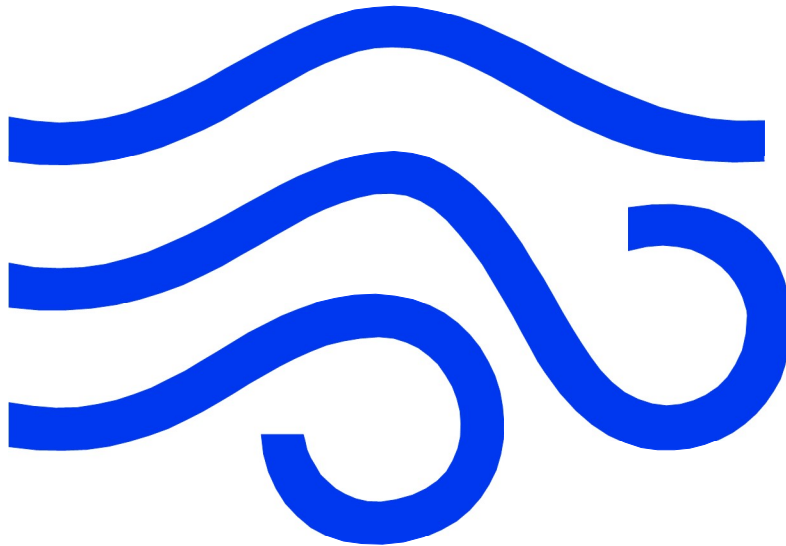


**TECHNICAL SPECIFICATIONS
DRILLING AND INSTALLATION OF
REPLACEMENT GVID WELL NO. 2
MOHAVE COUNTY, ARIZONA**

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1.0 GENERAL

1.1 LOCATION

The work to be accomplished under the following specifications consists of the drilling and completion of one production well for the County of Mohave (County) in Golden Valley, Arizona (Figure 1). The site address is 1506 S. Teddy Roosevelt Road, Golden Valley, Arizona. The site parcel number is APN 306-19-001. The legal location of the well is the NE $\frac{1}{4}$ (10-acre) of the NE $\frac{1}{4}$ (40-acre) of the NE $\frac{1}{4}$ (160-acre) of Section 25, in Township 21 North, Range 19 West of the Gila and Salt River Baseline and Meridian (also referenced as B(21-19)25aaa).

1.2 SCOPE OF WORK

The installation of the well, as specified herein, consists of the CONTRACTOR drilling the pilot borehole to the specified depth using the reverse circulation rotary drilling method and collecting cutting samples from the pilot borehole as specified. Geophysical logging will be conducted prior to borehole reaming at the well site. Based on the lithologic and geophysical logging results, depth-specific (zonal) groundwater sampling may also be conducted prior to borehole reaming. It is the responsibility of the CONTRACTOR to familiarize itself with the drilling conditions that may be encountered at the site, both surface and subsurface, prior to the bid submittal. It is the responsibility of the bidder to examine the drilling area and site access in order to become acquainted with local conditions. No allowance will be made after the bid has been accepted for any errors or omissions made by the CONTRACTOR. The CONTRACTOR will install the well pursuant to the final well design, which will be developed by the CONSULTANT (Clear Creek Associates) and approved by the OWNER (Mohave County). A preliminary well design for the well is presented on Figure 2. The scope of work presented herein includes aquifer testing (step-rate discharge test and constant-rate aquifer test) after the well installation and development of the well is complete. The CONSULTANT or OWNER reserve the right to drill beyond the depth specified, or to stop at a lesser depth, depending on subsurface conditions.

1.3 DEFINITIONS

Throughout this specification, the term “OWNER” shall be understood to represent Mohave County, and the term “CONSULTANT” shall be understood to represent Clear Creek Associates, LLC. The “CONTRACTOR” shall be the person, firm, or corporation with whom the OWNER will execute an agreement setting forth the terms and conditions for the work to be performed, as specified herein. The term “SUBCONTRACTOR” will apply to any person, firm, or corporation with whom the CONTRACTOR executes a secondary agreement for a portion of the scope of work.

1.4 PERFORMANCE OF WORK

1.4.1 Contractor Qualifications

The CONTRACTOR shall have no less than five (5) years of local (within the Basin and Range geologic province of Arizona or equivalent) experience using reverse circulation rotary drilling. In addition, the CONTRACTOR must have successfully completed no less than five (5) separate well installation projects in the Basin and Range area within the past two (2) years, using reverse circulation rotary drilling, and involving installation of potable water production wells with similar casing dimensions and well depths as specified herein. An experience and qualifications summary for the CONTRACTOR shall be submitted with the bid submittal. Additionally, a specifications summary of the drilling rig to be used must also be provided with the bid submittal. In lieu of local experience, the CONTRACTOR may submit equivalent experience from other similar geologic settings.

The CONTRACTOR shall hold: (1) a valid Arizona Department of Water Resources (ADWR) Well Driller’s License in the reverse circulation rotary category; (2) an Arizona Registrar of Contractor License type A, A-4, A-16, C-53 or CR-53; and (3) all other licenses required by Federal, State, County, or Municipal rules and regulations. SUBCONTRACTORS may also hold a valid Arizona Well Driller’s License in addition to that of the CONTRACTOR, but not in lieu of the CONTRACTOR’S ADWR Well Driller’s License. In addition, the CONTRACTOR shall be named as “Principal” on the Performance Bond and Payment Bond.

The CONTRACTOR shall provide a copy of their Arizona Well Driller's License and a copy of their Arizona Registrar of Contractor License with their bid submittal.

1.4.2 Operations

During installation or removal of drill tools or casing, the CONTRACTOR shall provide and utilize a drill tool "laydown line" (i.e., a stabilizing cable connected to the tail end of drill pipe, casing or drill collar, which will allow the pipe to be safely handled during its installation into or removal from the borehole). If such a laydown line is unavailable, the CONTRACTOR shall maintain no less than three (3) workers on site throughout the well drill tool or casing installation/removal operations (including tripping into or out of the well, making connections, and installation of the well casing or well screen). The laydown line system must be approved by the CONSULTANT or OWNER, and be in compliance with Occupational Safety and Health Administration (OSHA) requirements. All operations shall be performed under the direct and personal supervision of an Arizona-licensed well driller. The CONTRACTOR shall assign a foreman (tool pusher) who has been approved by the CONSULTANT to oversee all work required by this specification. After selection, the CONTRACTOR foreman shall provide to the CONSULTANT a written certification that he has read and fully understands this technical specification prior to mobilization to the well site.

The CONTRACTOR shall construct the production well in accordance with the Rules and Regulations of the ADWR, Article 8, Well Construction and Licensing of Well Drillers. The well construction shall also comply with the guidelines of the Arizona Department of Health Services Engineering Bulletin No. 10, and all other applicable Federal, State, County, and local regulations. Rejection of any materials, work, or equipment by the CONSULTANT or OWNER shall be at the CONTRACTOR'S expense, and at no cost to the OWNER. Replacement materials, work, or equipment that is in accordance with these specifications and approved by the CONSULTANT will be paid for by the OWNER in accordance with the Bid Schedule.

1.4.3 Contractor Responsibilities

Should the well be lost due to any negligent action on the part of the CONTRACTOR (as determined by the CONSULTANT), the well shall be abandoned at no cost to the OWNER, in accordance with ADWR Article 8, Rule R12-15-816, and a replacement well shall be constructed in the immediate area. Negligent action by the CONTRACTOR includes but is not limited to: failure or loss of equipment or tools, borehole instability due to inadequate drilling fluid properties, borehole misalignment, or any other cause attributable to inadequate or poor workmanship or equipment. The replacement well location will be selected by the CONSULTANT or OWNER. The replacement well shall be completed in accordance with all the terms and conditions stated herein. The CONTRACTOR shall credit the OWNER for any and all costs associated with the lost well, and this credit shall be applied against any additional CONTRACTOR charges associated with the drilling and completion of the replacement well.

If the loss of the well was not due to any negligent action of the CONTRACTOR, the CONSULTANT or OWNER may designate a replacement well location and the OWNER shall provide reimbursement for the replacement well on the basis of the unit costs presented in the CONTRACTOR'S Bid Schedule.

If a work delay, deficiency of work performance and/or a material's deficiency is caused by the CONTRACTOR failing to comply with any item of these specifications, the CONTRACTOR shall bear the burden of additional expenses, including any additional CONSULTANT charges assessed to the OWNER as a direct result of the delay or deficiency. This includes delays due to equipment failure, if the CONSULTANT or OWNER determines that the equipment failure could have been prevented through proper maintenance.

1.5 CONFIDENTIALITY

The CONTRACTOR shall not disclose any information relating to this project or the well site to anyone other than the OWNER or CONSULTANT without written permission from the

OWNER, except as may be required by law. At all times during the performance of the CONTRACTOR'S services, the CONTRACTOR and its employees, SUBCONTRACTORS, and agents shall treat the work conducted by the CONTRACTOR and its SUBCONTRACTORS and the results thereof as confidential and proprietary to the OWNER.

Any questions regarding the purpose or scope of work that are directed to the CONTRACTOR from individuals or entities other than representatives of the OWNER or CONSULTANT while work is being conducted for this project, should be directed by the CONTRACTOR to the CONSULTANT or OWNER.

The CONTRACTOR shall inform its employees of this confidentiality requirement, and shall obtain non-disclosure agreements from all SUBCONTRACTORS who will have involvement in the performance of any of the work and provide CONSULTANT with copies of the executed non-disclosure agreements. This provision shall survive the termination of contracted work tasks.

1.6 METHODS OF DRILLING

The well shall be drilled using the flooded reverse circulation rotary drilling method. The CONTRACTOR shall transport drilling make-up water from a source approved by the CONSULTANT or OWNER, and the CONTRACTOR shall provide the necessary pump(s), air compressor(s), and all other equipment required for its drilling operations. The CONTRACTOR is responsible for designing and controlling a drilling program that conforms to this specification.

1.7 SITE SAFETY PLAN

The CONTRACTOR must provide a Site Safety Plan for this project, in accordance with applicable OSHA requirements. The CONTRACTOR is responsible for assuring that CONTRACTOR personnel and SUBCONTRACTORS are thoroughly familiar with the Site Safety Plan for the proposed work. CONTRACTOR personnel are required to have been trained in the use of personal safety equipment required by the Site Safety Plan. A copy of the Site Safety Plan must be kept at the well site, and shall be available to all CONTRACTOR personnel

for review. The CONTRACTOR shall be responsible for having sufficient personal safety equipment at the work sites for each of the CONTRACTOR personnel to comply with provisions of the Site Safety Plan. The CONTRACTOR shall meet the requirements of the Site Safety Plan at its own cost.

1.8 NOISE CONTROL

It is the CONTRACTOR'S responsibility to meet all ordinances regarding noise and noise control during all drilling, testing, well installation, and development operations. Sound barricades are not required in this specification, but may be required if requested by the OWNER. If sound barriers are requested, the associated costs will be addressed via change order in accordance with the contract documents.

END OF SECTION

2.0 PROTECTION OF SITE

The CONTRACTOR shall take all necessary precautions to preserve the well site, as nearly as practical, in its present condition. The CONTRACTOR will be responsible for any required clearing and grubbing of existing vegetation or debris within the work area and access roads. The CONTRACTOR shall be responsible for replacing any damaged items. The CONTRACTOR shall provide, at its own cost, an adequate roll-off bin to contain all debris and trash collected at the site. All litter and debris will be cleaned up daily and placed in the roll-off bin for off-site disposal. The CONTRACTOR is responsible for the location and clearance of all underground utilities using Blue Stake, a private utility location service or both. The CONTRACTOR shall be responsible for any damage resulting from its failure to identify and avoid underground utilities.

A plastic tarp (6 mil, minimum) and berm shall be placed beneath the drilling rig during mobilization to protect the site against oil or hydraulic fluid spills or leaks, and will remain beneath the rig until demobilization. A plastic tarp and berm shall also be placed beneath other stationary equipment such as air compressors and fuel tanks. Compressed air introduced into the wells during drilling, sampling, or well development must be treated by passage through a carbon or coalescing filter to remove organic contaminants (e.g., compressor lubrication oil).

The CONTRACTOR is responsible to apply water for dust control to work area or access roads as required to meet State, County, or local dust control ordinances, or as requested by the CONSULTANT or OWNER. The CONTRACTOR shall meet the requirements for permitting and compliance with dust control at its own cost. The CONTRACTOR is also responsible to provide any track-out protection that may be required to prevent sediment or mud deposits on adjacent paved surfaces.

Circulation of drilling fluids will be conducted using above-ground mud tank(s). During drilling, the mud tank(s) shall be emptied of cuttings at necessary intervals. Drilled cuttings shall be spread evenly in a thin layer at the well site, such that they do not pose a threat to leave the site or alter the existing drainage.

Water pumped from the well during drilling, sampling, and development operations shall be conveyed to a location identified by the OWNER or CONSULTANT, where it will not cause damage to the property, contamination of other wells or waterways, or creation of a nuisance. Drilling fluid pumped from the well during drilling and well construction shall be contained, transported, and disposed of in a legal manner by the CONTRACTOR. For bidding purposes, the CONTRACTOR should plan to temporarily contain initial zonal sampling fluids and swab and airlift development water onsite in above-ground portable storage tanks (Baker Tank or equivalent), to allow suspended solids to settle. Once the suspended solids have settled, the clarified water can be pumped to a location specified by the CONSULTANT or OWNER, within 2,000 feet of the well site.

After completion of the work, the CONTRACTOR shall remove all debris, waste, oil-stained dirt, trash, and unused materials or supplies and shall obliterate all temporary construction facilities such as temporary work areas, temporary structures, stockpiles of excess or waste materials and shall restore the site, as nearly as possible, to its original condition. In addition, any residual mineral oil within the well casing (on the groundwater surface) resulting from the use of test pumping equipment shall be removed prior to final acceptance of the well. The OWNER must approve the cuttings disposal and site cleanup.

END OF SECTION

3.0 UTILITIES

3.1 WATER

Water for the drilling of the well will be the responsibility of the CONTRACTOR. The CONSULTANT and OWNER will provide reasonable assistance with locating the nearest available potable water source, which will be reasonably near the well site. The OWNER will provide the water at its source at no cost, but the CONTRACTOR must meter the water used, and will be responsible for all piping, connections, ancillary equipment, and labor required to convey the water to the well site for use. The CONTRACTOR will be responsible for obtaining an adequate flow rate of construction water for all operations under this specification. The CONTRACTOR will be responsible for all costs associated with transporting water to the well site.

3.2 ELECTRICITY

The CONTRACTOR shall provide, at its own cost, all power required for its operations under this specification.

3.3 RESTROOM FACILITIES

The CONTRACTOR shall provide, at its own cost, a portable restroom facility at the well site during all operations of this project. The restroom shall be adequately maintained, and shall be made available to the CONSULTANT and OWNER personnel for reasonable use, at no cost.

3.4 SITE LIGHTING

The CONTRACTOR shall be responsible for providing all necessary lighting for night work. This is to include illuminating the drilling work area, the sampling work area, and any normal foot travel paths used by personnel during the execution of their tasks. Lighting shall provide a minimum illumination of five (5) foot candles at two (2) feet above ground and at workstations.

Lighting shall be positioned in such a manner as to ensure that all lighting is directed toward the work area and not towards the adjacent surroundings.

3.5 UTILITIES

Location of all utilities at the site shall be the responsibility of CONTRACTOR. Utility damage, caused by CONTRACTOR, shall be repaired at CONTRACTOR'S expense in accordance with all Municipal, County, and State regulations and standards.

It is the responsibility of CONTRACTOR to contact Arizona 811 (previously, Blue Stake), a private utility location service, or both and the OWNER and maintain utility clearances prior to mobilization. The CONTRACTOR shall be responsible for any damage resulting from its failure to identify and avoid underground utilities.

END OF SECTION

4.0 EQUIPMENT

The CONTRACTOR shall furnish and maintain in safe and efficient working condition all equipment necessary to perform the specified work, including a drilling rig capable of performing the specified operations to the specified depths; pumping, testing, sampling equipment; and auxiliary equipment as specified or required to complete the described tasks. The CONTRACTOR shall submit a statement with their bid indicating the drilling equipment to be used. The drilling rig used for the installation of the well must possess a mast capacity equal to or greater than 1.5 times the combined weight of the well casing and screen, which is estimated to be 87,000 lbs based on the preliminary well design. Additionally, the well shall be installed without the use of a float plate. All equipment requirements specified in this Section shall be provided at the CONTRACTOR'S expense.

The equipment supplied by the CONTRACTOR shall include, but not be limited to:

- A wireline depth indicator capable of measuring depths equal to the total depth of the borehole, and equipped with a counter device which provides for a depth measurement accuracy of ± 1 foot;
- Specified devices for measurement of drilling mud viscosity and weight;
- An operating and accurate inclinometer tool;
- An operating and accurate penetration rate indicator (Geolograph or equal);
- An operating and accurate gauge that indicates the hook load (weight) of the drill string;
- Above-ground mud tanks capable of circulating drilling fluids and collecting drill cuttings;
- A first aid kit;
- A fully recharged and operable type ABC dry chemical fire extinguisher; and
- An operable "smart" mobile telephone (with texting and email capability) located at the well site. The rig mobile "smart" phone will be used to provide status updates to the CONSULTANT daily, at no charge. Each status update will

provide the current activities on site, including depths, conditions, scheduling adjustments, and any other information requested by the CONSULTANT.

The CONTRACTOR shall also maintain at the well site, or have the ability to rapidly fabricate, commonly used fishing tools (such as overshots, wall hooks, junk baskets, etc.) to accommodate the event that lost tools in the borehole require fishing operations.

In addition, the compressor used for air supply shall be capable of a minimum of 350 pounds per square inch (psi) and 750 cubic feet per minute (cfm). This requirement is for well development and zonal sampling. A smaller "air package" can be used during drilling. The drill pipe shall have a minimum 5½-inch inside diameter (I.D.), and the airline shall have a minimum 1¼-inch diameter to accommodate adequate air flow.

The drilling rig, pumping equipment and auxiliary equipment used for this project shall be well maintained, and shall meet the standards of OSHA. The rig walkways and stairways shall be guarded with rails to prevent falls, and CONTRACTOR personnel shall utilize a safety harness at all times when ascending the rig derrick. All high-pressure hoses shall be equipped with a safety chain to protect site personnel in the event of hose failure.

Prior to the start of drilling, the CONTRACTOR shall decontaminate the drill rig and downhole tools by steam cleaning. The method and extent of steam cleaning must be approved by the CONSULTANT and OWNER. The CONTRACTOR will be required to provide a letter of certification of the decontamination of the CONTRACTOR'S equipment, prior to utilization. The CONTRACTOR may certify, in writing, the decontamination of critical (downhole) pieces of drilling equipment in lieu of actual steam cleaning, provided the downhole pieces of drilling equipment have not been in contact with any hazardous or toxic materials since the last decontamination. All necessary steam cleaning will be conducted at the CONTRACTOR'S expense.

END OF SECTION

5.0 REPORTS, LOGS, AND RECORDS

5.1 GENERAL

The CONTRACTOR shall keep an accurate and legible daily log and record of all drilling, testing, and construction, describing all geologic material encountered during drilling, the depths at which changes in formation occur, and all difficulties or unusual conditions encountered. The logs and records shall also show the method of completing the well, including the lengths of the well casing and well screen installed and the volume of all annular fill and seal materials. The forms for penetration rate log, the daily driller's report, and the drilling fluid control log must be approved by the CONSULTANT.

5.2 PENETRATION RATE LOG

During the drilling of the borehole, a time log shall be kept showing the actual penetration time required to drill each foot of the borehole. The types of bits used in each interval of the borehole shall be noted on this log and whether designed for soft, medium, or hard formations, including approximate weight on the bit and rotation speed (RPM) of the bit, and any other information that may be requested by the CONSULTANT. These logs shall be available for review by the CONSULTANT throughout the drilling program and shall be delivered to the CONSULTANT upon completion of drilling.

5.3 DAILY DRILLER'S REPORT

During the drilling of the borehole, a detailed and up-to-date driller's report shall be maintained and **provided electronically** to the CONSULTANT at least once daily, via email, text message, or purpose-built smartphone application (such as, *Crew*, *Slack*, or approved equal). The hardcopy daily driller's reports shall be recorded on forms approved by the CONSULTANT. The reports shall give a complete description of all formations encountered; number of feet drilled; number of hours on the job; shutdown due to breakdown; any occurrence of lost circulation conditions, low penetration rate conditions, or unexpected problems (in accordance with Sections 6.4, 6.5 or

6.6 of this specification); drilling fluid additives used; length and type of casing set; volumes of filter pack and annular seal installed, and such other pertinent data as may be requested by the CONSULTANT. CONTRACTOR personnel will submit the reports to the CONSULTANT daily.

5.4 DRILLER'S LOG

During the drilling of the borehole, the CONTRACTOR shall prepare a detailed driller's log in compliance with the requirements of the ADWR. The log shall include the reference point for all depth measurements, a generalized description of each formation encountered, the depth at which each formation is encountered and the thickness of each formation. The lithologic log prepared by the CONSULTANT will be made available to assist the CONTRACTOR in the preparation of the driller's log. A copy of the driller's log shall be furnished to the CONSULTANT upon completion of drilling, prior to acceptance of the well.

5.5 DRILLING FLUID RECORD

During the drilling of the borehole, a log of drilling fluid properties shall be maintained by the CONTRACTOR. The drilling fluid record will be recorded on an American Petroleum Institute (API)-approved form, and shall document all items listed in Section 6.2. The drilling fluid records shall be available for review by the CONSULTANT and OWNER throughout the course of drilling, and the logs shall be delivered to the CONSULTANT upon completion of each day's work activities.

END OF SECTION

6.0 DRILLING FLUID CONTROL PROGRAM

6.1 DRILLING FLUID CONTROL PLAN

The CONTRACTOR shall provide a drilling fluid control plan to the CONSULTANT 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. The CONSULTANT must approve the drilling fluid control plan. Drilling fluid additives should be certified by the National Sanitation Foundation (NSF).

6.2 DRILLING FLUID TESTING

The CONTRACTOR shall retain an experienced drilling fluid engineer as a SUBCONTRACTOR. The CONTRACTOR'S selection of a drilling fluid engineer will be subject to approval by the CONSULTANT. The drilling fluid engineer will be available within a 2-hour travel time of the sites during all drilling and well construction operations. Drilling fluid tests will be required during periods when any drilling fluid additives (not only 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 are those 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 circulating 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 CONSULTANT. 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 CONSULTANT.

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, (including type,

amount, time, and depth); (3) variances or modifications from the agreed upon fluid program such as time, depth, reason, and authorization.

The CONTRACTOR is responsible for maintaining an adequate supply of drilling fluid additives at the drilling site and for the removal of all drilling fluids and additives from the borehole during development of the well. The above ground mud tanks shall have a minimum depth of 6 feet and a total volume no less than that of the reamed borehole (approximately 3,234 cubic feet or about 24,190 gallons, based on the preliminary well design). The mud tanks shall contain at least one baffle, to assist with the separation of cuttings and suspended solids from the drilling fluid. The specific dimensions and design of the mud tanks must be approved by the CONSULTANT.

6.3 GENERAL REQUIREMENTS

During the drilling and reaming of the borehole, and the installation of the well, the CONTRACTOR will be responsible to minimize the chemical and biological disturbance of the vadose zone and saturated alluvial 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. Safety Data Sheets (SDS's) from the manufacturer for all drilling fluid additives must be provided to the CONSULTANT for review prior to their use. The CONSULTANT 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, lost circulation);

5. Protection of the integrity of the boring during drilling, zonal sampling, and well installation operations, and
6. Complete and accurate geophysical logging of the borehole.

6.4 LOST CIRCULATION

During drilling or reaming operations, if Lost Circulation Conditions occur, then the OWNER will compensate the CONTRACTOR for the period of drilling under Lost Circulation Conditions at the CONTRACTOR'S hourly rate indicated in the Bid Schedule (Rig Hourly Rate with Crew), in lieu of footage compensation. The OWNER will also provide compensation at a rate of cost plus 10 percent markup to the CONTRACTOR for all drilling fluid materials and additives used during the period of Lost Circulation Conditions. If lost circulation is the result of the CONTRACTOR'S operations or activities (e.g., excessive fluid weight), all costs to regain circulation shall be borne by the CONTRACTOR.

“Lost Circulation Conditions” under this Section shall apply only when there is a loss of drilling fluid to the formation that exceeds the maximum available discharge rate of water into the borehole, to the extent that the fluid level in the annulus outside the drill pipe cannot be maintained to a level above the base of the surface casing for at least one (1) hour, due to no fault of the CONTRACTOR.

The CONTRACTOR is responsible to notify the CONSULTANT immediately upon the occurrence of Lost Circulation Conditions, and to document the times, quantities, and circumstances of Lost Circulation Conditions during each occurrence. Failure of the CONTRACTOR to promptly notify the CONSULTANT of Lost Circulation Conditions will void the CONTRACTOR'S opportunity to implement this clause, but will not affect the CONTRACTOR'S responsibility to maintain the integrity of the borehole, as required in Sections 1.4.3 and 6.3 of this Specification.

The conditions of this Section shall apply from the beginning of the period of lost circulation, and shall continue only until such time that the drilling fluid level can be maintained within the

surface casing. After an initial Lost Circulation Conditions event has occurred, should circulation be lost again, the conditions of this paragraph will go into effect immediately, and continue until such time as drilling fluid circulation is regained, as described in this paragraph.

6.5 LOW PENETRATION RATE

During drilling or reaming operations, if a formation is encountered that results in a penetration rate of less than 4.0 feet per hour for a period of at least two (2) continuous hours, while at least 1,500 pounds per diameter inch is applied to the drill bit, then the OWNER will compensate the CONTRACTOR for the period of Low Penetration Rate Conditions at the CONTRACTOR'S hourly rate indicated in the Bid Schedule (Rig Hourly Rate with Crew), in lieu of footage compensation. The OWNER will also provide compensation at a rate of cost plus 10 percent markup to the CONTRACTOR for all drilling bits used during Low Penetration Rate Conditions. During Low Penetration Rate Conditions, the CONTRACTOR will credit the prorated values of used drilling bits to the OWNER.

The CONTRACTOR is responsible to notify the CONSULTANT immediately upon the occurrence of Low Penetration Rate Conditions, and to document the times, quantities, and circumstances of Low Penetration Rate Conditions during each occurrence. Failure of the CONTRACTOR to promptly notify the CONSULTANT of Low Penetration Rate Conditions will void the CONTRACTOR'S opportunity to implement this clause. The conditions of this Section shall apply from the beginning of the time period of Low Penetration Rate Conditions (less than 4.0 feet per hour), and shall continue only until such time as drilling is resumed at a rate of 4.0 feet per hour or greater.

Upon invocation of this Section, if requested by the CONSULTANT, the CONTRACTOR will trip the drill string out of the hole for observation and documentation of the drill bit conditions by the CONSULTANT. The conditions of this Section shall apply only if the CONSULTANT'S observation of the drill bit does not indicate excessive bit wear, or improper bit type, that would substantially decrease the penetration rate. In the event that the drill bit observation by the

CONSULTANT indicates that this Section applies, the time expended for drill bit removal will be paid by the OWNER under the conditions of this Section. If the CONSULTANT is not notified during the initial 2-hour period of low penetration, or if bit observation by the CONSULTANT reveals excessive wear or improper type, the provisions of this clause will not be invoked.

6.6 UNEXPECTED PROBLEMS

In the event the CONTRACTOR encounters unexpected drilling or well installation problems that are not otherwise addressed by the Lost Circulation or Low Penetration portions of this technical specification (Sections 6.4 and 6.5, respectively), and provided that it is determined, at the sole discretion of the CONSULTANT, that the CONTRACTOR is not responsible for the unexpected problem, then the CONTRACTOR shall provide written Weekly Cost Increase Reports to the CONSULTANT and OWNER, itemizing all additional costs that have resulted from CONTRACTOR efforts to resolve the unexpected problem. Each Weekly Cost Increase Report will include:

- Itemized additional costs, with backup documentation where appropriate;
- All additional materials and rental equipment charges (at cost plus 10%);
- Additional time expended by the drilling rig and crew to resolve the problem (charged at the rig rate indicated in the bid schedule).

Conditions within the CONTRACTOR's control, including but not limited to: equipment failure, insufficiently plumb and aligned borehole, or inadequate drilling fluid properties will be considered indications of CONTRACTOR responsibility for the unexpected problem. If it is determined, at the sole discretion of the CONSULTANT, that the CONTRACTOR is not responsible for the unexpected problem, the CONTRACTOR may pursue appropriate cost recovery actions with the OWNER in accordance with the Contract Documents.

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

7.0 WELL DRILLING AND INSTALLATION

7.1 GENERAL DRILLING METHODS

Drilling will be conducted by the reverse circulation rotary drilling method. The CONTRACTOR is responsible for designing and controlling a drilling program that conforms to this specification.

7.2 SURFACE CASING INSTALLATION

7.2.1 Drilling

The surface casing installation for the well shall be conducted under the observation of the CONSULTANT. The surface borehole shall be drilled to a minimum 30-inch diameter, to a depth of 39 feet below land surface (bls). The CONSULTANT and OWNER reserve the right to direct the drilling of the surface borehole to a greater depth depending on geologic formations and other subsurface conditions. The surface boring may be drilled using a rotary drilling method as described in Section 1.6 and 7.1, or by use of the bucket auger (solid stem auger) drilling method.

During the drilling of the surface borehole, the CONTRACTOR shall collect and preserve for the CONSULTANT samples of the drilled cuttings collected at 10-foot intervals. The samples shall be placed in 4½-inch by 6-inch cloth sacks (Hubco or equivalent) furnished by the CONTRACTOR.

7.2.2 Materials

7.2.2.1 Surface Casing

The surface casing for the well (Figure 2) shall be new low-carbon steel (LCS), manufactured in accordance with ASTM Specification A53 Grade B steel or ASTM Specification A139 Grade B steel. The surface casing shall have a 24-inch outside diameter (O.D.) and have a minimum 0.375-inch wall thickness. The minimum length of the surface casing shall be 40 feet, to allow for a minimum 1-foot stickup above land surface.

Prior to casing installation, the CONTRACTOR shall submit certified test reports to the CONSULTANT to demonstrate compliance with the physical and chemical properties of the steel surface casing, as specified herein.

7.2.2.2 Surface Cement Grout Seal

The surface cement grout seal material shall consist of cement slurry containing 5.2 to 6.0 gallons of water per 94-pound sack of Portland cement. The Portland cement shall conform to ASTM Standard C150, Type II. The cement grout weight shall be measured prior to installation, as an indicator of the cement-water ratio. The cement grout slurry shall not exceed 17.0 pounds per gallon (lb/gal) (approximately 127 pounds per cubic foot, lb/ft³). The cement grout slurry may contain sand, which shall not exceed 50 percent by volume of the cement. Bentonite may be used as an additive, and must be in powder form and shall not exceed 4 percent by volume of the cement, or cement and sand. Water added for bentonite shall not exceed 1.3 gallons per 1.88 pounds of bentonite (2 percent by weight in cement). Accelerator additives, such as calcium chloride, shall not exceed 2 percent by weight of the cement. For information purposes, an example of a sand cement mix design is presented in Appendix A. Water used for preparing the grout slurry shall be potable. The water source and specific constituents of the cement grout must be approved by the CONSULTANT.

If the cement grout is not mixed on site, the CONTRACTOR must provide the specific constituents of the cement grout to the CONSULTANT prior to placement of the grout. The cement grout slurry shall be mixed thoroughly and must be free of lumps to the satisfaction of the CONSULTANT. Cement grout that does not comply with this specification will be rejected.

7.2.3 Surface Casing Installation

Details for the surface casing construction are shown on Figure 2. The surface casing, conforming to Section 7.2.2.1, shall be furnished and placed from 1 foot above the ground surface to at least 39 feet bls. The surface casing installation shall be conducted under the observation of the CONSULTANT.

7.2.4 Surface Cement Grout Installation

Cement grout slurry conforming to the specification in Section 7.2.2.2 shall be placed from the base of the surface casing to the ground surface. The CONTRACTOR shall be responsible to maintain an equalization of pressures to the extent necessary to prevent collapse of the surface casing during cement grout installation. The grout seal shall completely fill the annular space and form a continuous seal between the surface casing and the wall of the borehole. To accommodate the reverse circulation rotary drilling method, the surface casing grout seal may be placed in two separate installations to completely extend from the base of the surface casing to the ground surface. The surface casing shall be maintained centered in the borehole during and after cement grout installation. The method of grout installation must be approved by the CONSULTANT. A minimum curing time for the surface casing grout seal is 12 hours, with the cement grout obtaining a compressive strength of at least 500 pounds per square inch (psi).

7.3 PILOT BORING

7.3.1 Pilot Boring Drilling

The pilot borehole shall be drilled to a depth of approximately 1,225 feet bls, and shall have a minimum 16-inch diameter unless otherwise approved by the CONSULTANT. The boring shall be drilled using the methods described in Sections 1.6 and 7.1, and in compliance with the drilling fluid control program described in Section 6.0.

The CONTRACTOR shall take all diligent care to produce a plumb and straight boring. Single-shot deviation surveys (“A-1 Sureshot” or equal) will be required during the drilling of both pilot and reamed borings. Single-shot deviation surveys will be performed in the drill string at intervals of approximately 100 feet, from the base of the surface casing to the total depth of the boring, unless otherwise designated by the CONSULTANT. Surveys will be recorded on a 3-degree target which will be replaced each time a survey is performed. The borehole plumbness will be maintained at one-half (1/2) degree or less at all times. If at any single location the survey results indicate that the borehole plumbness has exceeded the specified tolerance, the CONTRACTOR

will be responsible for corrective measures to re-align the borehole until a survey indicates alignment is within acceptable limits. All survey results will be recorded on the geolograph logs and the daily drilling forms. Repeat single-shot deviation surveys may be required if requested by the CONSULTANT to verify the accuracy and repeatability of the tool.

During the drilling of the pilot borehole, the CONTRACTOR shall collect and preserve for the CONSULTANT samples of the drill cuttings collected at 10-foot intervals. The CONTRACTOR shall provide an acceptable means of sampling the drilled cuttings at the discharge pipe. A sump-type or baffle-type sample catching devise shall be provided by the CONTRACTOR. Each cutting sample shall be carefully collected from the sampling point, and the sample catching device shall be cleaned of all cuttings after each sample is taken.

The samples shall be placed in 4½-inch x 6-inch cloth sacks (HUBCO or equal) furnished by the CONTRACTOR. In addition, as an on-site visual record of the borehole stratigraphy, each sample shall be laid out in a sample storage area on a waterproof tarp or ground cloth for each sampled interval in descending order. The storage area and ground cloth must allow samples to be maintained in sequence and unmixed with surface material or other samples until they have been examined and logged by the CONSULTANT. Prior to the start of drilling, the CONTRACTOR shall submit details of the proposed formation sampling method to the CONSULTANT, including the specific sampling equipment (e.g., sample collection box) to be used. The sampling program and equipment must be approved by the CONSULTANT.

7.3.2 Geophysical Logging

Geophysical logging from a depth of 39 feet bls to the total depth of the boring shall be conducted at the cessation of drilling of the pilot boring. After the pilot boring has been reamed to its final diameter of 22-inches, a final caliper log will be conducted to confirm the diameter of the borehole. The CONTRACTOR shall retain a geophysical logging company as a SUBCONTRACTOR for the logging at the well site including the final caliper log of the reamed

borehole. The geophysical logging, including the pilot hole logging and the final caliper log of the well, shall be conducted under the observation of the CONSULTANT.

The geophysical logging suite for the borehole will include the following logs:

1. Spontaneous Potential and Resistivity Logs (Electric Log);
2. Natural Gamma Ray Log;
3. Dual Guard Log;
4. 3-Arm Caliper Log (2 surveys: pilot borehole and reamed borehole)
5. Magnetic Deviation Survey
6. Acoustic Log (Sonic Log)

The CONTRACTOR shall keep the borehole full of drilling fluid at all times during geophysical 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 logging tools can be run to the total depth of the pilot borehole and reamed boring without interference by obstructions or tight sections in the boring.

A minimum of three (3) field copies of each geophysical log shall be provided to the CONSULTANT upon completion of logging. In addition, a total of 5 (five) final paper copies of all logs and an electronic copy of all logs in Windows metafile (*.wmf) format, or other CONSULTANT-approved format, shall be provided to the CONSULTANT no later than 10 working days after completion of logging.

7.3.3 Depth-Specific (Zonal) Sampling and Testing

After the completion of geophysical logging of the boring, the CONTRACTOR shall collect a zonal groundwater sample(s) at depth(s) designated by the CONSULTANT. For bidding purposes, it is anticipated that one (1) zonal sample will be collected from the pilot borehole, although the CONSULTANT and OWNER 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, and standby while the CONSULTANT conducts a falling head test. The required method of sample collection is:

1. The borehole below each sample interval will be filled with clean gravel or sand. The portion of the borehole immediately beneath the interval to the sampled shall be sealed with no less than 5 feet of bentonite pellets or chips. The bentonite shall be installed to the appropriate depth, which shall be measured (tagged) with a wireline or other measurement device that has been approved by the CONSULTANT.
2. A minimum 4-inch I.D. steel eductor pipe shall be installed to the sample depth. The eductor pipe shall have a bottom cap and be perforated in the bottom 15 to 25 feet.
3. An envelope of clean pea gravel shall be installed around the eductor pipe, to the top of the interval to be sampled. The gravel envelope will be capped with another layer of bentonite pellets or chips (minimum 5 feet in thickness).
4. The sample interval of the borehole shall be purged by air lifting or pumping for an adequate period to evacuate the drilling fluid from the borehole to the extent that a representative zonal sample can be obtained. The equipment used during purging and sampling operations must be approved by the CONSULTANT, and shall be capable of providing a discharge of no less than 50 gallons per minute (gpm) of water from the sampling interval (subject to the limitations of the formation being sampled). The bentonite seals must remain intact throughout the purging and sampling period for each zonal sample interval, to the satisfaction of the CONSULTANT. If it is determined that the bentonite seals were breached during purging, all time spent purging prior to the breach will be at the CONTRACTOR'S own expense. Additionally, if a zone is improperly set, the CONTRACTOR will be required to remove the sampling tool and clean out the borehole back down to sample interval at the CONTRACTOR'S own expense. The CONTRACTOR may also be required to reimburse additional CONSULTANT fees if additional expenses are incurred due to breached seals and/or improperly set zones, in accordance with Section 1.4.3. It is anticipated that approximately 12 hours of airlifting and/or pumping will be required for each zonal sample. After the interval to be sampled has been purged to the satisfaction of the CONSULTANT, the CONSULTANT will collect the water sample from the discharge line.
5. A measurement of the static water level shall be obtained by the CONTRACTOR for the test interval. The CONTRACTOR then will standby while the CONSULTANT performs a falling head test on the zone. This process will consist of installing an electronic pressure transducer below the water level, injecting a "slug" of water of know volume, and recording the change in water level until the water level has returned to static conditions. The estimated standby time for each falling head test is approximately 2 hours.

6. After zonal sampling and testing has been completed for each interval, the CONTRACTOR shall raise the eductor pipe to the next interval, and the procedure shall be repeated for each sample location.

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 CONSULTANT. The zonal samples need not be free of sand grains, but must be reasonably clear.

7.3.4 Borehole Reaming

After completion of zonal sampling and testing, the borehole shall be reamed to its final depth and diameter, as shown on Figure 2. The borehole shall have a 22-inch diameter from 39 to 1,225 feet bls, unless otherwise approved by the CONSULTANT. The CONSULTANT or OWNER reserve the right to direct the reaming to greater or lesser depths, in accordance with the final well design. CONTRACTOR payment for the borehole reaming will be in accordance with the footage price provided in the bid schedule, as authorized by the OWNER. The boring shall be drilled/cleaned out using the methods described in Sections 1.6 and 7.1, and in compliance with the drilling fluid control program described in Section 6.0.

7.4 PRODUCTION WELL INSTALLATION

7.4.1 Materials

The materials to be installed in the boring are described below. The CONTRACTOR shall be responsible for the timely delivery of the well casing, well screen and other materials to the drilling site, as determined by the CONSULTANT and as required to complete the well installation program. The well casing and well screen must be approved by the CONSULTANT prior to their installation.

The final lengths and locations of the well casing and well screen will be determined by the CONSULTANT based on analysis of the geophysical logging data and zonal sampling data from the pilot borehole. Depending on which day of the week that the final zonal sample is collected and submitted to the laboratory, the CONSULTANT anticipates a period of up to 96 hours after

cessation of zonal sampling to prepare the final well design, based on the analytical results. No standby time will be allowed during this period.

Upon the completion of the borehole reaming to its final depth and diameter, as determined by the CONSULTANT, the CONTRACTOR shall immediately commence well installation operations.

The CONSULTANT may, at its discretion, reject any materials that do not meet these specifications or tolerances thereof, as determined by the CONSULTANT. Any additional standby time or other costs incurred by the CONTRACTOR as a result of the rejection of any specified materials provided by the CONTRACTOR or its suppliers shall not be compensated by the OWNER and shall be the sole responsibility of the CONTRACTOR.

7.4.1.1 Well Casing Material

The blank well casing for the well shall be new, High Strength Low Alloy (HSLA) casing manufactured from steel conforming to ASTM specification A606 Type 4 steel (Figure 2). The well casing shall have a 14½-inch O.D. and a 0.3125-inch wall thickness. The casing shall be new, and free of rust, pits, or other defects. The total length of the blank well casing for the well (including the 10-foot bottom sump and the 2-foot stickup) will be 1,082 feet (Figure 2).

The well casing shall be factory-assembled in not less than 40-foot-long sections (except for the casing sections used for the bottom sump and casing stickup). The well casing sections shall contain one spiral seam along the casing axis, and shall contain no more than one circumferential seam per 10 linear feet, unless otherwise approved by the CONSULTANT. Ends of casing lengths shall be as described in Section 7.4.2.1.

The bottom sump for the well shall consist of a 10-foot-long section of blank well casing as described in this Section, installed at the base of the screened interval. The bottom sump shall be capped with a bottom plate consisting of the same steel composition and same wall thickness as specified above.

Prior to casing installation, the CONTRACTOR shall submit certified test reports to the CONSULTANT to demonstrate compliance with the physical and chemical properties of the well casing steel that are specified herein.

7.4.1.2 Well Screen Material

The well screen for the well shall be new HSLA Ful Flo louvered screen manufactured from steel conforming to ASTM specification A606 Type 4 steel. The well screen shall have a 13⁷/₈-inch I.D. and 0.3125-inch wall thickness, with horizontal louvered openings. The horizontal louvered openings shall be factory-installed in the well screen with a minimum 2⁵/₈-inch slot length, in rows that are spaced approximately 1 inch apart in the vertical direction. There shall be 8 perforations per circle to provide 96 openings per linear foot. The screen slot size shall be 0.050 inches, and the open area of the screen shall be no less than 12.5 square inches per foot. The openings in the screen shall be machine made, horizontal to the axis of the casing, and of a louver form with the aperture facing downward. Ends of the screen lengths shall be as described in Section 7.4.2.1. The anticipated length of the well screen shall be 140 feet (Figure 2). The CONTRACTOR shall obtain from the well screen manufacturer, the screen tensile strength (pounds), collapse strength (psi), screen weight (pounds per linear foot), and maximum recommended hang weight (pounds). This information shall be provided to the CONSULTANT prior to delivery of the well screen to the site.

Prior to the well screen installation, the CONTRACTOR shall submit certified test reports to the CONSULTANT to demonstrate compliance with the physical and chemical properties of the well screen, as specified herein.

7.4.1.3 Filter Pack Sand and Disinfectant Material

The filter pack shall be Tacna 6-16 mesh sand or equivalent, consisting of clean, well-rounded grains that are smooth and uniform. The filter pack shall be siliceous with a limit of 2 percent by weight, calcareous material. The filter pack material shall be obtained from a source that has been approved by the CONSULTANT, and shall be free of shale, mica, clay, dirt, loam, organic

impurities of any kind, and shall not contain iron or manganese in a form or quantity that will adversely affect the water quality.

Samples of the filter pack sand and a sieve analysis (percent retained through U.S. Standard sieve numbers 4, 8, 10, 16, 30, 40, 50, 100, and 200) of the filter pack material shall be submitted to the CONSULTANT for approval, a minimum of 3 days prior to delivery of the filter pack to the well site. The filter pack material shall be contained in a temporary storage area at the well site in such a manner as to prevent contamination. The filter pack material shall be bagged in approximately 3,000-pound (about one cubic yard) “super sacks”. Each bag must be labeled with its actual weight. Any filter pack material delivered unbagged or unlabeled will be rejected.

During installation of the filter pack, an NSF-60 approved liquid sodium hypochlorite solution containing approximately 5-percent to 15-percent available chlorine may be used in accordance with American Water Works Association (AWWA) Standard C654 for disinfection of wells, in such a way that will produce a chlorine concentration of not less than 50 milligrams per liter (mg/L) in the entire volume of fluid within the well. Documentation shall be provided to the CONSULTANT prior to installation to demonstrate the “shelf life” of the hypochlorite has not expired, and it shall be flushed into the well through a closed system that will prevent workers from exposure to chlorine vapors. The specific hypochlorite concentration and installation method must be approved by the CONSULTANT.

7.4.1.4 Bentonite Seal and Formation Stabilizer Material

The bentonite seal material shall consist of sodium bentonite pellets or bentonite chips. The bentonite seal material shall contain no hazardous materials or gypsum. For bidding purposes, a 50-foot sealed interval of bentonite chips shall be installed below the annular cement grout seal of the well (Figure 2). A sample of the bentonite chip material shall be provided to the CONSULTANT for approval no less than 24 hours prior to installation.

The formation stabilizer shall consist of clean aggregate or sediment material. The formation stabilizer material must be composed of inert materials, containing no organic or hazardous

materials. For bidding purposes, an acceptable formation stabilizer would consist of clean siliceous pea gravel with 5-foot bentonite seals (chips) installed at 100-foot intervals. The specific formation stabilizer material must be approved by the CONSULTANT. A sample of the formation stabilizer material shall be provided to the CONSULTANT for approval no less than 24 hours prior to installation.

7.4.1.5 Cement Grout Material

The cement grout seal material shall consist of a neat cement slurry containing 5.2 to 6.0 gallons of water per 94-pound sack of Portland cement. The Portland cement shall conform to ASTM Standard C150, Type II. The cement grout slurry may contain pozzolanic material (fly ash) as an additive, which complies with ASTM Standard C618, and which shall not exceed 50 percent by volume of the cement. No non-pozzolanic aggregate or sand may be added to the cement grout. An example of a pozzolan cement mix design is presented in Appendix A. The cement grout weight shall be measured prior to installation as an indicator of the cement-water mix ratio. The cement grout slurry shall not exceed 15.6 lb/gal (117 lb/ft³). Accelerator additives shall not be used unless approved by the CONSULTANT. Water used for preparing the grout slurry shall be potable. The specific constituents of the cement grout must be approved by the CONSULTANT.

The CONTRACTOR must provide a cement mix design, the mix water source, and the specific constituents of the cement grout to the CONSULTANT prior to the start of cementing operations. The cement grout slurry must be mixed thoroughly and be free of lumps, to the satisfaction of the CONSULTANT. Cement grout that does not meet the requirements of this specification, or is not adequately mixed will be rejected.

7.4.2 Casing and Screen Installation

During the installation of the well casing, the boring shall be kept full of drilling fluid of the type specified in Section 7.0 and be free from any obstructions detrimental to completing the casing installation. The well casing shall be set centered in the borehole so as not to interfere in any way with the grout seal, filter pack, well installation, or maximum efficient operation of pumping

equipment within the well casing or screen. The CONTRACTOR will be required to work continuously, on a 24-hour per day, 7-day week basis, while installing and completing the well.

The well casing and well screen for the well shall be set by the CONTRACTOR at the depth intervals specified by the CONSULTANT. HSLA steel casing centralizers that have been approved by the CONSULTANT shall be secured to the well casing and screen at intervals of not greater than 80 feet. The casing shall be hung in suspension until the filter pack and cement grout seal have been installed.

7.4.2.1 Joints in the Well Casing

Joints in the steel well casing and well screen shall be field welded in accordance with applicable provisions of the AWWA Standard C206 for welded joints. A welding sequence will be followed that will avoid excessive distortion. All well casing joints or overlaps shall be made watertight to prevent the degradation of the water supply by the migration of poor-quality water. All welding shall be performed by an experienced welder. An affidavit of compliance with the welding provisions of this section shall be provided to the CONSULTANT prior to the acceptance of the production well. The affidavit of compliance will certify that all welding conducted during this project was performed in accordance with all applicable provisions of this Section of this specification.

If the casing or screen sections are butt-welded without the use of welding rings, the ends of the casing lengths shall be ground, or sufficiently scarfed, to remove sharp edges or burrs. The ends of each casing section shall not vary more than 0.010 inch at any point from a true plane at right angles to the axis of the casing. The casing and screen end shall be beveled at one end to allow complete penetration of the welds.

If the casing or screen sections are joined with welding rings, the ends of the casing lengths shall be ground, or sufficiently scarfed, to remove sharp edges or burrs. One end of the casing section shall be furnished with a welding collar of the same wall thickness and have the same physical and chemical properties as the corresponding casing sections. The welding collars shall have a minimum

5-inch length, and shall fit the O.D. of the well casing within 0.0625-inch diametrical clearance. The welding collars shall be delivered to the well site connected to the casing sections at one end with factory-welded connections. The inside edge of the welding collars shall be ground or sufficiently scarfed to remove sharp edges or burrs. Three alignment holes shall be provided in each welding collar (spaced at 120°), to ensure proper abutment of the casing sections. The alignment holes shall be no larger than 1 inch in diameter, and shall be completely filled with fillet welding. The ends of each casing section shall not vary more than 0.010 inch at any point from a true plane at right angles to the axis of the casing.

7.4.3 Annular Materials Installation

7.4.3.1 Filter Pack and Disinfectant Installation

Filter pack gravel, conforming to the specifications of Sections 7.4.1.3, shall be placed to completely fill the annulus in the specified interval (Figure 2). During the time of placement, fluid circulation shall be maintained through a CONSULTANT-approved swab block located no less than 40 feet below the fill depth of the filter pack sand. The swab block shall be periodically reciprocated to remove fine-grained material, prevent bridging, and aid in settling the filter pack in the borehole. Drilling fluid shall be maintained throughout the full depth of the well to the land surface and the well casing and screen shall be maintained in tension, until the filter material placement has been completed to the specified level. Care shall be taken to avoid bridging during installation of the gravel.

In accordance with applicable provisions of the AWWA Standard A100 for water wells, before the introduction of filter pack into the well annulus, the drilling fluid shall be reconditioned until it has the following properties:

- Weight – no greater than 9.1 lb/gal (68 lb/ft³);
- Viscosity – no greater than 30 seconds per quart; and
- Sand content – no greater than 1 percent by volume.

At the discretion of the CONSULTANT, the above standards may be exceeded in cases where different drilling fluid properties are required to protect or stabilize the well due to unstable borehole conditions, or other site-specific circumstances. The CONTRACTOR shall adhere to the standards listed above, unless otherwise approved by the CONSULTANT.

The filter pack shall be installed by use of a tremie pipe. At no time shall the bottom of the tremie pipe be located at a distance of greater than 30 feet above the interval being filled during filter pack placement. The level of the filter pack shall be measured periodically during placement with a wireline sounder, as required by the CONSULTANT. Placement of the filter pack will be continuous, except when additional precautions are necessary to prevent bridging, or while a measurement of the filter pack level is being conducted.

The quantity of filter pack material placed in the annulus shall not be less than that of the calculated volume. Upon completion of the filter pack placement, excess filter pack material will be judged an indication of voids in the gravel envelope and corrective measures shall be undertaken at the CONTRACTOR'S expense. The specific method of filter pack placement and the filter pack material must be approved by the CONSULTANT.

During installation, the filter pack shall be disinfected using hypochlorite or similar agent constituent with the specifications in Section 7.4.1.3. The CONTRACTOR is responsible for the uniform application of the disinfecting agent throughout the filter pack interval, without relying on subsequent mechanical surging action for dispersing the disinfectant. The specific method used to disinfect the filter pack must be approved by the CONSULTANT.

7.4.3.2 Bentonite Seal and Formation Stabilizer Installation

A 50-foot bentonite seal complying with Section 7.4.1.4 shall be installed in the well annulus immediately above the top of the filter pack interval. The CONSULTANT must approve the specific method of bentonite installation.

Once the bentonite seal has been installed and isolates the screened interval of the well from the overlying annulus outside the well casing, the fluid level inside the casing will drop to the static water level of the surrounding formation. To avoid excessive hydraulic pressure from the fluid level outside the well casing, the CONTRACTOR shall flood the interior of the well with potable water from a source approved by the CONSULTANT or OWNER during installation of the bentonite seal. The elevated water level inside the well casing shall be maintained continuously by the CONTRACTOR until at least 24 hours after the cement grout seal has been installed as described in Section 7.4.3.3. The CONTRACTOR is responsible to maintain hydraulic pressures and pumping pressures that will not exceed the collapse strength of the well casing.

Formation stabilizer material complying with Section 7.4.1.4 shall be installed in the annulus for the well within the interval from the top of the cement seal at approximately 850 feet bls to the base of the surface casing (Figure 2). Additional 5-foot bentonite seals shall be installed within the formation stabilizer at 100-foot intervals. The CONSULTANT must approve the specific method of bentonite and formation stabilizer installation.

7.4.3.3 Cement Grout Seal Installation

The well casing grout seal shall consist of a neat cement or pozzolan cement slurry conforming to the specification in Section 7.4.1.5. The cement grout shall be placed to completely fill the annular space between the well casing and the wall of the borehole, from the top of the bentonite seal at approximately 950 feet bls, up to 850 feet bls (Figure 2). An additional cement grout seal conforming to the specification in Section 7.2.2.2 will be installed between the well casing and the surface casing from a depth of 39 feet to land surface (Figure 2).

The cement grout shall be placed by pumping through a tremie pipe. Prior to pumping, the cement grout shall be passed through a ½-inch slotted bar strainer to remove any unmixed lumps. During the cement grout installation, the discharge end of the tremie pipe shall be continuously submerged in the grout until the zone to be grouted is completely filled. During cement seal

installation operations, the CONTRACTOR is responsible to maintain cement slurry hydraulic pressures and pumping pressures that will not reach excessive levels and cause casing collapse.

The well casing shall be hung in tension throughout the grouting operation, until the cement grout has cured sufficiently. The grout seal shall be placed in one continuous operation from the bottom to the top of the interval to be grouted, forming a continuous seal. The minimum curing time for the lower cement grout seal shall be 12 hours or the cement grout obtaining a minimum compressive strength of 500 psi. The specific method of cement grout installation must be approved by the CONSULTANT.

7.5 WELL DEVELOPMENT

Well development shall be accomplished by simultaneously swabbing and airlift pumping. The swabbing tool used for well development must be approved by the CONSULTANT. A dual or triple flanged closed end swab tool is required, unless otherwise approved by the CONSULTANT. The well development for the well shall include an initial quick pass downward, after which the well development shall proceed from the bottom of the screen to the top of the screen, at an average rate of no less than 10 minutes per linear foot of screen, unless otherwise directed by the CONSULTANT. During swab and air-lift development, a discharge rate of no less than 50 gpm must be maintained (unless limited by aquifer characteristics). A non-phosphoric dispersant (such as the Johnson Screen product NW-220 or equal) will be added to the well in accordance with the manufacturer's recommendations, during development operations. The CONTRACTOR shall provide the CONSULTANT with a SDS for all chemical additives used for well development at least 3 days prior to their use. The CONSULTANT must approve the specific type and placement method of all chemical additives prior to their use. Development water shall be contained and/or disposed of by the CONTRACTOR as specified in Section 2.0. Re-use of discharge water will not be allowed. The specific methods, chemical additives, and equipment used for well development must be approved by the CONSULTANT prior to commencement of development operations.

Payment for well development by swabbing and airlift pumping will be based on the unit price per hour shown on the bid schedule and shall apply only to those hours that the development tools are being operated for swabbing and airlifting and will not apply to other time such as trip time. After swabbing is complete, all sand, sediment, and foreign material shall be removed from the bottom of the production well. The CONTRACTOR shall provide the necessary equipment and air compressor capable of performing the required swabbing and airlifting without artificially raising the water level in the well boring.

After swabbing and airlift development, the well shall be further developed by pumping and surging. The specific pump-and-surge development method must be approved by the CONSULTANT. The pump-and-surge development program is anticipated to have a 12-hour duration for the well with pumping rates ranging from 100 to 600 gpm.

7.6 PLUMBNESS AND ALIGNMENT

The CONTRACTOR shall perform and report the well plumbness and alignment tests described in this Section. If the well fails the plumbness and alignment tests, the CONTRACTOR must correct the plumbness and alignment to the satisfaction and approval of CONSULTANT and the OWNER. Plumbness and alignment correction costs will be borne by the CONTRACTOR.

The plumbness and alignment requirements for this well are based on the following projected permanent pump equipment and anticipated conditions:

- The anticipated permanent pump for this well will have minimum **8-inch diameter bowls** and **6-inch diameter column pipe**.
- The deepest anticipated permanent pump setting depth is **1,070 feet below land surface**.
- The static water level is assumed to be approximately **895 feet bls**, and pumping water level is assumed to be approximately **995 feet bls**.
- The anticipated pumping rate of the well is assumed to be approximately **400 gpm**.

7.6.1 Measurement and Reporting

To demonstrate compliance with Sections 7.6.2 and 7.6.3, the CONTRACTOR shall furnish all labor, equipment, and materials to conduct plumbness and alignment tests described in this Section, to the satisfaction of the CONSULTANT and OWNER.

Preliminary tests for plumbness and alignment shall be made by the CONTRACTOR during the drilling of the pilot borehole and after the construction and development of the well is complete. All plumbness and alignment tests will be conducted at the CONTRACTOR'S expense. During the drilling of the pilot borehole, inclinometer (A-1 Sureshot tool or equal) surveys shall be performed by the CONTRACTOR at no less than 60-foot intervals. A 3-degree unit shall be used with the inclinometer, as described in Section 7.3.1. In addition, the CONTRACTOR shall review the results of a magnetic deviation survey of the pilot hole as described in Section 7.3.2, and take required actions to meet the well plumbness and alignment requirements of Sections 7.6.2 and 7.6.3.

The CONTRACTOR shall engage a geophysical logger SUBCONTRACTOR to perform the work described in this Section. The geophysical logger SUBCONTRACTOR must be approved by the CONSULTANT prior to performance of the work, and the CONTRACTOR shall be responsible for the work performed by its geophysical logger SUBCONTRACTOR. After completion of the well construction and development, the geophysical logger SUBCONTRACTOR shall conduct a plumbness and alignment test by use of a gyroscopic survey. The gyroscopic survey shall be conducted with a surface recording gyroscopic (SRG) logging tool or North-seeking gyroscopic logging tool equipped with an accelerometer that has an accuracy of at least $\pm 0.25^\circ$ and a resolution of at least $\pm 0.01^\circ$. The plumbness and alignment of the well shall be determined from the gyroscopic survey data, based on the minimum curvature method or the radius of curvature method. The gyroscopic survey shall be conducted under the observation of the CONSULTANT.

If a SRG gyroscopic logging tool is used, the CONTRACTOR must provide documentation that the logging tool has been properly calibrated by the manufacturer or a qualified technician within the past year. Prior to conducting the gyroscopic survey, the logging tool must be aligned to true North (or an established starting position that has been approved by the CONSULTANT) from a line-of-sight horizontal distance no less than 40 feet from the well. The azimuthal deviation (variance from starting position) of the SRG logging tool shall be measured before and after the gyroscopic logging, and that variance shall not diverge more than 10°.

If a North-seeking gyroscopic logging tool is used, documentation shall be provided prior to performance of the gyroscopic survey, that the tool has been calibrated in an oriented calibration jig or equivalent CONSULTANT-approved calibration process, within the past year. The calibration shall include four measurements at 90° orientations and in at least 2 different inclinations from angles of 5° to 30° from the vertical, to ensure the tool is within calibration limits.

Whether a SRG logging tool or North-seeking gyroscopic logging tool is used, the logging tool shall be centralized on both the top and bottom, with centralizing bands expanded to within 1.0 inch of the inside diameter of the smallest casing or screen interval to be logged.

If requested by the CONSULTANT, the geophysical logger SUBCONTRACTOR shall conduct a 100-foot repeat section to demonstrate the accuracy and repeatability of the gyroscopic data. The 100-foot repeat section must reasonably duplicate that originally-logged section of the well, to the satisfaction and approval of the CONSULTANT and OWNER. The repeat section shall be conducted at no cost to the OWNER or CONSULTANT. Immediately following the completion of the gyroscopic survey, the geophysical logger SUBCONTRACTOR shall provide three (3) field copies of the gyroscopic survey to the CONSULTANT at the well site. Within 10 working days following completion of the gyroscopic survey, five (5) final copies of the gyroscopic survey shall be provided to the CONSULTANT, as well as an electronic original of the logging data in Windows metafile (*.wmf) format, or another CONSULTANT-approved electronic format. The written plumbness and alignment report from the geophysical logger

SUBCONTRACTOR shall include numerical values of the well deviation with deviation units labeled, and also graphical diagrams of the well alignment in both a profile perspective (both Northing and Easting views), and a vertical perspective. The quality and clarity of the gyroscopic log must be approved by the CONSULTANT, and the plumbness and alignment report must be furnished to the CONSULTANT by the geophysical logger SUBCONTRACTOR prior to acceptance of the well.

7.6.2 Well Alignment Requirements

It is the CONTRACTOR's responsibility to drill, install and develop the well with sufficient alignment to permit the unobstructed installation of the permanent pump equipment at the projected setting depth indicated in Section 7.6, and to facilitate the operation of that permanent pump equipment without excessive vibration (not to exceed 0.17 inches per second, root mean square overall, as recommended by the Hydraulic Institute).

To demonstrate compliance with this requirement, the CONTRACTOR shall install a test pump of similar type and dimensions as the permanent pump (the pump length and diameter for the well are assumed to be 10 feet long x 8 inches in diameter), to the deepest anticipated permanent pump setting depth. The installation, operation, and removal of test pump equipment that complies with Section 8.0 of this Specification must be achieved without any well-related obstructions or operational problems. For this well, the deepest anticipated permanent pump setting depth is 1,070 feet bls.

The "*misalignment diameter*" is defined as the horizontal distance between the well casing centerline (as measured by the gyroscopic survey) and the proposed pump centerline (represented by a "best-fit" straight line oriented to minimize its horizontal distance from the well casing centerline). The misalignment diameter shall not exceed one half ($\frac{1}{2}$) the difference between the I.D. of the casing and the O.D. of the anticipated permanent pump column pipe. For this well's preliminary design (Figure 2), the misalignment diameter is represented by one half ($\frac{1}{2}$) the annular distance between the approximately 14-inch casing I.D. and the 6-inch pump

column pipe O.D. Therefore, the misalignment diameter for the well design (Figure 2) is 4.0 inches (Figure 3). The alignment standard of this Section shall apply for this well from the top of the well to the deepest projected pump setting depth of 1,070 feet bls.

The OWNER may waive the requirements for alignment in this Section if it is determined by the CONSULTANT that: (1) the CONTRACTOR has exercised all possible care in constructing the well and the defect is due to circumstances beyond the CONTRACTOR'S control; or (2) the utility of the completed well will not be materially affected.

7.6.3 Well Plumbness Requirements

It is the CONTRACTOR'S responsibility to drill, install, and develop the well with sufficient plumbness to permit the unobstructed installation of the permanent pump equipment at the projected setting depth indicated in Section 7.6, and to facilitate the operation of that permanent pump equipment without excessive vibration (not to exceed 0.17 inches per second, root mean square overall, as recommended by the Hydraulic Institute).

Section 7.6.3 will apply only if the well fails to meet the alignment requirements, in accordance with Section 7.6.2. If the well does not comply with the alignment requirements described in Section 7.6.2, the maximum allowable horizontal deviation from vertical (closure distance) shall not exceed two-thirds ($\frac{2}{3}$) the smallest inside diameter of the casing or screen, per each 100-foot depth interval of the well from the land surface to the projected pump setting. Based on the preliminary well design (Figure 2) and the projected permanent pump setting, the maximum allowable closure distance for this well is 9.3 inches per 100 feet of depth, from the land surface to 1,070 feet bls.

The OWNER may waive the requirements for plumbness in this Section if it is determined by the CONSULTANT that: (1) the CONTRACTOR has exercised all possible care in constructing the well and the defect is due to circumstances beyond the CONTRACTOR'S control; or (2) the utility of the completed well will not be materially affected.

7.7 VIDEO SURVEY

After completion and testing of the well, the CONTRACTOR shall provide a color video survey of the well. The video survey camera shall include both downward-looking and side-view capabilities, and the video survey shall be conducted under the observation of the CONSULTANT. Both the quality and clarity of the well video must be acceptable to the CONSULTANT. Prior to acceptance of the well, the CONTRACTOR shall provide two copies of the final well video (DVD or other CONSULTANT-approved format) to the CONSULTANT.

7.8 COVERING PLATE AND ACCESS PORT

After completion of all testing and surveys, the well shall be temporarily capped with a HSLA covering plate with the same composition and the same wall thickness as the well casing. The covering plate will be secured to the top of the well with a water-tight welded seam. Additionally, the covering plate will be equipped with a ½-inch diameter access port with a watertight threaded cap, to allow for the measurement of water levels.

END OF SECTION

8.0 WELL TESTING

8.1 GENERAL

Aquifer tests to be performed at the well shall consist of a 10-hour step-rate discharge test and a 24-hour constant-rate aquifer test, which will be followed by a 4-hour water-level recovery period. The CONSULTANT and OWNER reserve the right to extend or shorten the test duration.

The CONTRACTOR shall obtain and record water level measurements in half-hour intervals throughout the duration of the 24-hour constant rate aquifer test, or as directed by the CONSULTANT.

8.2 TEST EQUIPMENT

The CONTRACTOR shall furnish pumping equipment capable of pumping at rates of up to 600 gpm (for the step-rate discharge and 24-hour constant-rate aquifer test), with a pumping lift (not including pipe friction losses) of 1,000 feet bls. The pumping equipment shall include satisfactory throttling devices or valves such that the discharge can be adjusted to various rates, potentially below 200 gpm. The test pump setting for the well shall be determined by the CONSULTANT, based on the final well design. The anticipated setting of the test pump inlet is 1,070 feet bls. The pumping unit shall be complete with an ample power source and shall be capable of being operated without interruption for a period of 24 hours for the well.

The pump equipment shall not be removed from the well until after the completion of the water-level recovery test. The CONTRACTOR shall provide a flow meter (that provides readings in gallons per minute) or calibrated orifice as specified in Section 8.3. The CONSULTANT must approve the test pump, motor, metering equipment, and accessories.

8.3 PUMP DISCHARGE

The CONTRACTOR shall operate the test pump at the discharge rate(s) that have been directed by the CONSULTANT. Discharge from the pump shall be controlled by a gate valve and/or engine

throttle, or variable frequency drive (VFD). The discharge shall be controlled and maintained at the specified rate for the entire test duration at the well with an accuracy of plus-or-minus 5 percent.

The pump discharge shall be measured with a propeller-type or magnetic inductive-type flow meter, in addition to a calibrated orifice and manometer installed in the discharge pipe. All in-line flow meters shall be located in a straight portion of the discharge pipe without any bends, valves, or other obstructions that may interfere with the operation and/or accuracy of the meters for a distance of no less than 10 pipe diameters upstream, and for a distance of no less than 5 pipe diameters downstream (unless otherwise recommended by the manufacturer of the meter). At all times during pumping, the discharge pipe shall be oriented in such a manner as to ensure that the pipe remains full of water at the location of the flow meter and calibrated orifice. The discharge pipe shall be equipped with a CONSULTANT-approved spigot or valve for water sample collection.

The CONTRACTOR shall also furnish equipment for measurement of the sand production during pumping (a Rossum Sand Sampler, or equal) in accordance with AWWA Standard A-100. Discharge flow and sand measurement devices must be approved by the CONSULTANT.

The discharge water from the well shall be directed to a point of discharge that has been approved by the CONSULTANT and OWNER. The anticipated discharge point will be within 500 feet of the well site. The discharge piping shall be watertight and capable of conveying the specified flow rates for the specified pumping periods. The CONTRACTOR is responsible for providing adequate piping for the actual distance to the discharge point. The CONTRACTOR is responsible for coordination of any required permits, traffic control, and other considerations that may be required to address potential flooding or pipeline roadway crossings that result from the discharged water.

END OF SECTION

9.0 VISITATION AND INSPECTION

The CONSULTANT and OWNER representatives shall, at any reasonable time during the term of work, be entitled to review the CONTRACTOR'S facilities, its program operation, and the records that pertain to the program.

The CONTRACTOR agrees that the CONSULTANT, OWNER, or any of their duly authorized representatives, shall have access to the CONTRACTOR'S facilities and have the right to examine books, documents, and records of the CONTRACTOR involving transactions related to these specifications.

The CONTRACTOR further agrees to include in all subcontracts hereunder, if any, a provision that the SUBCONTRACTOR agrees that the CONSULTANT, OWNER, or any of their duly authorized representatives, shall have access to the SUBCONTRACTOR'S facilities and have the right to examine any books, documents, and records of the SUBCONTRACTOR involving transactions related to the subcontract and these specifications.

END OF SECTION

10.0 MEASUREMENT AND PAYMENT

10.1 GENERAL

Payment for the lengths, areas, volumes, weights, or times shall be compensation in full for the furnishing of all overhead, labor, materials, tools, equipment, and appurtenances necessary to complete the work in a satisfactory manner as specified with all connections, testing and related work completed. Each item, fixture, piece of equipment, etc., shall be complete with all necessary connections and appurtenances for the satisfactory use of and/or operation of said item. No additional payment will be made for work related to each item unless specifically noted or specified.

The Bid Schedule is presented in Appendix B. A Submittal List has been prepared for the convenience of the CONTRACTOR and is presented in Appendix C. The CONTRACTOR should refer to these Technical Specifications for this project, as the CONSULTANT makes no guarantee or warrantee that the Submittal List includes all requirements placed on the CONTRACTOR by these Technical Specifications or the OWNER contract documents. This Submittal List is limited to only these Technical Specifications for this project, and does not include any other requirements outside the scope of these Technical Specifications.

10.2 BASIS OF MEASUREMENT AND PAYMENT

Compensation for all work specified to be performed under this specification will be made under the payment items presented in this Section. The prices for the said payment items shall be full compensation for all costs in connection therewith. Principal features of the work to be included under the various payment items will be on a linear foot, hourly, per ton, per cubic foot, per cubic yard, per each, or lump sum basis, as designated. Measurement of completed work will be made in place, with no allowance for waste. Measurement of lengths, areas, volumes, weights, or time will be based on the dimensions indicated in this Section, unless altered by the CONSULTANT or OWNER to accommodate field conditions, but shall not exceed bid item amount unless authorized by OWNER.

10.3 BID SCHEDULE PAYMENT ITEMS

The payment schedule for well construction, development, and testing the Well are presented in the Bid Schedule. Bid Items listed as “Allowance” in the Bid Schedule may not be completed, at the discretion of the OWNER. However, bids will be evaluated based upon to cumulative value of “Allowance” and “Not-Allowance” bid items. A detailed description of each item of the payment schedule is presented below.

10.3.1 Item 1 – Mobilization and Demobilization

Item 1 consists of moving and assembling all drilling, testing, and support equipment to the job site, removing the equipment from the job site when the work is completed, and job site cleanup. Payment will be made on a lump sum basis. Up to 50% of the initial Mobilization/ Demobilization lump sum cost can be billed after mobilization to the well. The remaining 50% of the lump sum cost can be billed after demobilization from the well site and approval of the job site cleanup.

10.3.2 Item 2 – Surface Casing Material and Installation

Item 2 consists of all labor, equipment, material costs associated with drilling the surface boring for the well, and placement of the surface casing and surface grout seal in accordance with Section 7.2. This item includes: drilling the surface borehole in accordance with Section 7.2.1; providing the materials specified in Sections 7.2.2.1 and 7.2.2.2; and installation of the surface casing in accordance with Sections 7.2.3 and 7.2.4. Payment will be made on a linear foot basis.

10.3.3 Item 3 – Pilot Hole Drilling and Sampling

Item 3 consists of all labor, equipment, and material costs associated with drilling the 22-inch diameter borehole, geophysical logging, zonal sampling, falling head testing, and borehole cleanout for the well in accordance with Sections 7.3.1, 7.3.2, 7.3.3, and 7.3.4. Payment will be made on a linear foot, per each (per sample), hourly, and lump sum basis.

10.3.4 Item 4 – Casing and Screen Material

Item 4 consists of the material cost of the well casing and well screen for the well, as specified in Sections 7.4.1.1 and 7.4.1.2. Item 5 also includes the bottom well plate as specified in Section 7.4.1.1. Payment will be made on a linear foot basis for actual quantities installed and approved, and after placement is complete.

10.3.5 Item 5 – Casing and Screen Installation

Item 5 consists of all labor and equipment costs required for the installation of the casing and well screen for the well, including welding requirements, logs, and records, as specified in Sections 5.0 and 7.4.2. Payment will be made on a linear foot basis.

10.3.6 Item 6 – Annular Material and Installation

Item 6 consists of all labor, equipment, and material costs to furnish and install the filter pack, disinfectant, bentonite seal, and formation stabilizer in the well, as specified in Sections 7.4.3.1 and 7.4.3.2. The item 6 annular material volumes as indicated in the Bid Schedule are based on the calculated volume plus a 30 percent overage. Payment will be made on a per ton and per cubic foot basis for actual quantities installed and approved.

10.3.7 Item 7 – Cement Grout Material and Installation

Item 7 consists of all labor, equipment and material costs to furnish and install the cement grout seals in the well in accordance with the requirements of Sections 7.4.1.5 and 7.4.3.3. The item 7 cement grout material as indicated in the Bid Schedule is based on the calculated volume plus a 30 percent overage. Payment will be made on a per cubic yard basis for actual quantities installed and approved.

10.3.8 Item 8 – Well Development and Completion

Item 8 consists of all labor, equipment, and material costs associated with well development by swabbing and air-lift pumping, as well as pump-and-surge development for the well as specified in Section 7.5 Item 8 also consists of the testing for plumbness and alignment as described in Section 7.6, the final well video as described in Section 7.7, and the covering plate and access port as described in Section 7.8. Payment will be made on an hourly and lump sum basis.

10.3.9 Item 9 – Well Testing

Item 9 consists of the cost of all labor, equipment, and materials associated with the well testing requirements for the well as described in Sections 2.0 and 8.0. Payment will be made on a lump sum and hourly basis.

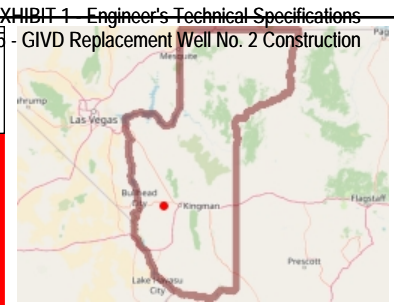
10.3.10 Item 10 – Rig Hourly Rate (Allowance Item)

Item 10 consists of the cost of maintaining equipment with and without personnel if a work stoppage occurs at the well, which is not due to any fault of the CONTRACTOR or SUBCONTRACTORS. Payment for any hourly time is subject to approval by the CONSULTANT and OWNER. The hourly rate with crew is also applicable to Lost Circulation Conditions as described in Section 6.4 and Low Penetration Rate Conditions as described in Section 6.5, assuming all conditions of each clause are met in full. Payment will be made on an hourly basis.

END OF SECTION

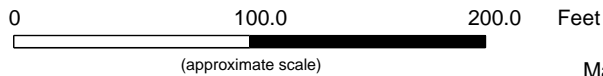
FIGURES

Figure 1- Proposed Well Location Map



- Legend**
- Hydrant
 - Waterlines
 - Main Arterials
 - Collectors
 - Township/Range
 - Proposed Well Location

1: 1,200



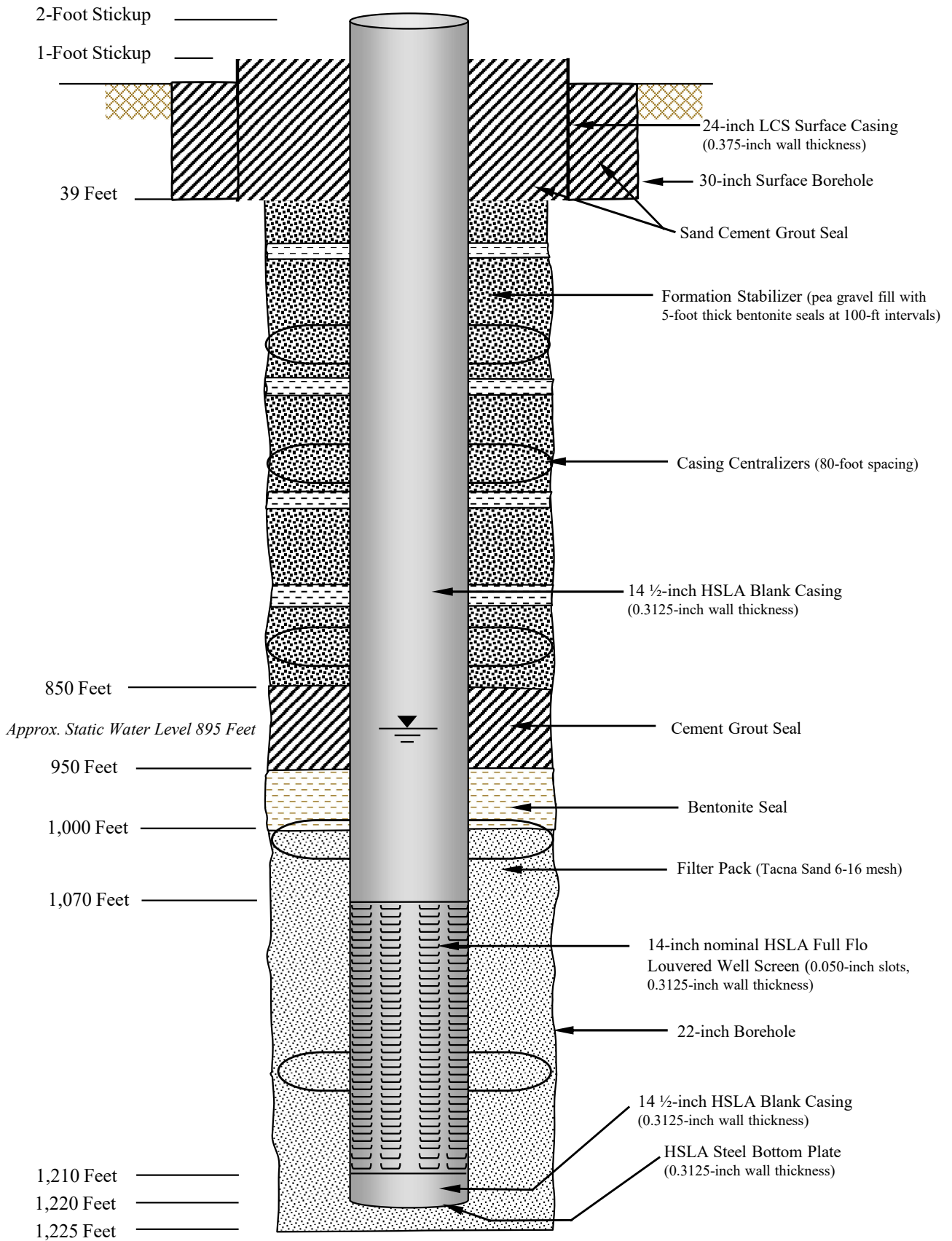
Map Created: 9/25/2023

This map is a user generated static output from the Mohave County Interactive Map Viewer and is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION, AS A LEGAL DOCUMENT, FOR PROPERTY DESCRIPTIONS, OR DETERMINATION OF LEGAL TITLE, AND SHOULD NEVER BE SUBSTITUTED FOR SURVEY OR DEED INFORMATION. The user agrees to comply with the Limitation of Use, and Assumption of Risk as stated in the full disclaimer at <https://gis.mohave.gov>

Notes:

Latitude: 35° 11' 4.167988" N
 Longitude: 114° 15' 14.393264" W
 Cadastral: B(21-19)25AAA

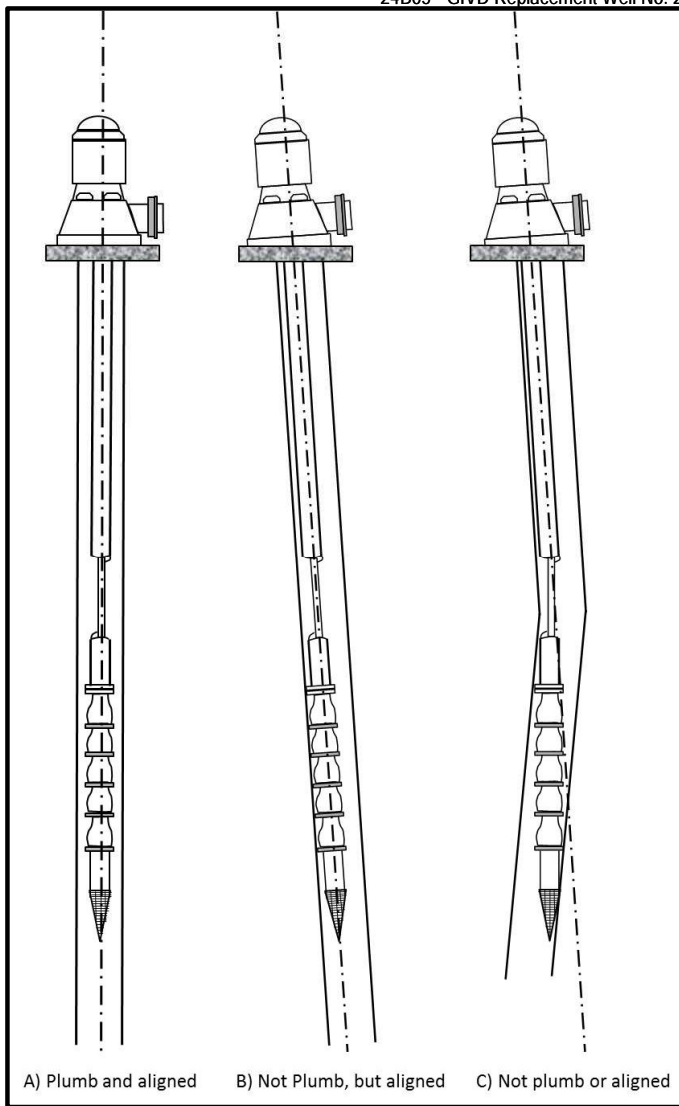
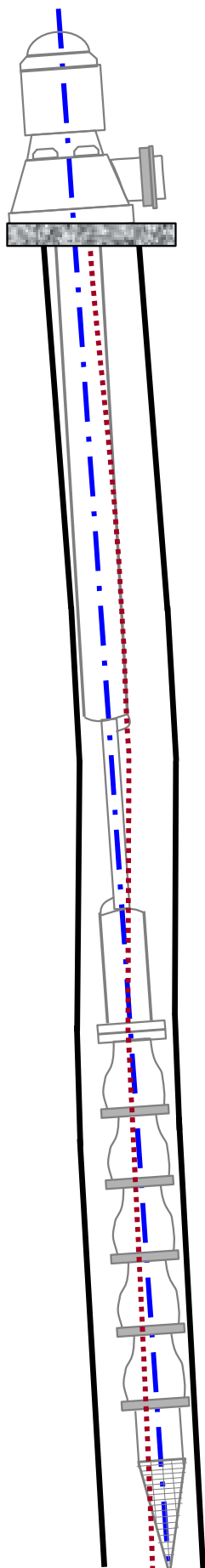
Well Location: B(21-19)25aaa



Not To Scale

Notes: LCS = low-carbon steel
 HSLA = high strength low alloy steel
 All diameters are O.D. unless otherwise stated

FIGURE 2
PRELIMINARY WELL DESIGN
 GVID Replacement Well No. 2
 Mohave County, Arizona



A) Plumb and aligned B) Not Plumb, but aligned C) Not plumb or aligned

From: DePonty, Glotfelty, DePinto, and Kornrumpf, *Plumbness and Alignment Standards – Analysis and Recommendations*: Water Well Journal, January 2014, p. 25.

Note: Allowable deviation between the Well Centerline and the Pump Centerline is **4.0 inches**, per Section 7.6.2 of this Technical Specification

Explanation

Pump Centerline — — — — —
(based on conceptual alignment of 6-inch diameter pump column pipe)

Well Centerline
(based on conceptual gyroscopic survey of 14-inch inside diameter well casing)

FIGURE 3
WELL ALIGNMENT REQUIREMENT
GVID Replacement Well No. 2
Mohave County, Arizona

APPENDIX A
CEMENT MIX DESIGN EXAMPLES

SAND CEMENT MIX DESIGN EXAMPLE

1 sack of cement = 1 bulk ft³ *
 = 94 lbs.
 = 3.6 absolute gallons

*A sack of cement has a bulk volume of approximately 1 cubic foot, which is composed of 0.52 cubic feet of air and 0.48 cubic feet of solids (actual space occupied by the solids of one sack of cement when mixed with water to form a slurry).

Calculations are based on the specific gravity of cement equal to 3.15 gm/cm³ and the specific gravity of sand aggregate equal to 2.65 gm/cm³.

Conversion: (specific gravity) (62.4) = lb/ft³

Materials	Pounds of Material	Factor (Absolute ft ³ /lb)	Absolute Volume (ft ³)	Water Requirement (gallons)
Cement	94	.0051	0.48	6.0
Sand	80	.0060	0.48	
Water	50	.016	0.80	
TOTAL	224		1.76	6.0

Slurry Wt. = 224 lb/1.76 ft³ = 127 lb/ft³ (17 lb/gal)

Slurry Yield = 1.76 ft³/sack cement

Slurry Yield = 15.34 sack cement/yrd³

For 1 yrd ³ :	Cement	1,447 lb	7.36 ft ³
	Sand	1,217 lb	7.36 ft ³
	Water	<u>766 lb</u>	<u>12.27 ft³</u>
		3,430 lb	27 ft³

POZZOLAN CEMENT MIX DESIGN EXAMPLE

1 sack of cement = 1 bulk ft³*
 = 94 lbs.
 = 3.6 absolute gallons

*A sack of cement has a bulk volume of approximately 1 cubic foot, which is composed of 0.52 cubic feet of air and 0.48 cubic feet of solids (actual space occupied by the solids of one sack of cement when mixed with water to form a slurry).

Calculations are based on the specific gravity of cement equal to 3.15 gm/cm³ and the specific gravity of pozzolan equal to 2.46 gm/cm³.

Conversion: (specific gravity) (62.4) = lb/ ft³

Materials	Pounds of Material	Factor (Absolute ft ³ /lb)	Absolute Volume (ft ³)	Water Requirement (gallons)
Cement	47	.0051	0.24	3.0
Pozzolan**	37	.0065	0.24	1.95
Water	41	.016	0.66	
TOTAL	125		1.14	4.95

Slurry Wt. = 125 lb/1.14 cu ft = 110 lb/ft³ (14.7 lb/gal)

Slurry Yield = 1.14 cu ft/sack cement and pozzolan

Slurry Yield = 23.68 sack cement and pozzolan/yrd³

 For 1 yrd³:

Cement	1,114 lb	5.68 ft ³
Pozzolan	874 lb	5.68 ft ³
Water	<u>977 lb</u>	<u>15.63 ft³</u>
	2,965 lb	27 ft³

** Added as 50% by volume of cement. Example is for Halliburton's Pozmix A. Water requirements will vary depending on composition and grind of pozzolan material.

APPENDIX B
BID SCHEDULE



APPENDIX B – BID SCHEDULE ^(a)

**Drilling and Installation of the
GVID Well No. 2 Replacement Well
Golden Valley, Arizona**

**Mohave County Public Works
3715 Sunshine Drive
P.O. Box 7000
Kingman, AZ 86402-7000**

Company Name: _____

Item	Description	Unit	Number of Units ^(b)	Unit Price (\$)	Total Price (\$)
1.	Mobilization and Demobilization	Lump Sum	1		
2.	Surface Casing Material and Installation	Linear Foot	40		
3.	Pilot Borehole Drilling and Sampling				
	A. Drill 16-inch Pilot Hole from 39 feet to 1,225 feet bls	Linear Foot	1,186		
	B. Geophysical Logging ^(c)	Lump Sum	1		
	C. Furnish, Install, Remove Zonal Sampling Tool	Per Each	1		
	D. Purging for Zonal Sampling	Hourly	12		
	E. Standby During Falling Head Test	Hourly	2		
	F. Ream - 22-inch Boring to 1,225 feet bls	Linear Foot	1,186		
	G. Final Caliper Log ^(c)	Lump Sum	1		
4.	Casing and Screen Material ^(d)				
	A. 14.5-inch O.D. HSLA Blank Well Casing	Linear Foot	1,082		
	B. 14-inch Nominal HSLA Louvered Screen	Linear Foot	140		
5.	Casing and Screen Installation	Linear Foot	1,220		
6.	Annular Material and Installation ^(e)				
	A. Filter Pack (Tacna Sand 6-16 mesh)	Ton	22		
	B. Bentonite Seal	Cubic Foot	97		
	C. Formation Stabilizer (Pea Gravel)	Ton	75		
	D. Formation Stabilizer (Bentonite)	Cubic Foot	78		
	F. Filter Pack Disinfectant	Lump Sum	1		
7.	Cement Grout Material and Installation ^(e)				
	A. Neat Cement Grout Seal	Cubic Yard	7		
8.	Well Development and Completion				
	A. Swab & Air Lift Development	Hourly	28		
	B. Pump and Surge Development	Hourly	12		
	C. Plumbness and Alignment Test	Lump Sum	1		
	D. Final Well Video	Lump Sum	1		
9.	Well Testing				
	A. Furnish, Install and Remove Test Pump and Equipment	Lump Sum	1		
	B. Pumping Tests	Hourly	34		
10.	Rig Hourly Rate (Allowance Item) ^(f)				
	A. With Crew	Hourly	-		-
	B. Without Crew	Hourly	-		-

Grand Total \$

Grand Total in Written Words:

Signature

Date

Estimated Availability Date:

Notes:


- a The Contractor's Total Bid is based upon unit prices and allowances. Bid amounts shall include all costs for the required labor, equipment, and materials, and bid amounts shall also include all applicable Federal, State, County and local taxes.
- b Quantities are not guaranteed. Final payment will be based on actual quantities installed. If the required quantities of the items listed above are increased or decreased by Change Order, the unit prices set forth above shall apply to such increased or decreased quantities.
- c Includes standby time to conduct geophysical logging at the well site. Any hourly time is subject to the approval of the OWNER.
- d Item 4 includes 1072 feet of 0.312-inch walled HSLA casing above the screen, and 10 feet of 0.312-inch walled casing to serve as a sump below the well screen for the well.
- e The filter pack, bentonite, formation stabilizer, and cement grout volume estimates are based on 30 percent over the calculated annular volume.
- f Any hourly time is subject to the approval of the OWNER

APPENDIX C
SUBMITTAL LIST



SUBMITTAL LIST*


Appendix C
GVID Replacement Well No. 2
Mohave County Public Works
Mohave County, Arizona

Item	Description	Due	Page in Bid Documents	Submittal Recipient	
1	Experience and Qualifications Summary Written summary describing the CONTRACTOR'S local experience and qualifications. In lieu of local experience, the CONTRACTOR may submit equivalent experience from other geologic settings.	With Bid Proposal	pg TS-5	CONSULTANT	
2	Drill Rig Specifications Summary Written specifications summary of the drilling rig to be used during the project.	With Bid Proposal	pg TS-5	CONSULTANT	
3	Arizona Well Driller's License and Arizona Registrar of Contractor License Provide copies of Arizona Well Driller's License and Arizona Registrar of Contractor License.	With Bid Proposal	pg TS-6	CONSULTANT	
4	Technical Specification Certification Written certification from the CONTRACTOR foreman of having read and understood the Technical Specification.	Prior to mobilization to the site	pg TS-6	CONSULTANT	
5	Non-Disclosure Agreements Executed non-disclosure agreements from all subcontractors who will have involvement in the performance of any of the work.	Prior to commencement of work by subcontractor	pg TS-8	CONSULTANT	
6	Site Safety Plan Site safety plan in accordance with OSHA.	Prior to mobilization to the site	pg TS-8	CONSULTANT & keep copy at well site	
7	Certification of Decontamination Certification showing decontamination of drilling rig and downhole tools.	Prior to the start of drilling	pg TS-15	CONSULTANT	
8	Penetration Rate Log Time log showing actual penetration time required to drill each foot of the borehole including notation of type of bit used, approximate weight on the bit, and rotation speed of the drill string.	Upon completion of drilling (available for review throughout drilling)	pg TS-16	CONSULTANT	
9	Daily Driller's Report Complete description of all formations; number of feet drilled; number of hours on job; hours of shutdown due to breakdown; length and type of casing set; volumes of filter pack and annular seal installed; other pertinent data on an approved form.	Daily	pg TS-16	CONSULTANT	
10	Driller's Log Detailed driller's log in compliance with requirements of ADWR.	Upon completion of drilling	pg TS-17	CONSULTANT and ADWR	
11	Drilling Fluid Record Record of drilling fluid properties recorded on an API-approved form (time, depth, and results of all drilling fluid tests; all materials added to system including type, time, depth; variances or modifications from original program).	Daily	pg TS-17	CONSULTANT	
12	Drilling Fluid Control Plan Outline of specific drilling fluid additives the Contractor plans to use; how anticipated changes in drilling conditions will affect the plan; fluid testing procedures; equipment to be used.	Prior to start of drilling	pg TS-18	CONSULTANT	
13	Safety Data Sheets for Drilling Fluid Additives SDSs from the manufacturer for all drilling fluid additives.	Prior to use	pg TS-19	CONSULTANT	
14	Certified Test Reports of surface casing steel Reports that demonstrate compliance with physical and chemical properties as specified.	Prior to installation	pg TS-24	CONSULTANT	
15	Specific Constituents of Cement Grout Seal for surface casing Listing of all constituents of the cement grout used to seal the surface casing.	Prior to placement of grout	pg TS-24	CONSULTANT	
16	Formation Sampling Method Details of the proposed method for collecting samples of cuttings.	Prior to start of drilling	pg TS-26	CONSULTANT	



SUBMITTAL LIST*

Appendix C
GVID Replacement Well No. 2
Mohave County Public Works
Mohave County, Arizona

Item	Description	Due	Page in Bid Documents	Submittal Recipient		
17	Field Copies of Geophysical Log Surveys	Three (3) field copies of the geophysical logging surveys.	Upon completion of logging	pg TS-27	CONSULTANT	
18	Final Copies of Geophysical Log Surveys	Five (5) final paper copies of all logs and and electronic copy in Windows metafile (.wmf) format, or other CONSULTANT-approved format.	Within ten (10) days of survey completion	pg TS-27	CONSULTANT	
19	Certified Test Reports of well casing steel	Reports that demonstrate compliance with physical and chemical properties as specified.	Prior to installation	pg TS-31	CONSULTANT	
20	Screen Specifications	Details of screen (tensile strength, collapse strength, maximum recommended hang weight, etc.) provided by well screen manufacturer.	Prior to delivery of screen to site	pg TS-31	CONSULTANT	
21	Filter Pack Sample and Sieve Analysis	Sample of the filter pack to be used and sieve analysis of the filter pack material.	Minimum of 3 days prior to delivery of material to site	pg TS-32	CONSULTANT	
22	Sodium Hypochlorite Documentation	Documentation shall be provided to the CONSULTANT prior to installation to demonstrate that the "shelf life" of the hypochlorite has not expired.	Prior to use	pg TS-32	CONSULTANT	
23	Sample of Bentonite Material	Sample of bentonite material.	Minimum of 24 hours prior to installation	pg TS-32	CONSULTANT	
24	Formation Stabilizer Material	Sample of formation stabilizer material.	Minimum of 24 hours prior to installation	pg TS-33	CONSULTANT	
25	Cement Mix Design for bottom seal	Design of cement mix; mix water source; specific constituents of the cement grout.	Prior to installation	pg TS-33	CONSULTANT	
26	Affidavit of Compliance with Welding Provisions	Affidavit that certifies compliance of all welding with applicable provisions of AWWA Standard C206.	Prior to acceptance of well	pg TS-34	CONSULTANT	
27	Safety Data Sheets for Well Development Additives	SDSs from the manufacturer for all chemical additives for well development.	Minimum of 3 days prior to use	pg TS-38	CONSULTANT	
28	Draft Plumbness and Alignment Report	Three (3) copies of draft Plumbness and Alignment report.	Upon completion of survey	pg TS-41	CONSULTANT	
29	Final Plumbness and Alignment Report	Five (5) copies of final Plumbness and Alignment report.	Within ten (10) days of survey completion	pg TS-41	CONSULTANT	
30	Final Well Video	Two (2) copies of the final well video.	Prior to acceptance of well	pg TS-44	CONSULTANT	

*Please note that this Submittal List has been prepared for the convenience of the Contractor and is not intended as an exhaustive list. The Contractor should refer to the Technical Specifications for this project, as Clear Creek Associates makes no guarantee or warranty that this list includes all requirements placed on the Contractor by the Technical Specifications or the Owner Contract Documents. Furthermore, this Submittal List is limited to the Technical Specifications for this project, and does not include other requirements, such as those required in the contract between Contractor and Owner, or any other requirements outside the scope of the Technical Specifications.