipt of Bids:
 - a. Complete list of equipment and methods that are proposed for the work.
 - b. List of relevant projects and reference information.
 - c. Bid Proposal Form
 - d. List of subcontractors and subcontract value
 - e. Bid Bond
 - 2. Prior to Commencing Construction Activities:
 - a. Progress Schedule, including the Contractor's estimated time to drill, construct, and test the well.
 - b. Schedule of Submittals
 - c. Schedule of Values
 - d. Drilling Fluid Control Plan
 - e. Intermediate and Production Casing Cementing Plan
 - 3. During Construction
 - a. Daily Drilling Report upon request of the Engineer.
 - b. Cutting samples and alignment surveys to Engineer.
 - c. Geophysical Logging results
 - d. Quality certificates for well materials.
 - e. Well development and pump test data.
 - f. Video survey

1.7 DRILLING FLUID CONTROL PLAN

- A. The CONTRACTOR shall provide a drilling fluid control plan to the OWNER OR ENGINEER prior to the start of drilling. The plan will outline specific drilling fluid additives the CONTRACTOR plans to use, how anticipated changes in the drilling conditions will affect the drilling fluid control plan, fluid testing procedures, and equipment that will be used. Specific borehole control methods, such as brine-based drilling fluid systems, shall be detailed and freshwater protection measures shall be described for evaporite sequences that are commonly encountered in Pecos County, Texas. The OWNER OR ENGINEER must approve the drilling fluid control plan. If available, drilling fluid additives should be certified by the National Sanitation Foundation.

1.8 DRILLING FLUID TESTING

- A. Drilling fluid tests will be required during periods when any drilling fluid additives (anything in addition to clear water) are being circulated in the borehole. Physical and chemical properties of the drilling fluid are to be measured in accordance with the procedures of the API Standard RP 13B, "Standard Procedures for Testing Drilling Fluids." Samples tested shall be collected at the rig discharge line, with care taken to assure a true and representative sample. Drilling fluid tests shall be conducted at a minimum of: (1) every 24 hours; (2) when significant changes to the drilling fluid are made; (3) whenever conditions appear to have changed or when problems arise; or (4) at the request of the OWNER OR ENGINEER. A Marsh-type viscosity funnel and a mud scale will be available at the well site during all well construction operations and, upon request, will be made available to the OWNER OR ENGINEER.
- B. The CONTRACTOR shall maintain current records at the site at all times to show: (1) the time, depth, and results of all drilling fluid tests; (2) all materials added to the system, (i.e., type, amount, time, and depth); and (3) variances or modifications from the agreed upon drilling fluid control program such as time, depth, reason, and authorization.
- C. The CONTRACTOR is responsible for maintaining an adequate supply of drilling fluid additives (including lost circulation material) at the drilling site and for the removal of all drilling fluids and additives from the borehole during development of the well. The mud pits must be of adequate size, with sufficient baffling to adequately remove suspended solids prior to recirculation.

1.9 INTERMEDIATE AND PRODUCTION CASING CEMENTING PLAN

- A. The CONTRACTOR shall provide an intermediate and production casing cementing plan to the OWNER OR ENGINEER prior to the start of drilling. The plan will outline specifics of the cement mix, method of placement, equipment to be used, calculation of differential pressures placed on the casing during cementing, and pressure testing to determine integrity of cement seal. The OWNER OR ENGINEER must approve the cementing plan. The cement seal shall be allowed to cure for a minimum of 48 hours or until grout obtains a compressive strength of at least 500 psi before new well work is undertaken.

1.10 GENERAL REQUIREMENTS

- A. During the drilling and reaming of the borehole and the installation the well, the CONTRACTOR will be responsible for minimizing the chemical and biological disturbance of the geologic matrix. The use of certain organic drilling fluid materials (such as starch, guar, or cottonseed hulls) will not be accepted for drilling, although some organic polymer additives may be allowed. Material Safety Data Sheets (MSDSs) from the manufacturer for all drilling fluid additives must be provided to the OWNER OR ENGINEER for review prior to their use. The OWNER OR ENGINEER reserves the right to reject any and all proposed additives. The CONTRACTOR shall be

responsible for maintaining the quality of the drilling fluid to ensure:

1. protection of water-bearing and potential water-bearing formations exposed to the borehole,
2. representative samples of the formation materials and groundwater,
3. maximum development capacity and optimum potential yield of the completed well,
4. inhibition of the formation and prevention of formation-caused drilling problems (e.g., heaving sands, swelling clays, unstable evaporite sequences, lost circulation),
5. protection of the integrity of the boring during the drilling and zonal sampling operations, and
6. complete and accurate geophysical logging of the open borehole.

PART 2 PRODUCTS

2.1 CONTRACTOR'S EQUIPMENT AND METHODS

- A. General Requirements: The wells shall be constructed using the reverse circulation rotary drilling method. The CONTRACTOR shall transport drilling make-up water from a source approved by the OWNER. For bidding purposes, the water source is assumed to be within five miles of the drill site. The CONTRACTOR is responsible for designing and controlling a drilling program that conforms to this specification. The Contractor shall supply capable and experienced personnel and suitable equipment to perform the work, as specified herein. The Contractor shall employ only competent workers for the execution of the work, which shall be directly supervised by an experienced drilling superintendent who shall be deemed satisfactory by the Owner/Engineer.
- B. Contractor shall be held responsible, and payment will be withheld for damages to wells due to any act of omission, error, or faulty operation by the Contractor or his employees or agents. Resulting repairs shall be completed by the Contractor to the satisfaction of the Owner, or a replacement well drilled at no additional cost to the Owner, and without claim against the Owner, Engineer, or agents.
- C. Contractor shall submit to the Engineer for approval a complete list of all equipment proposed for the work and a description of the methods proposed to drill, develop, and test the wells. If the Contractor fails to submit, or if the equipment and methods he proposes to use do not meet the Engineer's approval, the Owner reserves the right to reject his bid as non-responsive. Other methods, equipment, or instruments shall not be substituted for the approved methods and equipment. The listed equipment shall be available for the work when scheduled.

- D. The Contractor shall submit to the Engineer for approval the following information.
1. Proposed drilling rig equipment:
 - a. Make and model of the drilling rig.
 - b. Hook load and safe load rating
 - c. Mast height
 - d. Total horsepower of rig, rotary table, draw works.
 - e. Drilling fluid circulating rate.
 2. Drilling rig shall be equipped with the following accessory equipment:
 - a. Weight indicator
 - b. Gages for determining drilling air pressure or circulation.
 - c. Equipment for measuring drilling fluid properties
 - d. Chart recorder (geolograph) for determining drill penetration rates.
 - e. Blow Off Prevention Equipment (BOPE)
 3. Proposed development rig equipment (if different from drilling rig)
 - a. Horsepower of development rig
 - b. Minimum spooling capacity
 - c. Rated mast capacity
 - d. Compressors for air-lift pumping
 4. Description of test pump equipment and instruments shall include:
 - a. for a line-shaft turbine pump:
 - 1) column, shaft, and tubing sizes
 - 2) bowl capacity and RPM at maximum lift
 - 3) number of bowl stages required at maximum lift.
 - 4) type and horsepower of drive unit
 - b. for submersible pump:
 - 1) horsepower of motor
 - 2) pump type and pump curve
 - 3) diameter of drop pipe
 - 4) generator rating
 - c. type, size, flow range, and accuracy range of flow meters
 - d. sizes of discharge pipe and description of valves
- E. The Contractor shall provide at least five (5) references for similar projects completed within the last five (5) years. Provided information shall include depth of borehole, casing size, depth of well, name of reference, and phone number and contact address of reference.

2.2 BLOW OFF PREVENTION EQUIPMENT (BOPE):

- A. It is not anticipated that BOPE will be required for this project.

2.3 CIRCULATING MEDIA:

- A. The boreholes shall be drilled using reverse circulation mud rotary methods. Drilling fluid shall meet the requirements specified below:

1. Weight: Target drilling fluid weights of approximately 9 lbs./gal, to be adjusted as needed, to speed drilling, minimize lost circulation, and prevent tight hole.
 2. Funnel Viscosity: Mud viscosity should be kept as thin as practical and still retain formation stability and adequate hole cleaning. Normal viscosities of 30 to 40 seconds per quart shall be maintained to adequately clean the hole.
 3. Thirty-Minute Water Loss: Filtrate values below 10 cc should be maintained while drilling pilot holes. Filtrate control should be maintained at 13 cc or below while reaming.
 4. Filter Cake: Filter cake thickness shall be maintained at less than 3/32-in.
 5. Sand content of fluid entering the hole should not exceed 4 percent by volume.
- B. Mud Pits: The Contractor shall provide two open mud circulation pits with a volume of not less than two (2) times the borehole volume constructed and maintained so as to minimize potential for contamination of the drilling fluid. The drilling fluid shall discharge into the first pit for settling of drill cuttings, then flow into the second pit before recirculating into the hole. The properties of the drilling fluid shall be such that fine drill cuttings will settle in the mud pit. Pits shall be cleaned daily, or as directed by the Engineer.
- C. Construction Water: The Contractor will be provided access to the water needed for construction from the City's existing wellfield facilities. Water used in any drilling operation shall be of safe sanitary quality and water used in the mixing of drilling fluids or muds shall contain a chlorine residual of at least 0.5 milligrams per liter (mg/L). Costs for facilities/equipment required to convey the water to the point of use shall be borne by the Contractor. It shall be the Contractor's responsibility to provide and maintain any required temporary plumbing, transportation, and storage required to complete the work. The water use shall be monitored by the Contractor and all water shall be carefully conserved. Before final acceptance of the well, all temporary connections and piping installed by the Contractor shall be removed in a manner satisfactory to the Engineer.
- D. Drilling Fluid Constituents: Acceptable drilling fluid constituents must be NSF approved for use in water-supply wells and may include bentonite, synthetic polymers, inorganic-phosphate thinning agents, drilling detergents and foaming agents, and weighting materials, as approved by the Engineer. With adequate measures to protect water-bearing zones, brine-based drilling fluid systems are acceptable for advancing the borehole through evaporite sequences. Lost-circulation materials shall not be used without approval of the Engineer. It is expressly understood that toxic and/or dangerous substances will not be added to the drilling fluid. The drilling fluid properties required will depend on: (1) the type and size of drilling equipment to be used, and (2) down hole conditions anticipated or encountered. Properties of the drilling fluid are to be measured in accordance with the procedures of the American Petroleum Institute (API) Code RP 13B, "Recommended Standard Field Procedure for Testing Drilling Fluid". Samples tested shall be caught at the rig pump suction inlet with care taken to assure a true and representative sample. Tests should be conducted: (1) every 50 feet of depth or (2) every four circulating hours or (3) whenever conditions appear to have changed or problems arise.
- E. The contractor shall maintain current records including the drilling fluid log on the site at all times to show: (1) time, depth and results of all mud tests, (2) all materials added to

the drilling system including kind, amount, time, and depth, and (3) variances or modifications from agreed to drilling fluid program including time, depth, reason and authorization.

2.4 CEMENT GROUT SEALS

- A. Annular seals for the surface, intermediate, and well casing will consist of neat cement or sand cement grout that meets the requirements of the ASTM C150 Type II. Grout density will depend on the approved cementing mix but are expected to be in the range of 14 to 16 lbs./gal (117 lbs./) for each application. Sulfate resistant cements (Type V) will be required where seals are placed across intervals of bedded gypsum/anhydrite. A maximum of 3 percent bentonite and 2 percent calcium chloride by weight may be added to the cement grout. All additives must be approved by the OWNER or ENGINEER prior to use. Surface casing shall be cemented in place using tremie methods. The intermediate and production casing shall be cemented in place using an approved pressure grouting method. High shear mixing equipment shall be used to ensure proper hydration of cement mixture. The installation will proceed by pumping the grout down the well casing, out the base of the intermediate and/or production well casing, and into the annular space where it will raise in a body up the sides of the intermediate and/or production casing forming a dependable seal. The cement will be allowed to set for a period of at least 48 hours whereupon a pressure testing must be completed to validate integrity of the cement seal. A grout compressive strength of at least 500 psi must be achieved before new well work can be undertaken.

2.5 CASING FOR WATER-SUPPLY WELL

- A. All materials to be used for construction of the wells shall conform to AWWA A100-06. No well materials containing 8% or more of lead are allowed.
- B. The Engineer will determine final well construction depths after reviewing test boring cuttings and geophysical logs obtained during drilling, and after consulting with the Owner. Casing materials will not be finalized until geophysical logs have been reviewed by the Engineer and the final well designs are approved by the Owner. If quantity of borehole drilled or quantity of materials actually incorporated in well construction change, unit bid prices shall prevail.
- C. Surface casing shall be supplied in minimum lengths of 20 ft, and the casing end finish shall be plain end beveled. The surface casing shall be new and free of rust, pits, or other defects. Surface casing shall be 24-inch outside diameter blank, low carbon steel casing, ASTM A-53 Grade B, Schedule 40. For bidding purposes, the length of the casing string shall be as summarized on the Bid Sheet. The actual length of the casing will be subject to change as determined by the Engineer.
- D. Production well casing shall be new and free of rust, pits, or other defects. Sixteen (16) inch nominal well casing, high strength low alloy (HSLA) steel casing, ASTM A-139 Grade B having a minimum wall of Schedule 40. Casing will be provided with welded collars to facilitate placement. For bidding purposes, the length of the casing string shall be as summarized on the Bid Sheet. The actual length of the casing will be subject to change as determined by the Engineer.

2.6 CENTERING GUIDE

- A. Weld-on type centralizers of the same type and grade of as the blank casing shall be installed at intervals no greater than 40 feet along the well casing string. Centering guides shall consist of four, 1/4-inch by 2-inch by 2-foot-long rigid steel guides welded on the casing, with approximately 2-inch standoff from the casing. Guides shall be aligned vertically with respect to each other and approved by the Engineer.

2.7 WELL HEAD COMPLETION AND SOURCE WATER PROTECTION

- A. A concrete sealing block shall be formed around the well head as described in the project detail drawings (Figure 3), and Specification Sections 03100 Concrete Formwork, 03200 Concrete Reinforcement, and 03300 Cast-In-Place Concrete. The concrete shall be re-reinforced with #5 steel rebar running in the horizontal and vertical planes and dimensioned as shown on the project drawings. All flat surfaces shall be sloped at not less than 0.3-in per foot. The top of the casing shall be no less than 2 feet above the natural ground level.

PART 3 EXECUTION

3.1 DRILLING METHODS

- A. Drilling methods shall be consistent with standard practices for construction of water supply wells.
- B. Control of drilling fluid properties shall be maintained throughout all drilling and reaming operations as specified. Drilling fluid shall consist of a mud-based system with approved additives for ease of drilling, filtrate control, flow control, and protection of the drilling operation. Adequate facilities for the collection of representative cuttings samples shall be maintained at all times.
- C. During drilling, the contractor shall use acceptable methods for controlling flow including addition of approved weighting materials to drilling fluid. It shall be the Contractor's responsibility to control flow as necessary during drilling or other portions of the work in order to successfully complete the project.
- D. To obtain accurate depth determination, representative cuttings samples, and a straight and plumb hole, the Contractor shall comply with the following:
 - 1. Maintain reasonably constant weight on the bit and rotary speed.
 - 2. Use drill collars of appropriate diameter, weight, and length. Drill collar diameter should be of the maximum size allowable without interference with circulation.
 - 3. Run a mechanical drift indicator at intervals of no less than 100 feet of depth to the total depth of the hole during drilling of the pilot and reamed hole.
 - 4. The maximum allowable horizontal deviation (drift) of the borehole from the vertical shall not exceed 0.5°. Under no circumstances shall borehole deviation prevent construction and use of the supply well described in these specifications. If a higher deviation is recorded, the Contractor should at the Engineer's discretion correct the alignment or abandon and properly plug the hole at no additional cost to the Owner and another hole shall be drilled at no additional cost to the Owner.

3.2 CONTRACTOR'S LOG AND RECORDS

- A. The Contractor shall keep an accurate, current log of operations at all times in the form of a daily drilling report and shall include material setting reports as well as any cementing certificates. The report shall include, at minimum, the following information:
1. Bit number, size, type, and depth-in
 2. Length and diameter of in-hole drilling assembly, including bit, hole-opener(s), subs, collars and drill pipe.
 3. Rotary speed
 4. Number and rating of compressors and boosters in use
 5. Time devoted to each activity.
 6. Description of soil/rock type and notation of depth at each change
 7. Water volume used for drilling.
 8. Lengths, diameters, and types of casing and perforated casing run
 9. Volumes of gravel placed.
 10. Grout volume, thickness, and location
 11. Time devoted to each stage of development and characteristics of fluid produced.
- B. The reference of each depth given in the report shall be denoted as "KB" (Kelly bushing), "DF" (drilling floor), or "GL" (ground level), and the distance from ground level to the drilling floor and the Kelly bushing shall be measured and included in the report. The depth datum for caliper survey shall be ground level.
- C. One copy of each Daily Drilling Report shall be made available to the Engineer on the following day. Upon completion of the drilling, a complete set of the Daily Drilling Reports shall be provided to the Engineer. Any signatures made on the daily field reports or other field documentation provided by the Contractor shall be considered only to acknowledge that the form or report was accepted, not an acceptance of the hours worked, footage drilled, materials provided, placed, or the like.

3.3 PIPE TALLIES

- A. An accurate record of all drill-pipe, tubing, and casing on the location shall be maintained at all times. A current pipe tally shall be maintained for all drill bits, subs, crossovers, drill-pipe, tubing, and casing run into the borehole. Measurements of each joint shall be made to the nearest 0.01 foot prior to running in the borehole. Upon completion of the well construction, copies of the pipe tallies shall be provided to the Engineer.

3.4 WELL CONSTRUCTION

- A. **Surface Protection:** The open annulus shall be protected from entry of unwanted material at all times by preventing surface runoff from reaching and entering the boring during construction activities. Whenever work ceases on the boreholes and well, the top of the casing shall be capped to cover and protect the hole until the permanent well head assembly is installed. The Contractor shall construct and maintain drainage berms around the wellhead to prevent surface runoff from reaching and entering the well during construction. After installing well casing, the Contractor shall continue to guard against entry of unwanted objects and contaminants into the well casing.
- B. **Well Drilling**
1. A 30-in diameter (minimum) borehole shall be drilled from ground surface to an approximate depth of 40 feet, bgs to accommodate the 24-inch surface casing as directed by the Engineer. A minimum of 40 feet of surface casing shall be installed.

2. For the 16-inch production casing, a 21-in diameter (minimum) borehole shall be advanced from the bottom of the surface casing to the bottom of the Edwards/Trinity aquifer (approximately 400 feet) as directed by the Engineer.
 3. Any of the depths indicated on drawings and the bid sheet may be subject to change as determined by the Engineer (unit rates will apply).
- C. Formation Sampling: During well drilling, the Contractor shall collect cutting samples at 10-foot intervals; additional samples shall be taken at each formation change or as directed by the Engineer. Samples shall be collected from the borehole discharge with an appropriate sample screen or at the shale shaker and immediately placed in cloth or plastic sample bags approved by the Engineer. Each bag shall be permanently identified, including the well name and number, the depth interval represented by the sample, and the date.
- D. Plumbness and Alignment
1. During well drilling, deviation measurements shall be taken with a mechanical drift indicator at intervals of no less than 100 feet to the total depth during pilot hole drilling and reaming. The Contractor shall label survey targets by depth and provide to the Engineer upon request.
 2. The maximum deflection shall be $\frac{2}{3}$ of the smallest inside diameter of the part of the well being tested per 100 feet of depth to a depth of 400 feet to accommodate installation of pumping equipment. If a higher deflection is recorded the Contractor will at the Owner's discretion correct the alignment or abandon and properly plug the hole at no additional cost to the Owner and another hole shall be drilled at no additional cost to the Owner.
 3. The alignment must be satisfactory for the successful installation of the specified well and future installation of permanent pumping equipment; and shall meet AWWA A100-06, Section 4.7.9 specifications for plumbness and alignment from the ground surface to 400 feet within the production well casing.
- E. Geophysical Logging: The following logs shall be run from the surface to the total drilled depth within the Edwards/Trinity (will require multiple mobilizations to complete logging of entire drilled section within open hole):
1. Electric
 2. Gamma
 3. Neutron
 4. Guard and
 5. Sonic

The CONTRACTOR will contract the geophysical logging company. The CONTRACTOR shall keep the borehole full of drilling fluid at all times during logging, to stabilize the borehole and provide log integrity. The CONTRACTOR shall assist the geophysical logger in rigging of the geophysical survey equipment. The CONTRACTOR shall ensure that the borehole is open and clear so that logging tools can be run to within 20 feet of the total depth of the borehole without interference by obstructions or tight sections in the boring. If the total borehole cannot be logged to within 20 feet of the borehole depth due to hole fill, bridging, collapse, improper mud conditioning or other obstructions, the CONTRACTOR shall re-open and recondition the borehole to the original drilled depth and have the hole re-logged. The effort to re-open and re-log the

borehole shall be at the CONTRACTOR's sole expense. The OWNER or ENGINEER, at their sole discretion, may accept the geophysical logging of a hole to a depth less than 20 feet of the total depth of the borehole if the available logs do not compromise the objective of the borehole and subsequent well construction.

- F. Caliper and Deviation Logs: The following logs shall be run from the surface to the total depth in the 21" borehole:
1. 3-arm caliper log
 2. Deviation survey
- Four (4) paper copies of each log, in addition to digital files, shall be furnished to the Engineer at log completion.
- G. Blank Casing Installation
1. The drilling fluid shall be circulated and thinned immediately before casing installation. The placement of casing shall be staged to allow continuous construction immediately after the hole has been completed to its total depth. Prior to installation, all casing materials shall be measured to the nearest 0.01' and marked by the Contractor to determine the amount and location of blank sections to be placed in the borehole. Casing shall extend 18" above ground.
 2. All required materials shall be on-site and inspected by the Engineer prior to initiating installation activities. The casing shall be suspended above the bottom of the borehole a sufficient distance to ensure that none of the casing is supported from the bottom; at no time shall the casing string be placed in compression.
 3. Casing shall be fitted with approved centering guides installed at points as approved by the Engineer. The casing string will be hung from the surface casing through the use of an Engineer approved landing clamp.
 4. A stainless-steel rod based skinless screen with 0.032" perforations shall be installed in the bottom 60' of the casing. Bottom of the screen to be set at 380 ft., bgs.
 5. Welders employed for field assembly of casing shall be qualified in accordance with the latest revision of the section title "Welding Procedure" of the ASME Boiler Construction Code, or by the AWS Standard Qualification Procedures. Welder's certification shall be presented to the Engineer for approval. All welds shall be fully penetrating; the entire beveled or collared and flat area shall be filled with weld bead. The joint shall be watertight, straight, and as strong as the casing.
- H. Cement Grouting:
1. A continuous cement grout annular seal will be placed around the casing. The annular seal shall be a continuous cement plug placed through the casing (also known as the Halliburton method) utilizing two spacer plugs. When completed, the annular seal shall completely fill the space between the well casing and the reamed bore hole, including that interval of the surface casing, from the top of the bottom of the surface casing to ground level.
 2. The cement grout shall be placed by pumping down the well casing in accordance with AWWA A100-06, Appendix C: Section C.4 (Positive Displacement, Interior Method - Drillable Plug). Provision for placement of the grout shall be detailed in the production casing cementing plan and pre-approved by the Engineer. Placement of the cement grout by gravity feed is not acceptable.
 3. After the annular seal is completely in place, a minimum of 48 hours setup time shall be observed, and a pressure test shall be completed prior to any additional

work being performed in the well.

- I. Sanitary Seal and Vents: Sanitary well seals shall be provided in order to prevent contamination from entering the well casing. The sanitary seal shall incorporate a vent that terminates in a down-turned position and shall be covered by a corrosion-resistant screen as shown on the project detail drawings (Figure 3).

3.5 WELL DEVELOPMENT BY ZONED AIR-LIFT PUMPING

- A. Within 48 hours of well completion, the Contractor shall furnish all plant, materials, and labor required to accomplish the development. All hours counted toward development of the well will be actual time spent developing with appropriate equipment as specified. No time will be considered for downtime due to improper, inadequate, or malfunctioning equipment, test procedures or techniques. Circulation of fluids after the well is completed shall be included in the development time; circulation of fluids prior to or during well completion shall not be considered part of well development.
- B. The Contractor shall develop the well through a step-by-step procedure consisting of fresh water circulation while swabbing and airlift development, followed by the introduction of a phosphate free dispersant, removal of the dispersant by swabbing and airlifting, and pump development.
- C. During initial development, when produced water contains a high percentage of drilling fluid and sediment, water shall be impounded on-site. After the development water is returning to clear it may be discharged to the temporary discharge conveyance system constructed by the Contractor. Produced water shall be discharged to locations in accordance with the project's SWPPP plan and approved by the Engineer. Discharge is to be routed approximately 300 ft through temporary discharge pipe and spread on the surface to prevent channeling.
- D. The Contractor shall run a tremie line to within 20 feet of the well bottom and circulate clean water until fluids return clear. Thereupon, the well shall be swabbed from top to the bottom and back to the top of the open production interval. Pipe joints shall be added as each interval clears. The Contractor shall add and subsequently remove phosphate free dispersant during this development process.
- E. A 2.5-inch-diameter air injector pipe shall be run within the eductor pipe to provide the airlift pumping. The air injector pipe shall be capped at the end and shall have sufficient holes drilled in the lower 5 feet to act as an air diffuser. The air compressor used for the airlift shall be rated at not less than 2,000-cfm at 900-psi discharge pressure. The air shall be filtered to prevent oil entrainment within the compressed air. The air injector pipe shall be set at approximately 50% submergence in the eductor pipe and maintained at that depth.
- F. Air lifting shall proceed until the produced water is free of suspended sediment, as approved by the Engineer. The well development program outlined above shall be refined by the Engineer in consultation with the Contractor.
- G. Once airlift development is complete, the Contractor shall tag the bottom of the well using the tremie pipe. As determined by the Engineer, any significant accumulation of sediment shall be removed from bottom of the open borehole.

3.6 DEVELOPMENT BY PUMPING

- A. The Contractor shall furnish, install, operate, and remove either a submersible pump, or a deep-well turbine pump for developing the well. If a deep-well turbine pump is used, the prime mover shall be a variable speed type. Development pumping shall be initiated within 4 days after development by air-lift pumping is complete.
- B. The 15-inch casing well pump shall have a capacity ranging from not less than 800 gallons per minute (gpm) with a pumping level of 380 feet, bgs to 1,600 gpm with a pumping level of 380 feet, bgs. The contractor shall provide a magnetic flow meter capable of instantaneous and total flow measurements and continuous data recording, a manometer, valves, orifice plates, and discharge piping capable of discharging the produced water to the pit(s) near the well, and as the water clears, to a point up to 300 ft from the well through temporary discharge piping. The Contractor's pump, valve, and equipment must be capable of holding the pumping rate to within 5 percent of desired pumping rates. Flow meter data will be collected at 1-minute intervals. The Contractor shall ensure that the flow meter is providing readings that are accurate to within 5 percent of the flow rate measured from the manometer readings and orifice chart.
- C. The Contractor shall provide a 500-foot wire-line electric sounder calibrated in increments of not less than 0.02 foot for manual water level measurements. The wire-line sounder shall not contain wire which is stretched or no longer provides accurate measurements.
- D. The initial pumping rate shall be restricted and, as the water clears, shall be gradually increased until the maximum rate is reached. The maximum rate will be determined by the Engineer after consideration of the well drawdown and discharge.
- E. At intervals determined by the Engineer the pump shall be stopped to allow surging of the well. The cycle of pumping and surging shall be repeated until the discharged water is clean of sand, silt, and mud and until there is no increase in specific capacity during at least 2 hours of continuous pumping and surging.
- F. The Contractor shall continue development until the following conditions have been met:
 - 1. Sand production is less than 15 parts per million (ppm) within 20 minutes after commencement of pumping at the maximum rate as determined by the Engineer.
 - 2. Average sand production does not exceed 5 ppm for a two-hour cycle after commencement of pumping at the maximum rate as determined by the Engineer. Sand production shall be measured by a Rossum centrifugal sand separator.
- G. Development pumping will be performed for a minimum of 12 hours, or longer as approved by the Engineer, followed by a 12-hour period for water level recovery. The Contractor shall keep independent records of pumping time, flow rate per flow meter, manometer height and flow rate per manometer, pumping water level, sand production, and other discharge characteristics as directed by the Engineer recorded at 15-minute intervals throughout the time of pumping.

3.7 DISINFECTION

- A. Disinfection procedures shall comply with AWWA standard C654-03 DISINFECTION OF WELLS except that the disinfectant shall remain in the well for at least twelve hours but not more than twenty-four hours.
- B. Upon well completion, the well shall be completely disinfected. The Contractor shall distribute granular calcium hypochlorite throughout the water column with a chlorine basket. The chlorine basket shall have a fine mesh exterior and be of such design so that it can be lowered on a wire line to the full depth of the well and be capable of holding at least 30 pounds of chlorine. The amount of granular calcium hypochlorite shall be sufficient so that the resulting solution within the well shall have an available chlorine concentration maintained of at least 50 mg/L. The basket shall then be run to the bottom of the well on a wire line and slowly retrieved through the entire water column. This process shall be repeated until all of the chlorine has dissolved. After the chlorine has been applied, the well shall be surged to improve the mixing and induce contact of the chlorinated water with the adjacent aquifer.
- C. During the installation of the test pump, all downhole equipment shall be sprayed thoroughly with a sodium hypochlorite solution with a concentration of no less than 12.5% chlorine prior to emplacement in the well. After the test pump is installed, the well casing and pump column shall be disinfected with a solution of sodium hypochlorite (at least 50 mg/L available chlorine) and water. The solution shall be mixed at the surface and introduced into the well through the top of the casing and a portion recirculated via a valve on the pump discharge port. The amount of disinfectant added shall be sufficient so that the resulting solution shall have an available chlorine concentration maintained of at least 50 mg/L.

3.8 PROTECTION OF BORING AND WELL DURING CONSTRUCTION

- A. Whenever work ceases on the production well, the top of the casing shall be capped using not less than a 3/8-inch-thick steel plate to cover and protect the well until the permanent pump installation is begun. The plate shall be attached with a continuous weld to the top of the well casing or otherwise secured to insure protection and prevention of access.

3.9 PLUMBNESS AND ALIGNMENT

- A. The well shall comply with the plumbness, and alignment criteria specified in AWWA A- 100-06, Section 4.7.9 (Plumbness and alignment).
- B. The completed well shall be sufficiently straight and plumb for the free installation and operation of a line-shaft turbine pump regularly built for the appropriate casing size (15-inch casing) and shall meet AWWA A-100-06 specifications for plumbness and alignment from the ground surface to 400 feet.
- C. A well plumbness and alignment test shall be conducted by a drift indicator survey or other method approved by the Engineer. Results shall be labeled with the following information.
 - 1. Name and number of well

2. Date
3. Deviation at each 10-foot interval
4. Direction of deviation at each 10-foot interval
5. Notations requested by the Engineer.

In the event that the test pump or pump selected for permanent equipment cannot be installed to a depth of 400 feet, or if there is disagreement between the Contractor and the Owner or Engineer regarding plumbness and alignment, the drift indicator surveys shall be analyzed by a service company selected upon agreement between both the Contractor and the Owner. Two copies of the services company's interpretation of the survey shall be supplied to the Owner, and this interpretation shall be binding on both parties. This service will be provided by the Contractor at no additional cost to the Owner.

- D. Records of deflection readings and all other pertinent information shall be kept and made part of the permanent well log and record. The Owner may modify the requirements for plumbness if in his judgment the utility of the completed well will not be materially affected. To assure that the borehole is started straight and plumb, the drilling rig shall be leveled so that the drilling tools hang free and plumb in the center of the rotary table. The drilling rig shall be supported on jack pads properly designed and constructed so that undue settling does not occur. The Contractor shall periodically check the drilling rig level and make adjustments necessary to correct the level due to settling.

3.10 ZONAL WATER SAMPLE COLLECTION

Zonal water quality sample collection will be conducted at the sole discretion and approval of the OWNER. If conducted, the following specifications will be adhered to.

After completion of geophysical logging, the CONTRACTOR shall collect zonal (depth-specific) groundwater samples at the depths designated by the OWNER OR ENGINEER. It is anticipated that up to three zonal samples could be collected, although the OWNER OR ENGINEER may add or omit samples based on subsurface conditions encountered. After each zonal sample is collected, the CONTRACTOR shall obtain a measurement of the static water level for that test interval. Zonal samples are expected for depths below 300 feet, bgs in the Edwards/Trinity. The recommended method of sample collection is as follows:

- A. Drilling will commence into the Edwards/Trinity for approximately 100 feet into the formation as directed by the OWNER or ENGINEER. A single inflatable packer will be installed near the top of the formation to isolate a test zone. Pressure ratings and diameter of the packer will be chosen based on observed borehole conditions. Pressure measurements will be required to confirm that the zone is adequately sealed.
- B. The sample interval of the borehole shall be purged by airlifting and pumping for a period adequate to evacuate the drilling fluid from the borehole to the extent that a representative zonal sample can be obtained. The equipment used during purging (airlift) and sampling operations (pumping with submersible pump-minimum 10 horsepower) shall be capable of providing a discharge of no less than 50 gallons per minute (gpm) of water from the sampling interval. It is anticipated that approximately 10 hours of airlifting and 4 hours of pumping (submersible pump) will be required for collection of each zonal sample. After the

interval to be sampled has been purged to the satisfaction of the OWNER OR ENGINEER, the OWNER OR ENGINEER will collect the water sample from the discharge line.

- C. The zonal sample procedure shall be repeated for each sample location. Zonal sampling will begin with the shallowest test zone and finish with the deepest test zone identified on the lithologic logs. Following collection of water quality samples, the packer assembly shall be removed, and the hole conditioned for geophysical logging.
- D. The specific zonal sampling procedure, the duration of pumping at each sample interval, and the point of discharge for purged water must be approved by the OWNER OR ENGINEER. The zonal samples need not be free of sand grains but must be reasonably clear. Samples will be submitted for laboratory analysis for the constituents specified in Section 3.12.

3.11 TEST PUMPING

- A. Upon completion of the development and disinfection, a pumping test shall be conducted by the Contractor to assess the performance of the well. The test shall not begin until the well has been shut down at least 12 hours from the end of development by pumping. Test pumping shall consist of an 800-minute (13.3 hours) step-drawdown test and a Four Day (96-hour constant-rate test), and associated recovery tests.
- B. The Contractor shall furnish all necessary equipment, materials, and maintenance to make a complete pumping test of the well within 48 hours following development work. The test pumping equipment shall have a capacity not less than specified in Section 3.6 Development by Pumping and shall be capable of delivering water from the given level below the ground surface.
- C. Water-level data will be collected with a pressure transducer and data logger provided by the Engineer. Pumping rates shall be maintained to within 5 percent of the desired rate specified by the Engineer for the entire period of the test. Equipment required to measure and maintain consistent pumping rates will include a magnetic flow meter capable of instantaneous and total flow measurements and continuous data recording, a manometer, and a discharge control valve adequate for the purpose of making fine adjustments to the discharge rate as performed or directed by the Engineer. Flow meter data will be collected at 1-minute intervals. The Contractor shall ensure that the flow meter is providing readings that are accurate to within 5 percent of the flow rate measured from the manometer readings and orifice chart. An inability to provide data to this level of accuracy will void the results of the test(s) and require rerunning the test(s) at the Contractor's expense.
- D. Upon completion of development pumping, a step-drawdown pumping test shall be conducted. The test shall not begin until the well has been shut down at least 12 hours or until 95-percent water level recovery has been achieved.
 - 1. The step test shall consist of four, 200-minute pumping periods (or as otherwise directed by the Engineer), such that a total of 800 minutes (13.3 hours) of uninterrupted pumping is accomplished at four successively higher rates. The pumping rates shall be determined by the Engineer.

- 2. Any time incurred for restarts or delays caused by mechanical or other failures will not be considered part of the test time and will be at no additional cost to the Owner.

- E. Upon completion of a minimum 12-hour recovery period after the step-drawdown pumping test, or until 95-percent water level recovery has been achieved as directed by the Engineer, the Contractor shall perform a 96 hour (or as otherwise directed by the Engineer) sustained yield test pumping at a constant pumping rate near maximum capacity, as determined by the Engineer. The constant rate test will be followed by at least a 24-hour water-level recovery period, or longer as specified by the Engineer. The pump may not be pulled from the well until the 95-percent recovery period has ended.

- F. If the pump is shut off for any reason during the pumping portion of the constant rate test, it shall remain shut off for a minimum of 12 hours or until 95-percent water level recovery has been achieved and the complete test rerun at no additional expense to the Owner, unless directed otherwise by the Engineer.

- G. Upon completion of the test, results shall be turned over to the Engineer for analysis.

- H. Upon removal of the test pump, the Contractor shall allow the well to set for at least 96 hours prior to performing the video survey.

3.12 WATER QUALITY TESTING

- A. The Contractor shall assist the Engineer in collecting water samples at the end of the constant-rate test pumping for the water-supply well. All samples shall be collected in properly preserved bottles provided by the laboratory. Samples shall be stored immediately on ice or blue ice after collection and remain so stored until received by the laboratory.

- B. All laboratory holding times for sample preservation shall be followed. Laboratory detection limits must be below the TCEQ standards for parameters analyzed. Samples for water-quality analysis of inorganic and organic parameters listed below shall be submitted for analysis by a certified laboratory acceptable to the Engineer.

Group	Constituent
Metals	Aluminum Arsenic Barium Boron Cadmium Chromium Copper Lead Mercury
Metals (continued)	Selenium Silver Thallium Zinc

Group	Constituent
Organics	Endrin Lindane Methoxychlor Toxaphene 2,4-D 2,4,5-TP Silvex Benzene Vinyl Chloride Carbon tetrachloride 1,2-dichloroethane Trichloroethylene 1,1-Dichloroethylene 1,1,1-trichloroethane para-dichlorobenzene
Major Cations and Anions	Ammonia Bicarbonate Calcium Carbonate Chloride Fluoride Iron Magnesium Manganese Nitrate (as N) Nitrite (as N) Phosphate Potassium Silica Sodium Sulfate Sulfides
Other Constituents	Color Conductivity Corrosivity Odor pH Total dissolved solids (TDS) Total hardness Turbidity
Radiological	Gross Alpha Radium-226, -228 Uranium

3.13 COLIFORM WATER ANALYSIS

- A. The Contractor shall assist the Engineer in collecting water samples at the end of the constant-rate test pumping for the water-supply well. Once it is confirmed that the

residual chlorine content is not greater than 0.4 mg/L, water samples shall be taken from the well and shall be submitted to a laboratory for bacteriological analysis until three successive daily raw water samples are free of coliform organisms. If unsatisfactory bacteriological results are obtained, the well disinfection shall be repeated as described in Section 3.8(C), the well flushed until the residual chlorine content is not greater than 0.4 mg/L, and samples taken until satisfactory results are obtained for bacteria.

- B. It is Contractor's responsibility to see that the well is so tested and, if unacceptable, to repeat the well disinfection procedure. Disinfection and subsequent testing shall continue at the Contractor's expense until test results are approved, indicating acceptable conditions. The pump shall not be removed from the well until results are approved.

3.14 DISPOSAL OF WASTEWATER AND DRILLING MUD

- A. Water produced by test pumping or other operations shall be disposed of in a manner and at the location in accordance with the project's specifications and the requirements of the TCEQ and the Owner. Water produced during development and pump testing will be discharged to a location approximately 300 feet down gradient of the well site or as otherwise directed by the Engineer. The Contractor shall be responsible for supplying all discharge plumbing and additional pumps necessary for discharging the water. Discharge shall be such that erosion is minimized. Drainage of water from the well location onto surfaces adjoining the well site will not be permitted. Disposal of water will be by such methods that damage to structures, roads or utilities or interference with same or interference with construction projects will be prevented.
- B. Brine-based drilling muds will require proper disposal and rehabilitation of the mud pits prior to drilling into the target production zone within the Capitan Reed Complex. Mud pits must be thoroughly cleaned and back filled with granular material upon completion of work.
- C. All cost incurred in connection with the disposal of water, drilling mud, cuttings, and cleaning and back filling of mud pits will be incidental to well drilling and be borne by the Contractor.

3.15 VIDEO INSPECTION

- A. The Contractor shall make a closed-circuit color video inspection of the entire depth of the well following removal of the test pumping equipment. The camera equipment shall have a wide-angle (fisheye) lens directed downward and shall also include right-angle (side-scan) capability. The camera depth, in feet below ground surface, shall be displayed on the tape at all times. The Engineer must be present for observation of video monitoring and to determine where side scanning will be required.
- B. A NSF certified flocculent approved by the Engineer shall be added to the well in sufficient quantity before logging to remove suspended material from the water column. The well water shall be sufficiently clear to allow examination of the entire hole and well casing during the videotaping. If not, the Contractor shall be required to clear the water at his own expense to allow examination of the entire hole in subsequent video tapings.

- C. If the video shows that the well completion does not meet specifications or that the casing is deformed beyond the manufactures ellipticity tolerances, the Contractor shall remedy deficiencies.
- D. Four electronic copies of the video shall be furnished to the Engineer for delivery to the Owner. The recording shall be labeled with the following information:
 - 1. Name of the Owner
 - 2. Name and number of well
 - 3. Date
 - 4. Depths
 - 5. Notations requested by the Engineer.
 - 6. Name of company performing the video

3.16 WELL ABANDONMENT

- A. In the event that the production well is not accepted for completion because of insufficient capacity or unsatisfactory chemical or bacteriological quality, or if it is abandoned because of poor alignment, loss of tools, or for any other cause, the Contractor shall, as directed by the Owner, fill the abandoned hole with expansive clay or a clay and concrete mixture in accordance with the administrative rules of the Texas Department of Licensing and Regulation 16 TAC, Chapter 76.

3.17 WELLHEAD COMPLETION

- A. Each well site shall be fine graded so that the site is free from depressions, reverse grades, or areas too rough for proper ground maintenance so as to ensure that surface water will drain away from the well. In all cases, arrangements shall be made to convey well pump drainage and floor drainage away from the well head.
- B. At a minimum, each well unit shall be protected by a fence as specified in Section 02835, the gates of which are provided with locks.
- C. A concrete sealing block shall be provided around the wellhead and shall extend at least three feet from the well casing in all directions as shown in the project drawing details (Figure 3). The sealing block must have a minimum thickness of six inches and be sloped to drain away at not less than 0.25 inches per foot per TCEQ requirements. The wellhead completion design shown in the project drawing details (Figure 3) exceeds these requirements. The minimum required slope on the concrete surfaces must be implemented correctly or the well may be subject to rejection.
- D. The Contractor shall install a suitable locking cap to cover and protect the well prior to permanent pump installation. The top of the well must be constructed so that no foreign matter or surface water can enter during or after construction. The completed well casing shall extend at least 18-inches above the final ground surface and at least 12-inches above the installed sealing block as shown on the project drawings (Figure 3).
- E. The Contractor shall seal the wellhead using a gasket or sealing compound and properly vent the well to prevent the possibility of contaminating the water well. A well casing vent shall be provided with an opening that is covered with 16-mesh or finer corrosion-

resistant screen, facing downward, elevated and located so as to minimize the drawing of contaminants into the well. The wellhead and well vent shall be at least two feet above the highest known watermark or 100-year flood elevation, if available.

- F. A sampling port shall be provided on the well discharge pipe of the well prior to any treatment to facilitate raw water sampling.

3.18 PUMP AND COMPONENTS

A. Pump Bowls

Bowls shall be of ductile iron double bolted or close-grained, gray cast iron, Class 30, precision cast, free from blow holes, sand pockets, and other detrimental defects. Water passageways in said bowls shall be smooth so as to allow freedom from cavitation and permit maximum efficiency. Each bowl shall have end or side seal (or both) to prevent slippage of water between bowl and impeller.

Bowls shall be lined with vitreous porcelain enamel, or equal, to produce long effective life (said lining shall not be applied for the purpose of short time gain in efficiency). Lining, identical to that furnished hereunder, shall have been used in the field under similar conditions with satisfactory results for at least a five-year period.

Bowls shall be of such size to fit the well casing with proper clearance (net clearance of 2 inches or more). Bowls shall be capable of withstanding 1-1/2 times the pump shut-off head pressure (zero discharge) or twice the rated capacity pressure, whichever is greater. Bowl materials shall have a minimum tensile strength of 30,000 psi. Pump shall have a capacity of 1600 gpm. Turbine motor shall be provided by the City.

B. Pump Impellers

Impellers shall be of the enclosed type, constructed of SAE 40 bronze. They shall be balanced hydraulically and dynamically to prevent vibration and shall be smoothly finished on all surfaces for minimum friction. Impellers shall be accurately fitted and securely locked to the pump shaft. Vertical adjustment of impellers shall be possible by adjusting top shaft nut. Impellers in multi-stage pumps shall all have the same diameter and trim.

C. Pump Shaft

Pump shaft shall be constructed of AISI-410 or 416 stainless steel and shall be accurately machined to provide smooth operation. It shall easily withstand torsional loads and other stresses encountered within the pump. Pump shaft shall have adequate bearing support at every bowl section and at top bottom and case section and shall be equipped with a suitable steel coupling for connection to the line shaft.

D. Pump Bearings

Pump bearings shall be sleeve type constructed of SAE 40, 64, 67, or 660 bronze, or approved equal. Bearing area, bearing cooling, and bearing lubrication shall be ample for long, trouble-free operation.

E. Discharge Case

Discharge case shall securely fasten the pump bowl assembly to the column piping. It shall be heavily reinforced with streamlined fluid passages, and it shall contain sleeve bearings for the pump shaft. Discharge case shall be provided with a means of reducing to a minimum the leakage of water into the shaft enclosing tube. It shall have bypass ports of sufficient area to permit the escape of water that leaks through the seal bushing.

F. Suction Case

Suction case shall securely fasten the suction piping to the bowl assembly. It shall be heavily reinforced with streamlined fluid passages, and it shall contain a sleeve bearing for the pump shaft which is effectively plugged at the bottom to form a grease container. A sand collar shall prevent sand from entering the suction case bearing.

G. Suction Pipe and Strainer

Unless specified otherwise, the suction pipe shall be 10 feet in length and comprised of the same material and diameter as the column piping. A cone type strainer shall be provided for attachment to the suction pipe. The strainer shall be galvanized steel, bronze, or equivalent and shall have a net inlet area of at least four times the suction pipe area. The maximum strainer opening shall not be more than 75% of the minimum opening of the water passage through the bowl or impeller.

Strainer shall be stainless steel, rod based skinless screen with 0.32" perforations to extend 20' above pump placement.

H. Column Piping

Column pipe to be a 10" steel, ASTM A-53, 0.375" wall thickness, and minimum of 34.24 lbs. per foot.

Pipe shall be furnished in interchangeable sections of 20-foot nominal length for enclosed line shaft and 10-foot length for open line shaft, with the exception of the top column section which shall be of 5-foot nominal length and the bottom column section which may be of shorter length. Column pipe sections shall be connected with threaded steel sleeve type couplings. Ends of each pipe section shall be faced normal to section axis and machined with threads to permit ends to butt to ensure proper alignment when assembled. Coating of the column piping, either interior or exterior, is not required.

I. Lubrication System

Water lubrication system shall be automatic unless specified otherwise. It shall consist of piping or tubing from a source of water pressurized when pump is off, solenoid control valve, and appurtenant piping supports. System shall comply with pump manufacturer's recommendations for flow.

Water solenoid control valve shall open or close upon command of control system. It shall automatically start or stop the flow of water to the shaft bearings. It shall also permit manual operation upon control system failure.

3.19 CLEAN UP AND RESTORATION

- A. After the work is completed, the Contractor shall remove all debris, tools, equipment, supplies, and excess material from the site and shall restore the site to its original condition, as approved by the Owner/Engineer.

3.20 ADDITIONAL INFORMATION

- A. The Contractor is responsible for the structural integrity of the well. If bidder's professional opinion is that any of these specifications are inadequate to ensure the long-term structural integrity of the well, the bidder shall notify Owner and Engineer in writing prior to the bid date.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Form stripping.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 03 30 00 - Cast-In-Place Concrete: Supply of concrete accessories for placement by this Section.

1.3 RELATED SECTIONS

- A. Section 03 20 00 - Concrete Reinforcement.
- B. Section 03 30 00 - Cast-in-Place Concrete.

1.4 REFERENCES

- A. ACI 347 - Recommended Practice For Concrete Formwork.
- B. PS-1 - Construction and Industrial Plywood.

1.5 DESIGN REQUIREMENTS

- A. Design, engineer, and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 347.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.8 COORDINATION

- A. Coordinate this Section with other Sections of work which require attachment of components to formwork.

- B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, submit proposal to Engineer with requested modifications.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

- A. Plywood: Douglas Fir species; medium density overlaid one side grade; sound undamaged sheets with clean, true edges.
- B. Lumber: Douglas fir species; construction grade; with grade stamp clearly visible.

2.2 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off type, metal, fixed length, cone type, free of defects that could leave holes larger than one inch in concrete surface.
- B. Form Release Agent: Colorless mineral oil which will not stain concrete or absorb moisture.
- C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

3.2 EARTH FORMS

- A. Verify with Engineer prior to the use of earth forms in lieu of specified form material.
- B. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members which are not indicated on Drawings.
- F. Provide chamfer strips on all exposed corners.

3.4 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in or passing through concrete work.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.
- D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

- A. Clean and remove foreign matter within forms as erection proceeds.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms, unless formwork and concrete construction proceed within heat enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.

3.8 FIELD QUALITY CONTROL

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- B. Do not reuse wood formwork more than four times for concrete surfaces to be exposed to view. Patched formwork will be rejected.

3.9 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.2 RELATED SECTIONS

- A. Section 03 10 00 - Concrete Formwork.
- B. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI SP-66 - American Concrete Institute - Detailing Manual.
- D. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
- E. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- F. ANSI/AWS D1.4 - Structural Welding Code for Reinforcing Steel.
- G. ANSI/AWS D12.1 - Reinforcing Steel Welding Code.
- H. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- I. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
- J. CRSI - Concrete Reinforcing Steel Institute Manual of Practice.
- K. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.
- L. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.

- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel, bending and cutting schedules, and supporting and spacing devices.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice, ACI 301, ACI SP-66, ACI 318.

1.6 COORDINATION

- A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, plain.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.
- B. Weld reinforcement when approved by the Engineer in accordance with ANSI/AWS D1.4.
- C. Locate reinforcing splices not indicated on Drawings, at point of minimum stress. Review location of any splices with Engineer. Minimum splice overlap shall not be less than 24 bar diameters.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Accommodate placement of formed openings.

C. Conform to ACI 318 for concrete cover over reinforcement.

3.2 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01400.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cast-in-place concrete foundations.
- B. Slabs on grade.
- C. Control, and expansion and contraction joint devices associated with concrete work.
- D. Equipment pads.

1.2 RELATED SECTIONS

- A. Section 03 10 00 - Concrete Formwork: Formwork and accessories.
- B. Section 03 20 00 - Concrete Reinforcement.

1.3 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 302 - Guide for Concrete Floor and Slab Construction.
- C. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- D. ACI 305R - Hot Weather Concreting.
- E. ACI 306R - Cold Weather Concreting.
- F. ACI 308 - Standard Practice for Curing Concrete.
- G. ACI 318 - Building Code Requirements for Reinforced Concrete.
- H. ASTM C33 - Concrete Aggregates.
- I. ASTM C94 - Ready-Mixed Concrete.
- J. ASTM C150 - Portland Cement.
- K. ASTM C260 - Air Entraining Admixtures for Concrete.
- L. ASTM C494 - Chemicals Admixtures for Concrete.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Product Data: Provide data on joint devices, attachment accessories, admixtures and cement types to be used.
- C. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.
- B. Acquire cement and aggregate from same source for all work.
- C. Conform to ACI 305R when concreting during hot weather.
- D. Conform to ACI 306R when concreting during cold weather.

1.6 COORDINATION

- A. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal, Type II - Moderate, Portland type. All cement shall be from the same manufacturer unless approved by the Engineer.
- B. Fine and Coarse Aggregates: ASTM C33, Size No. 57.
- C. Water: Clean and not detrimental to concrete.

2.2 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Chemical: ASTM C494, Type A - Water Reducing; Type B - Retarding; Type C - Accelerating; Type D - Water Reducing and Retarding; Type E - Water Reducing and Accelerating admixture.
- C. Fly Ash: Not allowed.

2.3 CONCRETE MIX

- A. Mix and deliver concrete in accordance with ASTM C94, Alternative No. 2 and 3.
- B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1, Method 2 and Method 3.
- C. Provide concrete to the following criteria:
 - 1. Compressive Strength (7 days): 2,800 psi.
 - 2. Compressive Strength (28 days): 4,000 psi.
 - 3. Slump: 3 to 5 inches.
 - 4. Air: 4 to 6 percent.
- D. Use set retarding admixtures during hot weather only when approved by Engineer.
- E. Add air entraining agent to normal weight concrete mix.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify requirements for concrete cover over reinforcement.
- B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304.
- B. Notify Engineer minimum 24 hours prior to commencement of operations.
- C. Ensure reinforcement, inserts, embedded parts, formed joint fillers are not disturbed during concrete placement.

3.4 CONCRETE FINISHING

- A. Provide formed concrete surfaces to be left exposed with smooth surfaces free of honeycombs, aggregate breakout, and fins.
- B. Steel trowel and brush top surfaces of slabs.

3.5 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Cure concrete in accordance with ACI 308, Standard Practice for Curing Concrete.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for a minimum of three (3) days for hydration of cement and hardening of concrete.

3.6 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed in accordance with ACI 301.
- B. Provide free access to Work and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to Engineer for review prior to commencement of Work.
- D. Tests of cement and aggregates may be performed by Owner to ensure conformance with specified requirements.
- E. Four concrete test cylinders will be taken for every 100 or less cu. yds of each class of concrete placed or as determined by the Engineer.
- F. One additional test cylinder may be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. One slump test will be taken for each set of test cylinders taken.

3.7 PATCHING

- A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.
- C. Patch imperfections as directed.

3.8 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by the Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

D. Defective concrete work shall be repaired or replaced at Contractor's expense.

3.9 SCHEDULE - CONCRETE TYPES AND FINISHES

A. Well Pad: 4,000 psi 28-day concrete, Type I cement, sack rubbed finish.

B. All other concrete - 4,000 psi 28-day cement, Type 1 cement.

END OF SECTION

Figures