



**PURCHASING ITEM  
FOR  
COUNCIL AGENDA  
Memo No. CA08-095**

**1. Agenda Item Number:**  
21

**2. Council Meeting Date:**  
November 8, 2007

**TO: MAYOR & COUNCIL**

**3. Date Prepared:** October 11, 2007

**THROUGH: CITY MANAGER**

**4. Requesting Department:** Municipal Utilities

**5. SUBJECT:** Award a one-year Job Order Contract (JOC) JOC 07-13 to Layne Christensen Company for well drilling and rehabilitation services, in an amount not to exceed \$2,500,000 for the first year with the option of four one-year extensions, and award a project agreement for the Tumbleweed Aquifer Storage and Recovery (ASR) Wells 9 and 10 drilling, Project No. WA0806-401, in an amount not to exceed \$1,313,060.

**6. RECOMMENDATION:** Staff recommends that Council award a one-year Job Order Contract (JOC) JOC 07-13 to Layne Christensen Company for well drilling and rehabilitation services, in an amount not to exceed \$2,500,000 for the first year with the option of four one-year extensions, and award a project agreement for the Tumbleweed Aquifer Storage and Recovery (ASR) Wells 9 and 10 drilling, Project No. WA0806-401, in an amount not to exceed \$1,313,060.

**7. BACKGROUND/DISCUSSION:** The development of new water production well sites and the rehabilitation of existing well sites is required to provide water to meet the City's future demand. These Job Order Contracts will provide for drilling and rehabilitation services for diagnostic, monitoring, injection, and water production wells. This contract will be for a one-year period with an option of four one-year renewals. Under this contract, individual project agreements will be prepared for execution and approval for each specific project. Project agreements over \$50,000 will be submitted for Council approval up to the annual aggregate of \$2,500,000 for each contract. This action will result in saving the time to bring individual projects forward by eliminating the bid process for each individual project.

This project agreement provides for drilling of two ASR wells (9 and 10) in the Tumbleweed Recharge area. ASR wells are needed to support the reclaimed water distribution system. ASR wells are used to inject reclaimed water in the upper aquifer when irrigation demands are low. When irrigation water demand is high, these wells are pumped to recover the stored effluent water for use in the reclaimed water distribution system. A construction management services contract for the drilling of the wells will be awarded separately.

**8. EVALUATION:** Staff solicited and received statements of qualifications for well drilling and rehabilitation services from five (5) qualified firms. The selection process was conducted in accordance with established City policies and procedures. The selection committee consisted of the following members:

- John Knudson, Senior Engineer
- Joshua Plumb, Engineering Project Manager
- Bob Blankenship, Water Systems Maintenance Superintendent
- Lorna Tremaine, Contractor/Resident

The selection committee met on April 16, 2007 and reviewed statements of qualifications from Zim Industries, Inc., Stewart Brothers Drilling Co., Layne Christensen Co., WDC Exploration & Wells, and Arizona Beeman Drilling. The panel recommended Layne Christensen Co. for award of the well drilling JOC.

**9. FINANCIAL IMPLICATIONS:**

Cost: \$1,313,060  
Savings: None  
Long Term Costs: None

**Fund Source:**

<u>Account No.</u>	<u>Fund Name</u>	<u>Program Name</u>	<u>CIP Funded</u>	<u>Amount</u>
610.3910.0000.6817.7WW189	Effluent Reuse Bond	Effluent Reuse Storage/Recovery Wells	FY06/07	\$1,313,060

**10. PROPOSED MOTION:** Move that Council award a one-year Job Order Contract (JOC) JOC 07-13 to Layne Christensen Company for well drilling and rehabilitation services, in an amount not to exceed \$2,500,000 for the first year with the option of four one-year extensions, and award a project agreement for the Tumbleweed Aquifer Storage and Recovery (ASR) Wells 9 and 10 drilling, Project No. WA0806-401, in an amount not to exceed \$1,313,060, and authorize the Mayor to sign the contract documents.

**ATTACHMENTS:** Location Map, Contract

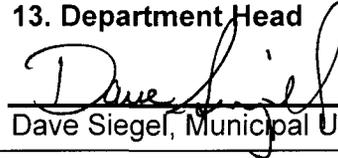
**APPROVALS**

**11. Requesting Department**



Robert Mulvey, Assistant Municipal Utilities Director

**13. Department Head**



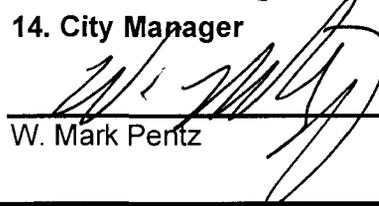
Dave Siegel, Municipal Utilities Director

**12. City Engineer**



Sheina Hughes, Acting Assistant Public Works  
Director/City Engineer

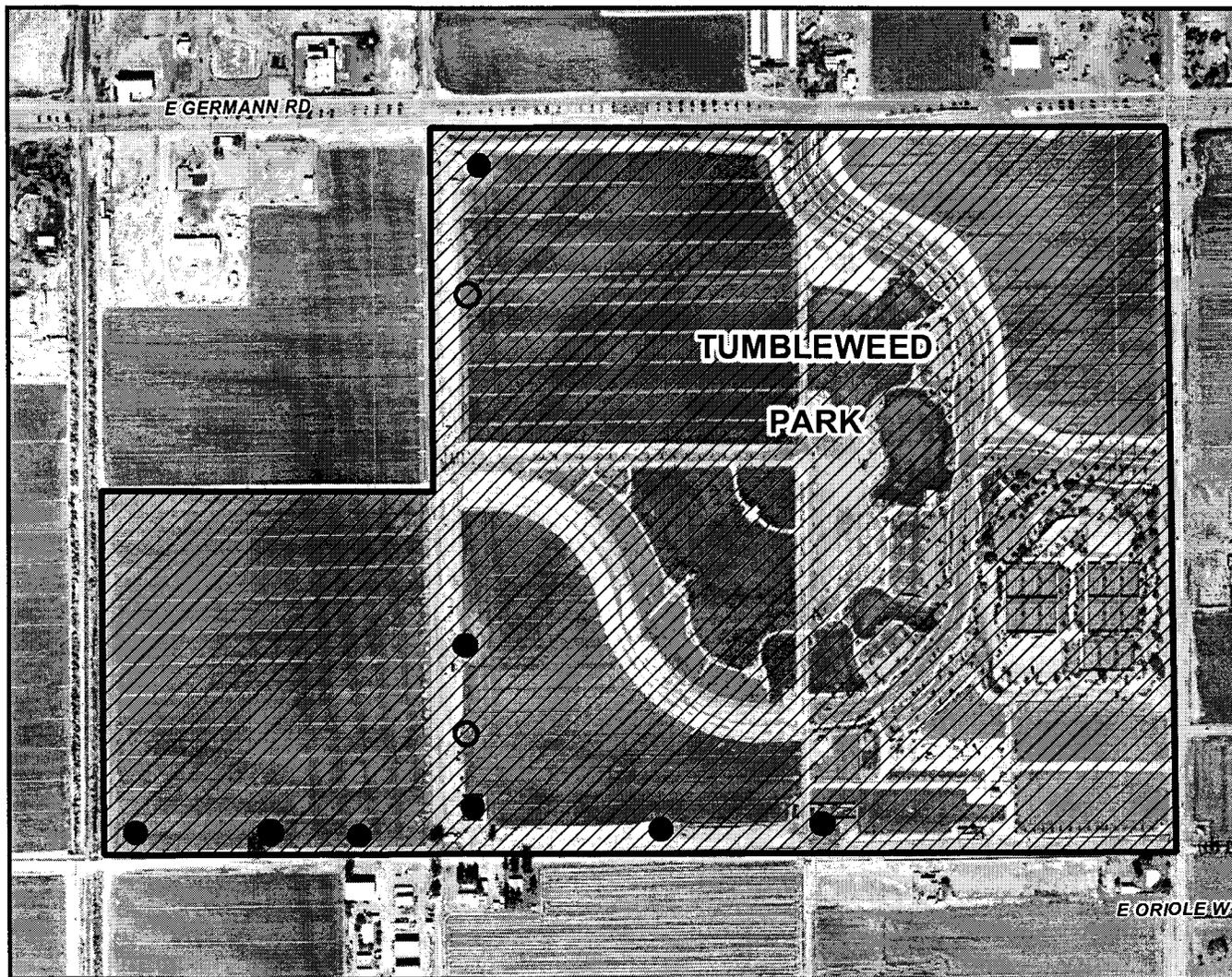
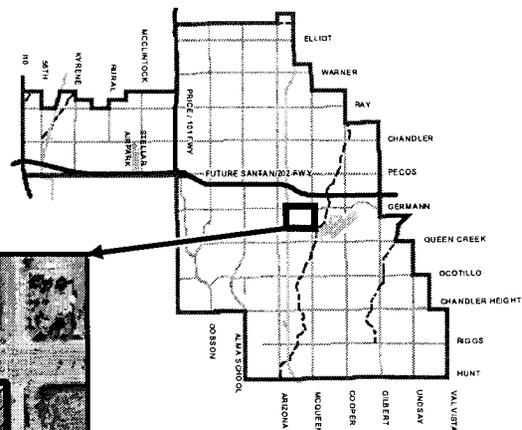
**14. City Manager**



W. Mark Pertz



# TUMBLEWEED ASR WELLS 9 AND 10 PROJECT NO. WW0806 - 401



MEMO NO. CA08-095

**LEGEND:**

- Existing ASR Wells
- Future ASR Wells No.'s 9 and 10



**JOB ORDER CONTRACT**

**CONTRACT NO: JOC 07-13**

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## JOB ORDER CONTRACT

**CONTRACT NO: JOC 07-13**

This CONTRACT is made this \_\_\_\_\_ day of \_\_\_\_\_, 2007, by and between the City of Chandler, a municipal corporation (hereinafter referred to as "CITY"), and **Layne Christensen Company, a Delaware corporation licensed to do business in the state of Arizona**, (hereinafter referred to as "JOC").

CITY and JOC, in consideration of the mutual covenants hereinafter set forth, agree as follows:

### ARTICLE 1 – DEFINITIONS

1.1 The Contract Documents for each project shall include:

- This Job Order Contract,
- The JOC's Performance Bond and Payment Bond
- The City's Standard General Conditions for Construction Projects are applicable to the project,
- Supplementary Conditions, if any,
- The Project Agreement for that job order,
- Work Change Directives or Change Orders, if any, and
- The project plans including project design and shop drawings for each project.

1.2. The following CITY standard forms are attached hereto and made a part hereof and shall be used as referenced herein:

- A. Application for Payment
- B. Certificate of Completion
- C. Contractor's Affidavit of Settlement of Claims
- D. Request for Change Order

1.3. The definitions contained in the City's Standard General Conditions for Construction Projects apply to this Agreement with the following clarifications:

1.3.2. Project Designer: When a Project Agreement requires JOC to provide design services for the Project, the those rights, duties and responsibilities assigned by the City's Standard General Conditions for Construction Projects to the Project Designer shall be performed by JOC except those which require final decisions on behalf of City, in which case City shall make the final determination.

1.3.3. Contract and Contract Documents: Include the documents listed in Section 1.1 and 1.2 hereinabove.

### ARTICLE 2 – OWNER'S REPRESENTATIVE

CITY has appointed an OWNER'S REPRESENTATIVE to manage this Contract and will appoint an OWNER'S REPRESENTATIVE to represent the CITY for each Project Agreement. The OWNER'S REPRESENTATIVE will assume all duties and responsibilities and will have all rights and authority assigned to the OWNER'S REPRESENTATIVE in the contract documents in connection with completion of the work. Any references to the Engineer or Project Engineer mean the OWNER'S REPRESENTATIVE. The OWNER'S REPRESENTATIVE does not have authority to verbally authorize any changes in the scope of work in any Project Agreement which would change the contract price or contract time as such changes must be by written Change Orders executed by appropriate CITY staff.

### ARTICLE 3 – DESCRIPTION OF WORK

3.1 This is an indefinite quantity and indefinite delivery Job Order Contract for well drilling and rehabilitation services, and includes drilling, well construction, testing, reporting requirements, post-construction aquifer testing, video surveys, geophysical logging, rehabilitation, removal of existing pump equipment, pump re-installation, and other well and pump related services as required for diagnostic, monitor, water production and aquifer storage and recovery (ASR) wells. For any project determined by CITY to be appropriate for this Job Order Contract, CITY will issue a delivery order to JOC, at which time

the parties will execute a Project Agreement specifying the cost and completion schedule for that project. Although CITY anticipates that JOC will be issued a substantial amount of work, the total cost of work issued to JOC by the City of Chandler in any one-year contract term will not exceed Two Million Five Hundred Thousand Dollars (\$2,500,000). JOC is not guaranteed any minimum amount of work nor any jobs at all. JOC is aware that there is more than one Contractor who has been awarded a Job Order Contract for this type of work. CITY reserves the right and will issue delivery orders based on ability of the contractor to meet CITY's work schedule and the availability of trades and expertise in relation to each project.

**3.2** JOC shall complete, provide and perform, or cause to be performed, all work in a proper and workmanlike manner, with appropriate consideration for public safety and convenience, consistent with the highest standards of professional and construction practices and in full compliance with, and as required by or pursuant to, this Contract and the Project Agreement, and with the greatest economy, efficiency, and expediency consistent therewith all as more particularly described in the Contract Documents.

**3.3** JOC shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. JOC shall be solely responsible for coordination of all of the work. JOC shall supervise, direct and cooperate fully with all subcontractors, manufacturers, fabricators, suppliers, distributors, installers, testing agencies and all others whose services, materials or equipment are required to ensure completion of the Work within the Contract Time. JOC shall also coordinate their Work with the work of others, including work to be done by CITY, to assure compliance with schedules.

#### **ARTICLE 4 - STANDARDS**

**4.1** Construction materials, methods and procedures of the Project shall be in accordance with the requirements of the latest edition of the following separate documents except as modified and supplemented by these Contract Documents:

A. Current City of Chandler City Code, including, but not limited to, Engineering Standard Specifications and Details and City of Chandler Traffic Barricade Manual and all applicable state and federal laws and regulations.

B. The portions of Maricopa Association of Governments Uniform Standard Specifications and Details for Public Works Construction (MAG Standard Specifications and Details) adopted by the City of Chandler.

C. IBC (2000 ed), Spec text, C-Spec or Master Spec as determined in each Project Agreement.

#### **ARTICLE 5 - CONTRACT TERM AND DELIVERY**

**5.1** The term of this Contract is one (1) year commencing on the date the Contract is executed by the last party to sign, with CITY reserving the option to extend the Contract for Four (4) additional terms of one (1) year each.

**5.2** Within ten (10) days of the date CITY issues a delivery order, JOC shall submit to CITY a construction progress schedule in Critical Path Method (CPM) format indicating the times for starting and completing the various stages of the work, including any Milestones specified in the Project Agreement and as more fully described herein. The construction progress schedule agreed upon by the parties shall be included as a part of the Project Agreement. Where applicable, such schedule shall include a schedule for project design and engineering, a schedule of shop drawings submission, and where applicable, a schedule of values of the work. These schedules shall be satisfactory in form and substance to OWNER'S REPRESENTATIVE. The schedule of values shall include quantities and unit prices aggregating the contract price, and shall subdivide the work into component parts in sufficient detail to serve as the basis for progress payments during construction. Upon acceptance of these schedules by CITY, they shall be incorporated into the Project Agreement.

**5.3 Time is of the essence.** All of the time limits for Milestones, if any, substantial completion, and completion and readiness for final payment as stated in the Project Agreement, are of the essence of both the Project Agreement and this Job Order Contract.

**5.4** Failure of JOC to perform any covenant or condition contained herein and in the Project Agreement within the time periods specified therein, shall constitute a material breach of both the Project Agreement and this Job Order Contract, entitling CITY to terminate either or both the Project Agreement and this Job Order Contract, unless JOC applies for and receives an extension of time in accordance with the procedures set forth herein. The amount of Liquidated and Special Damages, if appropriate, will be established in each Project Agreement.

**5.5** The CITY'S agreement to waive a specific time provision or to extend the time for performance shall not constitute a waiver of any other time provisions contained in this Job Order Contract or in the Project Agreement. Failure of JOC to complete performance promptly within the additional time authorized in the waiver or extension of time agreement shall constitute a material breach of this Job Order Contract and also of the Project Agreement, entitling CITY to all the remedies set forth herein or provided by law.

## **ARTICLE 6 - CONTRACT PRICE**

**6.1** CITY shall pay JOC for completion of each project the amount specified in each Project Agreement.

**6.2** Within ten (10) days of the date CITY issues a delivery order JOC shall submit to CITY a cost estimate for such work together with supporting data as requested by CITY. Upon acceptance of the cost estimate this price shall be inserted into the Project Agreement. For more complex Projects CITY may specify a longer period of time for JOC to complete the price estimate.

## **ARTICLE 7 - CONTRACTOR'S RESPONSIBILITIES**

### **7.1 Permits, Engineering & Design**

**7.1.1** Unless otherwise specified in the Project Agreement, JOC shall obtain all construction permits and licenses. JOC shall pay all governmental charges and inspection fees necessary for the prosecution of the Work. JOC shall also pay all charges of utility service companies for connections to the Work, and CITY shall pay all charges of such companies for capital costs related thereto, such as plant investment fees and system development fees.

**7.1.2** JOC shall provide Architectural and Engineering design as necessary or required for construction and permitting purposes and as further provided in the Project Agreement.

### **7.2 Plans, Shop Drawings and Samples**

**7.2.1** CITY shall provide to JOC the Project Scope of Work and Project Program for each Project or Job Order issued to JOC.

**7.2.2** For each Project or Job Order issued, JOC shall prepare or cause to be prepared and submit to CITY for approval, a Schematic Design and Design Development Package and the Construction Documents Package. Such documents shall be signed and/or stamped by such licensed professionals as deemed necessary by JOC.

A. After CITY review and approval of the Schematic Design and Design Development Package and Construction Documents Package, JOC shall submit to CITY for review and approval, in accordance with the accepted schedule of shop drawing submissions, copies of all shop drawings, which shall have been checked by and stamped with the approval of JOC.

B. CITY'S review and approval of shop drawings or samples shall not relieve JOC from responsibility for any deviations from the contract documents unless JOC has in writing called CITY'S attention to such deviation at the time of submission and CITY has given written concurrence and approval to the specific deviation, nor shall any concurrence and approval by CITY relieve JOC from responsibility for errors or omissions in the shop drawings or samples.

C. If JOC believes that any shop drawing or communication relative thereto justifies an increase in the contract price or contract time, JOC may make a claim therefore as provided in Article 11 or Article 12 of the City's General Conditions for Construction Contracts.

**7.3 Correction of Mistakes.** JOC shall be responsible for the completeness and accuracy of the work prepared or compiled under JOC's obligation for this project and shall correct, at JOC's expense, all errors or omissions therein which may be disclosed. Correction of errors disclosed and determined to exist during any construction of the project on architectural or engineering drawings and specifications shall be accomplished by JOC. The cost of the design necessary to correct those errors attributable to JOC and any damage incurred by CITY as a result of additional construction costs caused by such engineering or architectural errors shall be chargeable to JOC and shall not be considered a cost of the Work. The fact that CITY has reviewed or approved JOC's work shall in no way relieve JOC of any of its responsibilities.

## **8. ARTICLE 8 - LIQUIDATED AND SPECIAL DAMAGES**

8.1. Liquidated Damages: CITY and JOC recognize that time is of the essence of both this Job Order Contract and the Project Agreement and that CITY will suffer financial loss, in addition to and apart from the costs described herein above, if the work and/or portions of the work are not performed and completed within the times specified in the Project Agreement, plus any extensions thereof allowed in accordance with this Job Order Contract. CITY and JOC also recognize the delays, expense, and difficulties involved in proving, through legal or arbitration proceedings, the actual loss suffered by CITY if the work or portion of the work is not completed on time. Accordingly, instead of requiring any such proof, CITY and JOC agree that liquidated damages for delay (but not as a penalty) are appropriate and that the actual dollar amount per day shall be determined in each Project Agreement for each calendar day that expires after the time specified in the Project Agreement for substantial completion until the work is substantially complete. After substantial completion, if JOC shall neglect, refuse or fail to complete the remaining work within the contract time or any proper extension thereof granted by CITY, JOC shall pay CITY the amount set forth in the Project Agreement for each day that expires after the time specified in the Project Agreement for final completion and readiness for final payment.

8.2. Special Damages: In addition to the amount provided for liquidated damages, JOC shall pay CITY the actual costs reasonably incurred by CITY for the CITY'S REPRESENTATIVE, engineering and inspection forces employed on the work for each day that expires after the time specified in the Project Agreement for final completion, including any extensions thereof made in accordance with this Job Order Contract, until the work is finally complete.

## **9. ARTICLE 9 - BONDS AND INSURANCE**

### **Performance, Payment And Other Bonds**

JOC shall furnish Performance and Payment Bonds, each in the amount of **Seven Hundred Fifty Thousand Dollars (\$750,000)**, as security for the faithful performance and payment of all JOC'S obligations under this Job Order Contract and each of the Project Agreements, provided; however, in the event the total cost of projects concurrently in progress by JOC exceeds **Seven Hundred Fifty Thousand Dollars (\$750,000)**, then JOC shall increase each bond to an amount equal to that estimated by CITY as the cost of construction remaining to be done by JOC for that year of the Job Order Contract.

9.1.2. With the performance and payment bonds JOC, shall provide a copy of the surety company's Certificate of Authority, said copy to have been certified by the Arizona Department of Insurance. These Bonds shall remain in effect during the warranty period for all work performed under this contract after the date of final payment. All Bonds shall be in the form specified by A.R.S. §34-608 and be executed by such sureties as:

- A. Are licensed to conduct business in the State of Arizona and have an agent for service of process in Arizona;
- B. Are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department; and
- C. Are acceptable to the City of Chandler.

9.1.3 All Bonds signed by an agent must be accompanied by a certified copy of the authority to act.

9.1.4 If the surety on any bond furnished by JOC is declared a bankrupt or becomes insolvent or it ceases to meet the requirements of Paragraph 18.1.2, JOC shall within five (5) days thereafter substitute another bond and surety, both of which shall be acceptable to CITY.

## **9.2 Contractor's Insurance**

9.2.1 The JOC, at JOC's own expense, shall purchase and maintain the herein stipulated minimum insurance with companies duly licensed, possessing a current A.M. Best, Inc. Rating of B++6, or above and licensed to do business in the State of Arizona with policies and forms satisfactory to CITY.

9.2.2 All insurance required herein shall be maintained in full force and effect until all work required to be performed under the terms of the contract is satisfactorily completed and formally accepted; failure to do so may, at the sole direction of CITY, constitute a material breach of this contract.

9.2.3 The JOC's insurance shall be primary insurance, and any insurance or self insurance maintained by CITY shall not contribute to it.

9.2.4 Any failure to comply with the claim reporting provisions of the policies or any breach of an insurance policy warranty shall not affect coverage afforded under the policy to protect CITY.

9.2.5 The insurance policies, except Workers' Compensation, shall contain a waiver of transfer rights of recovery (subrogation) against CITY, its agents, representatives, directors, officers, and employees for any claims arising out of the JOC's work or service.

9.2.6 The insurance policies may provide coverage which contains deductibles or self-insured retentions. Such deductible and/or self-insured retentions shall not be applicable with respect to the coverage provided to CITY under such policies. The JOC shall be solely responsible for deductible and/or self-insured retention and CITY, at its option, may require the JOC to secure the payment of such deductible or self-insured retentions by a surety bond or an irrevocable and unconditional letter of credit.

9.2.7 Upon execution by JOC of this Contract, JOC shall furnish to CITY copies of any or all of the herein required insurance policies and/or endorsements. CITY shall not be obligated, however, to review same or to advise JOC of any deficiencies in such policies and endorsements, and such receipt shall not relieve JOC from, or be deemed a waiver of the CITY'S right to insist on strict fulfillment of JOC's obligations under this contract.

9.2.8 The insurance policies, except Workers' Compensation, required by this contract shall name the CITY, its agents, representatives, officers, directors, officials and employees as additional insureds.

## **9.3 Required Coverage**

### **General Liability**

9.3.1 JOC shall maintain Commercial General Liability insurance with a limit of not less than \$1,000,000 for each occurrence with a \$1,000,000 Products and Completed Operations Aggregate and \$2,000,000 General Aggregate Limit. The policy shall include coverage for bodily injury, broad form property damage, personal injury, products/completed operations and blanket contractual coverage including, but not limited to, the liability assumed under the indemnification provisions of this contract, which coverage will be at least as broad as Insurance Service Office, Inc. Policy Form CG 00011093 or any replacement thereof. The coverage shall not exclude X, C, U.

9.3.2 Such policy shall contain a severability of interest provision, and shall not contain a sunset provision or commutation clause, nor any provision which would serve to limit third party action over claims.

9.3.3 The Commercial General Liability additional insured endorsement shall be at least as broad as the Insurance Service Office, Inc.'s, Additional Insured, Form B, CG20101185, and shall include coverage for JOC's operations and products and completed operations.

### **Automobile Liability**

9.3.4 JOC shall maintain Commercial/Business Automobile Liability insurance with a combined single limit for bodily injury and property damage of not less than \$1,000,000 each occurrence with respect to the JOC's any owned, hired, and non-owned vehicles assigned to or used in performance of the JOC's work. Coverage will be at least as broad as coverage code 1, "any auto", (Insurance Service Office, Inc. Policy Form CA 00011293, or any replacements thereof). Such insurance shall include coverage for loading and off loading hazards. If hazardous substances, materials or wastes are to be transported, MCS 90 endorsement shall be included and \$5,000,000 per accident limits for bodily injury and property damage shall apply.

### **Workers' Compensation**

9.3.5 The JOC shall carry Workers' Compensation insurance to cover obligations imposed by federal and state statutes having jurisdiction of JOC's employees engaged in the performance of the work; and, employer's liability insurance of not less than \$1,000,000 for each accident, \$1,000,000 disease for each employee, and \$1,000,000 disease policy limit.

9.3.6 In case any work is subcontracted, the JOC will require the subcontractor to provide Workers' Compensation and employer's Liability to at least the same extent as required of the JOC.

### **Builders' Risk (Property) Insurance**

9.3.7 Prior to commencement of each specific project, the JOC shall purchase and maintain, on a replacement cost basis, Builders' Risk insurance in the amount of the Project Agreement amount as well as subsequent modifications thereto for the entire work at the site. Such Builders' Risk insurance shall be maintained until final payment has been made for that project, or until no person or entity other than CITY has an insurable interest in the property required to be covered, whichever is earlier. This insurance shall include interests of CITY, the JOC, and all subcontractors and sub-Subcontractors in the work during the life of the Project Agreement and course of construction, and shall continue until that project work is completed and accepted by CITY. For new construction projects, the JOC agrees to assume full responsibility for loss or damage to the work being performed and to the buildings under construction. For renovation construction projects, the JOC agrees to assume responsibility for loss or damage to the work being performed at least up to the full Project Agreement amount.

9.3.8 Builders' Risk insurance shall be on an all-risk policy form and shall also cover false work and temporary buildings and shall insure against risk of direct physical loss or damage from external causes including debris removal, demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for architect's service and expenses required as a result of such insured loss.

9.3.9 Builders' Risk insurance must provide coverage from the time any covered property comes under JOC's control and/or responsibility, and continue without interruption during construction or renovation or installation, including any time during which the covered property is being transported to the construction installation site, and while on the construction or installation site awaiting installation. The policy will provide coverage while the covered premises or any part thereof are occupied. Builders' Risk insurance shall be primary and not contributory.

9.3.10 If the Project Agreement requires testing of equipment or other similar operations, at the option of CITY, the JOC will be responsible for providing property insurance for these exposures under a Boiler Machinery insurance policy.

### **9.4 Cancellation and Expiration Notice**

9.4.1 Insurance evidenced by these certificates shall not expire, be canceled, or materially changed without fifteen (15) days prior written notice to CITY.

9.4.2 In the event any insurance policy(ies) required by this contract is(are) written on a "claims made" basis, coverage shall extend for two (2) years past completion and acceptance of the JOC's work or services and as evidenced by annual Certificates of Insurance.

## **ARTICLE 10 - INDEMNIFICATION**

### **(a) For Professional Liability:**

To the fullest extent permitted by law, JOC shall defend, indemnify and hold harmless the City of Chandler, its agents, representatives, officers, directors, officials and employees, individually and collectively, (hereinafter CoC) from and against all losses, claims, damages, suits, actions, payments, judgments, demands, expenses, and costs, including but not limited to, attorney's fees, defense costs, court costs, and the cost of appellate proceedings, or actions of any kind and nature related to, arising out of, or alleged to have resulted from the errors, mistakes or omissions relating to professional services by JOC, its employees, agents, or any tier of subcontractors in the performance of this Contract or of any other person for whose errors, mistakes or omissions JOC may be legally liable. This indemnity shall not be construed to include losses, claims, damages, suits, or actions of any kind and nature, to the extent arising from or alleged to have resulted from the errors, mistakes or omissions of CoC (other than JOC, its employees, agents, or any tier of subcontractors). The provisions of this paragraph shall survive termination of this Contract.

### **(b) Correction of Mistakes:**

JOC shall be responsible for the completeness and accuracy of the work prepared or compiled under JOC's obligation for this project and shall correct, at JOC's expense, all errors or omissions therein which may be disclosed. Correction of errors disclosed and determined to exist during any construction of the project on architectural or engineering drawings and specifications shall be accomplished by JOC. The cost of the design necessary to correct those errors attributable to JOC and any damage incurred by CITY as a result of additional construction costs caused by such engineering or architectural errors shall be chargeable to JOC and shall not be considered a cost of the Work. The fact that CITY has reviewed or approved JOC's work shall in no way relieve JOC of any of its responsibilities.

### **(c) For all Other Liabilities, Hazards and Exposures:**

To the fullest extent permitted by law, JOC shall defend, indemnify and hold harmless the City of Chandler, its agents, representatives, officers, directors, officials and employees, individually and collectively, (hereinafter CoC) from and against all losses, claims, damages, suits, actions, payments, judgments, demands, expenses, and costs, including but not limited to, attorney's fees, defense costs, court costs, and the cost of appellate proceedings, or actions of any kind and nature, wages or overtime compensation due employees in rendering service under this Contract and whether to any person or property, including natural resources and any claim made under the Fair Labor Standards Act or any other federal or state laws, related to, arising out of, or alleged to have resulted from the actions of JOC and alleged to have been caused in whole or in part by any act or omission of JOC, anyone directly or indirectly employed by them or anyone for whose acts JOC may be legally liable, and from any claims or amounts arising or recovered under Workers' Compensation laws or any other law, bylaw, or ordinance, order or decree or any failure on the part of JOC, its agents, employees or representatives to fulfill JOC's obligations under this Contract. This indemnity shall not be construed to include losses, claims, damages, suits, or actions of any kind and nature, to the extent arising from or alleged to have resulted from the errors, mistakes or omissions of CoC, (other than JOC, its employees, agents, or any tier of subcontractors). The provisions of this paragraph shall survive termination of this Contract.

### **(d) Consequential Damages:**

The parties intend that damages and/or costs and all other terms implying an amount tied to liability shall include consequential damages and loss of productivity limited to the total value of this contract in dollars as payable by the City of Chandler or twice the amount of aggregate insurance required by this Contract, whichever is greater.

### **(e) Insurance does not limit liability:**

The amount and type of insurance coverage requirements set forth herein will in no way be construed as limiting the scope of the indemnity in this paragraph.

**ARTICLE 11 – PARTIAL INVALIDITY**

If any provision of this Contract is held by a court of competent jurisdiction to be invalid, void or unenforceable, the remaining provisions shall nevertheless continue in full force without being impaired or invalidated in any way.

**ARTICLE 12 - COOPERATIVE PURCHASING**

**Cooperative Use of Contract.** In addition to the City of Chandler and with approval of the CONTRACTOR, this Contract may be extended for use by other municipalities, school districts and government agencies of the State. A current listing of eligible entities may be found at [www.maricopa.gov/materials](http://www.maricopa.gov/materials) and then click on 'Contracts', 'S.A.V.E.' listing and 'ICPA'. Any such usage by other entities must be in accordance with the ordinance, charter and/or procurement rules and regulations of the respective political entity.

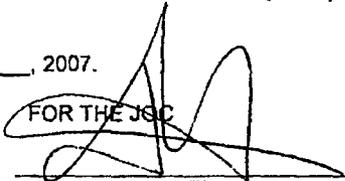
IN WITNESS WHEREOF, the parties hereto have executed this Contract on the day and year first written above.

This Contract will be effective on \_\_\_\_\_, 2007.

FOR THE CITY OF CHANDLER

FOR THE JOC

\_\_\_\_\_  
MAYOR Date

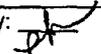
  
\_\_\_\_\_  
Signature

ADDRESS FOR NOTICE  
City of Chandler  
P.O. Box 4008, Mail Stop 407  
Chandler, AZ 85244-4008  
480-782-3307

ADDRESS FOR NOTICE  
Layne Christensen Company  
2030 E. Pinal Rd.  
Chandler, AZ 85249  
Phone: 480 895-9404

APPROVED AS TO FORM:

ATTEST: If Corporation  
Aminda C. West  
Secretary

\_\_\_\_\_  
City Attorney By: 

ATTEST:  
\_\_\_\_\_  
City Clerk

SEAL

**PERFORMANCE BOND**

ARIZONA STATUTORY PERFORMANCE BOND  
PURSUANT TO TITLES 28, 34, AND 41, ARIZONA REVISED STATUTES  
(Penalty of this bond must be 100% of the Contract amount)

KNOW ALL MEN BY THESE PRESENTS THAT: \_\_\_\_\_

(hereinafter "Principal"), and \_\_\_\_\_ (hereinafter "Surety"), a corporation organized and existing under the laws of the State of \_\_\_\_\_ with its principal office in the City of \_\_\_\_\_, holding a certificate of authority to transact surety business in Arizona issued by the Director of Insurance pursuant to Title 20, Chapter 2, Article 1, as Surety, are held and firmly bound unto \_\_\_\_\_ (hereinafter "Obligee") in the amount of \_\_\_\_\_ (Dollars) (\$ \_\_\_\_\_), for the payment whereof, Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 2007 for construction of [TITLE] CITY PROJECT NO. JOC 07-13 which contract is hereby referred to and made a part hereof as fully and to the same extent as if copies at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the Principal faithfully performs and fulfills all the undertakings, covenants, terms, conditions and agreements of the contract during the original term of the contract and any extension of the contract, with or without notice of the Surety, and during the life of any guaranty required under the contract, and also performs and fulfills all the undertakings, covenants, terms, conditions, and agreements of all duly authorized modifications of the contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, the above obligation is void. Otherwise it remains in full force and effect.

PROVIDED, HOWEVER that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, to the same extent as if it were copied at length in this agreement.

The prevailing party in a suit on this bond shall recover as part of the judgment reasonable attorney fees that may be fixed by a judge of the court.

Witness our hands this \_\_\_\_\_ day of \_\_\_\_\_, 2007.

\_\_\_\_\_  
AGENT OF RECORD

\_\_\_\_\_  
PRINCIPAL SEAL

By \_\_\_\_\_

\_\_\_\_\_  
SURETY SEAL

\_\_\_\_\_  
AGENT ADDRESS

**PAYMENT BOND**

ARIZONA STATUTORY PAYMENT BOND  
PURSUANT TO TITLES 28, 34, AND 41, OF THE ARIZONA REVISED STATUTES  
(Penalty of this Bond must be 100% of the Contract amount)

**KNOW ALL MEN BY THESE PRESENTS THAT:** \_\_\_\_\_

(hereinafter "Principal"), as Principal, and \_\_\_\_\_ (hereinafter "Surety"), a corporation organized and existing under the laws of the State of \_\_\_\_\_ with its principal office in the City of \_\_\_\_\_, holding a certificate of authority to transact surety business in Arizona issued by the Director of the Department of Insurance pursuant to Title 20, Chapter 2, Article 1, as Surety, are held and firmly bound unto \_\_\_\_\_ (hereinafter "Obligee") in the amount of \_\_\_\_\_ (Dollars) (\$ \_\_\_\_\_), for the payment whereof, the Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_ for construction of **Job Order Contract for Well Drilling and Rehabilitation Services], CITY PROJECT NO. JOC 07-13** which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the Principal promptly pays all moneys due to all persons supplying labor or materials to the Principal or the Principal's subcontractors in the prosecution of the work provided for in said contract, this obligation is void. Otherwise it remains in full force and effect.

PROVIDED, HOWEVER that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2 Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions, conditions and limitations of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, to the same extent as if it were copied at length in this agreement.

The prevailing party in a suit on this bond shall recover as part of the judgment reasonable attorney fees that may be fixed by a judge of the court.

Witness our hands this \_\_\_\_\_ day of \_\_\_\_\_, 2007.

\_\_\_\_\_  
AGENT OF RECORD

\_\_\_\_\_  
PRINCIPAL SEAL

By \_\_\_\_\_

\_\_\_\_\_  
AGENT ADDRESS

\_\_\_\_\_  
SURETY SEAL

**CITY OF CHANDLER**  
**CERTIFICATE OF INSURABILITY**

**CITY OF CHANDLER PRIVILEGE TAX LICENSE**

**PROJECT NAME: Job Order Contracting for Well Drilling and Rehabilitation Services**

**PROJECT NUMBER: JOC 07-13**

**PROJECT AGREEMENT  
PURSUANT TO JOB ORDER CONTRACT NO. JOC 07-13**

**AGREEMENT NO: WA0806-401**  
**PROJECT NAME (or LOCATION): Drilling of Tumbleweed Wells 9 & 10**  
**DEPT.: Municipal Utilities**

This AGREEMENT is made this 22<sup>nd</sup> day of October 2007, by and between the City of Chandler, a municipal corporation (hereinafter referred to as "CITY") and **Layne Christensen Company, a Delaware corporation licensed to do business in the state of Arizona**, (hereinafter referred to as "JOC") and is a Job Order entered into pursuant to JOB ORDER CONTRACT NO. JOC 07-13.

CITY and JOC, in consideration of the mutual covenants herein set forth, agree as follows:

**ARTICLE 1. DESCRIPTION OF WORK**

This Job Order Project is Drilling of Tumbleweed Wells 9 & 10, Project Number WA0806-401. The scope of work consists of drilling Tumbleweed Wells 9 & 10, all as more particularly set forth in Exhibit A attached hereto and incorporated herein by reference.

The JOC shall not accept any change of scope, or change in contract provisions, unless issued in writing, as a contract amendment or change order and signed by the authorized signatories for each party.

**ARTICLE 2. CONTRACT PRICE**

CITY shall pay JOC for completion of the Work in accordance with the Contract Documents a fee not to exceed the Guaranteed Maximum Price of One Million Three Hundred Thirteen Thousand Sixty Dollars (\$1,313,060) determined and payable as set forth in Contract JOC 07-13 and Exhibit B attached hereto and made a part hereof by reference.

**ARTICLE 3. CONTRACT TIME & SCHEDULE**

The Contract Time is Ninety days and JOC agrees to complete all Construction within Ninety (90) days from the effective date of the Notice to Proceed.

**ARTICLE 4. GENERAL**

This Project Agreement is entered into pursuant to JOB ORDER CONTRACT NO. JOC 07-13 and the terms and conditions contained therein are incorporated herein by reference as if set forth in full.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day and year first written above.

This Agreement will be effective upon execution by the both parties.

IN WITNESS WHEREOF, the parties have hereunto subscribed their names to this \_\_\_\_\_ day of \_\_\_\_\_ 2007.  
CITY OF CHANDLER FOR THE JOC:

\_\_\_\_\_  
MAYOR DATE:

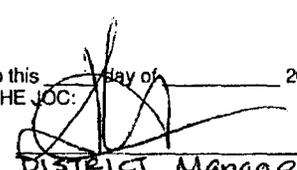
ADDRESS FOR NOTICE  
City of Chandler  
P.O. Box 4008, Mail Stop 407  
Chandler, AZ 85244-4008  
480-782-3307

APPROVED AS TO FORM:

\_\_\_\_\_  
City Attorney

By: \_\_\_\_\_  
ATTEST:

\_\_\_\_\_  
City Clerk

By:   
Title: DISTRICT Manager

ADDRESS FOR NOTICE  
Mr. James M. Hausladen  
Layne Christensen Company  
12030 E. Riggs Rd.  
Chandler, AZ 85249-3701

Phone: 480-895-9404  
Fax: fax 895-9536

PROJECT AGREEMENT
PURSUANT TO JOB ORDER CONTRACT NO. JOC 07-13

AGREEMENT NO: WA0806-401
PROJECT NAME (or LOCATION): Drilling of Tumbleweed Wells 9 & 10
DEPT.: Municipal Utilities

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CITY OF CHANDLER FOR THE JOC:

\_\_\_\_\_  
MAYOR DATE:

By: \_\_\_\_\_  
Title: \_\_\_\_\_

ADDRESS FOR NOTICE
City of Chandler
P.O. Box 4008, Mail Stop 407
Chandler, AZ 85244-4008
480-782-3307

ADDRESS FOR NOTICE
Mr. James M. Hausladen
Layne Christensen Company
12030 E. Riggs Rd.
Chandler, AZ 85249-3701

APPROVED AS TO FORM:

Phone: \_\_\_\_\_
Fax: fax 895-9536

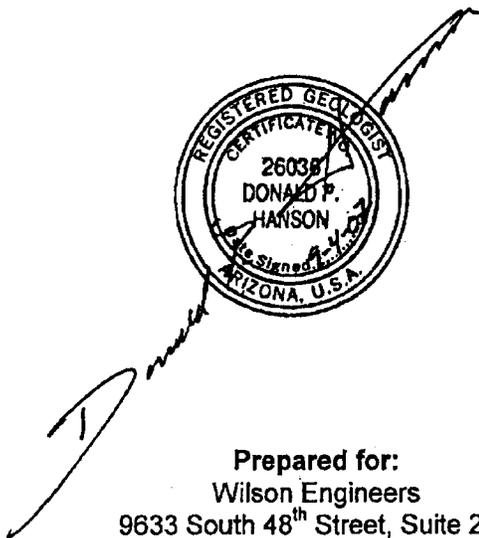
By: [Signature]
ATTEST:
City Attorney

\_\_\_\_\_  
City Clerk

EXHIBIT A

## TECHNICAL SPECIFICATIONS

TUMBLEWEED RECHARGE FACILITY  
INSTALLATION OF AQUIFER STORAGE AND RECOVERY WELLS 8/9/10  
CITY OF CHANDLER, ARIZONA



**Prepared for:**  
Wilson Engineers  
9633 South 48<sup>th</sup> Street, Suite 290  
Phoenix, Arizona 85044

and

The City of Chandler  
Mail Stop 408  
P.O. Box 4008  
Chandler, Arizona 85244-4008

**Prepared By:**  
Clear Creek Associates  
6155 E. Indian School Rd. Suite 200  
Scottsdale, Arizona 85251

September, 2007

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## PART 1 GENERAL

### 1.01 LOCATION AND GEOLOGIC SETTING

- A. The work to be accomplished under the following Specifications consists of the drilling, testing, and completion of two (2) aquifer storage and recovery (ASR) wells and the abandonment of ten (10) Vadose Zone Recharge Wells at the Tumbleweed Recharge Facility in Chandler, Arizona. At the discretion of the City of Chandler, a third ASR well may also be drilled and completed. The Tumbleweed Recharge Facility is located southwest of the intersection of Germann Road and McQueen Road, extending 1 mile west and ½ mile south along Germann and McQueen Roads respectively. The ASR wells will be located on the southern boundary of the Tumbleweed Recharge Facility, and will be designated as Tumbleweed ASR Well 8 (TW-ASR8), and Tumbleweed ASR Well 9 (TW-ASR9). The Vadose Zone Recharge Wells to be abandoned are designated as RW-9, RW-13, RW-14, RW-15, RW-16, RW-17, RW-18, RW-19, RW-24, and RW-25, and are located north and east of the proposed wells. A location map is provided as Figure 1.
- B. The legal location of the TW-ASR8 well is the SW ¼ of the SE ¼ of the NW ¼ of Section 10, Township 2 South, Range 5 East, Gila and Salt River Baseline Meridian (also designated D(2-5)10bdc). An alternate location for this well, TW-ASR8b is the SW ¼ of the SW ¼ of the NW ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10acc). The legal location of the TW-ASR9 well is the SW ¼ of the SW ¼ of the NW ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10acc). The legal location of the TW-ASR10 well is the NW ¼ of the NW ¼ of the NE ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10abb). The wells are expected to penetrate basin-fill or fluvial deposits that are primarily unconsolidated or semi-consolidated clay, silt, sand and gravel. If fluvial deposits are penetrated, coarse gravel and cobbles may also be encountered.
- C. The legal location of the Vadose Zone Recharge Wells are as follows:
- RW-9 is the SW ¼ of the SW ¼ of the NE ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10acc).
  - RW-13 is the SW ¼ of the SW ¼ of the NE ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10acc).
  - RW-14 is the SW ¼ of the SW ¼ of the NE ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10acc).
  - RW-15 is the SE ¼ of the SW ¼ of the NE ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10acd).
  - RW-16 is the SE ¼ of the SW ¼ of the NE ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10acd).

- RW-17 is the SW ¼ of the SE ¼ of the NE ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10adc).
- RW-18 is the NW ¼ of the NW ¼ of the NE ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10abb).
- RW-19 is the NW ¼ of the NW ¼ of the NE ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10abb).
- RW-24 is the SW ¼ of the SW ¼ of the NE ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10acc).
- RW-25 is the SE ¼ of the SW ¼ of the NE ¼ of Section 10, Township 2 South, Range 5 East (also designated D(2-5)10acd).

## 1.02 SCOPE OF WORK

- A. The installation of the two (2) ASR wells, as specified herein, consists of the CONTRACTOR drilling a borehole to the specified depth using the reverse circulation rotary drilling method, and collecting cutting samples from the borehole as specified, for each location. A third well may be added at the OWNERS discretion.
- B. Geophysical logging (subcontracted directly by the CONTRACTOR) will be conducted prior to the borehole reaming.
- C. It is the responsibility of the CONTRACTOR to familiarize himself with the drilling conditions that may be encountered at the site, both surface and subsurface, prior to cost submittal. It is the responsibility of the driller to examine the drilling location and site access in order to become acquainted with local conditions and requirements. No allowance will be made after the contractor unit price schedule has been accepted for any errors or omissions made by the CONTRACTOR.
- D. The CONTRACTOR will install the wells pursuant to the final well design, which will be developed by the CONSULTANT (Clear Creek Associates) and approved by the ENGINEER (Wilson Engineers) and the OWNER (City of Chandler), based on analysis of the pilot boring. The preliminary well designs are presented on Figure 2. The scope of work presented herein includes aquifer testing (step-discharge test and constant rate discharge test) after the well installation and development operations are complete.
- E. The OWNER, or its agent, reserves the right to direct the CONTRACTOR to drill beyond the depths specified, or to stop at lesser depths, depending on subsurface conditions.
- F. The abandonment of the ten (10) Vadose Zone Recharge Wells consists of the CONTRACTOR removing existing well head and tubing, and installing fill and seal materials in accordance with ADWR Article 8, Rule R12-15-816 and as specified herein, for each location. Abandonment of the vaults is not part of the scope.

G. The drilling, well installation, testing, and well abandonment activities performed by the CONTRACTOR or SUBCONTRACTOR shall be conducted under the inspection of the CONSULTANT.

H. DEFINITIONS

1. Throughout this specification, the term "OWNER" shall be understood to represent the City of Chandler, the term "ENGINEER" shall be understood to represent Wilson Engineers, and the term "CONSULTANT" shall be understood to represent Clear Creek Associates, PLC.
2. 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.

**1.03 PERFORMANCE OF WORK**

A. Operations:

1. The CONTRACTOR shall employ only competent employees for the execution of work. 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. The tool pusher shall be present at the well site to oversee all critical operations of the well installation (as determined by the CONSULTANT), when borehole or equipment problems arise, or at the request of the CONSULTANT or OWNER. 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.
2. The CONTRACTOR shall construct the ASR wells and perform the recharge well abandonments 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 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 Contractor Unit Price Schedule (Appendix A).

B. Contractor Responsibilities:

1. Should the well be lost due to any negligent action on the part of the CONTRACTOR or SUBCONTRACTORS (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. 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.

2. If the loss of the well was not due to any negligent action of the CONTRACTOR or SUBCONTRACTORS, 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 Contractor Unit Price Schedule (Appendix A).
3. If a work delay, deficiency of work performance and/or a material's deficiency is caused by the CONTRACTOR or SUBCONTRACTORS 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 determines that the equipment failure could have been prevented through proper maintenance.

C. Confidentiality:

1. 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.
2. 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.
3. 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 the contracted work tasks.

D. Methods of drilling:

1. Wells TW-ASR8 and TW-ASR9 and/or TW-ASR10 shall be drilled using the reverse circulation rotary drilling method. The CONTRACTOR shall transport drilling make-up water from a source approved by the CONSULTANT, 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.

E. Noise and lighting:

1. Noise Control: It is the CONTRACTOR'S responsibility to meet all ordinances regarding noise and noise control during all drilling, well installation, and testing operations. If required, sound barriers must be approved by the

CONSULTANT. Noise control must be in accordance with American Society for Testing and Materials (ASTM) Standard E 90-90 and shall provide noise reduction as follows:

Center Band Frequency, hertz:	125	250	500	1,000	4,000
-------------------------------	-----	-----	-----	-------	-------

Minimum Acceptable Calculated Silenced SPL db, 60 feet from the site boundary:	11	27	35	32	35
--	----	----	----	----	----

2. The drilling rig mast and work areas must be adequately illuminated during nighttime hours to comply with Occupational Safety and Health Administration (OSHA) regulations and accommodate a safe working environment. However, the CONTRACTOR shall also light the work site in such a manner that, to the extent possible, all lights are either downward facing or oriented away from any nearby residential neighborhoods.

#### 1.04 SITE SAFETY PLAN

- A. The CONTRACTOR must develop a Site Safety Plan for this project, in accordance with applicable OSHA requirements, MAG Specs, and City of Chandler General Provisions. 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 site for each of the CONTRACTOR personnel to comply with provisions of the Site Safety Plan.
- B. The CONTRACTOR shall meet the requirements of the Site Safety Plan at its own cost.

#### 1.05 PROTECTION OF SITE

- A. The CONTRACTOR will be responsible for any required clearing and grubbing of existing vegetation or debris within the well work areas. The CONTRACTOR shall take all necessary precautions to preserve the well sites, as nearly as practical, in their present condition. 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.
- B. A plastic tarp 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, and beneath the pump rig during the

well testing activities. Compressed air introduced into the well 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).

- C. The CONTRACTOR is responsible to apply water for dust control to work areas 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 dust control at its own cost.
- D. All open pits must be fenced to prevent accidental injury of people or animals. The CONTRACTOR will provide fencing at its own cost. After completion of drilling, all sub-grade pits will be drained and allowed to dry to the maximum extent possible before backfilling. All subsurface mud pit excavations shall be filled with self-compacting aggregate material that has been approved by the OWNER or CONSULTANT. Drilled cuttings shall be spread evenly in a thin layer at the well site, such that they do not pose a threat to the existing vegetation or drainage.
- E. Water pumped from the well or from the mud pits 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. For costing purposes, the CONTRACTOR should plan to discharge all fluids at an OWNER-specified location no more than ¼ mile from each well site.
- F. After completion of the work, the CONTRACTOR shall remove and dispose of, in a proper manner, all debris; waste; oil-stained dirt; trash; and unused materials or supplies. The CONTRACTOR shall obliterate all temporary construction facilities such as temporary work areas, temporary structures, and 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 must be removed prior to final acceptance of the well. The CONSULTANT or OWNER must approve the cuttings disposal and site cleanup.

## 1.06 UTILITIES

- A. Water:
  - 1. Water for the drilling of the ASR wells will be available to the CONTRACTOR from a source within ¼ mile of each drilling site. The CONTRACTOR must obtain a construction water meter and a backflow prevention device from the OWNER, for connection with the water source. The water meter must be acceptable to the OWNER. The CONTRACTOR must meter the water used, and will be responsible for any additional piping, connections or ancillary equipment, or labor required to convey water to the site for use. The CONTRACTOR will be responsible for maintaining an adequate flow rate of construction water for all operations under this specification. The CONTRACTOR will also be responsible for any coordination, permits, and/or costs associated with traffic control and road crossings that may be required to convey water to the well site. The OWNER will be responsible for all charges associated with providing water for this project.

- B. Electricity:
1. The CONTRACTOR shall provide, at its own cost, all power required for its operations under the contract.
- C. Restroom Facilities:
1. 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.

**1.07 SUBMITTALS**

- A. The following submittals, samples, certifications, and information listed below shall be provided in accordance with these Specifications.

<u>Submittal Item:</u>	<u>Required Time of Submittal:</u>
1. Statement of drilling equipment to be used	With Contractor Unit Price submittal
2. Certification from drilling foreman, having read and understood the Specifications	Prior to mobilization to site
3. Subcontractor Non-disclosure Agreements	Prior to commencing work by subcontractors
4. Letter of Certification of Decontamination	Prior to equipment use
5. Certified Test Reports of surface casing steel	Prior to installation
6. Specific constituents of cement grout seal for surface casing	Prior to placement of grout
7. Certified test reports of well blank casing, screen, and sounding/transducer tubes steel	Prior to installation
8. Screen tensile strength, collapse strength, weight, and maximum recommended hang weight	Prior to delivery to site
9. Filter Pack sieve analysis/sample	Three days prior to delivery to site
10. Bentonite sample	24 hours prior to installation
11. Cement mix design for well bottom seal and annular seal	Prior to placement of grout

<u>Submittal Item:</u>	<u>Required Time of Submittal:</u>
12. Cement mix design for abandonment seals	Prior to placement of grout
13. Sample of abandonment fill material	Prior to delivery to site
14. Bentonite sample for abandonment seals	24 hours prior to installation
15. Daily Driller's Report	Daily during operations
16. Driller's Well Completion Report	Within 30 days after well completion (per ADWR requirement)
17. Well Abandonment Completion Report	Within 30 days after well completion (per ADWR requirement)
18. Penetration Rate Log	Daily during drilling operations
19. Drilling Fluid Record	Daily during operations
20. Drilling Fluid Control Plan	Prior to start of drilling operations
21. Material Safety Data Sheets	Prior to use of material
22. Formation sampling method	Prior to start of drilling
23. Copies of geophysical logs (including electronic format)	Within 10 working days of logging
24. Affidavit of Compliance with welding provisions	Prior to acceptance of the well
25. Copies of Plumbness and Alignment report (including electronic format)	Prior to acceptance of the well
26. DVD disc of final well video	Prior to acceptance of the well

**1.08 VISITATION AND INSPECTION**

- A. 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.
- B. The CONTRACTOR agrees that the CONSULTANT or 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.

- C. The CONTRACTOR further agrees to include in all subcontracts hereunder, if any, a provision that the SUBCONTRACTOR agrees that the CONSULTANT or 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.

## **PART 2 MATERIALS**

### **2.01 EQUIPMENT**

- A. The CONTRACTOR shall furnish and maintain in safe and efficient working condition all equipment necessary to perform the specified work, including a drilling rig or rigs 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.
- B. The CONTRACTOR shall submit a statement with their Contractor Unit Price Schedule indicating the drilling equipment to be used. The drilling rig used for the installation of the Tumbleweed ASR Wells 8/9/10 shall have a mast capacity no less than 1½ times the string weight of the well casing and screen, and the well shall be installed without 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:
1. 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;
  2. Specified devices for measurement of drilling mud viscosity and weight;
  3. An operating and accurate inclinometer tool;
  4. An operating and accurate penetration rate indicator (Geolograph or equal);
  5. Operating and accurate gauges that indicate the hook load (weight) and torque of the drill string;
  6. A first aid kit;
  7. A fully recharged and operable type ABC dry chemical fire extinguisher; and
  8. An operable mobile telephone located at the well site. The rig mobile phone will be made available to the CONSULTANT and OWNER personnel for reasonable use, at no charge.
- C. 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.
- D. In addition, the compressor used for air supply during well development operations shall be capable of a minimum of 350 pounds per square inch (psi) and 750 cubic feet per minute (cfm). The drill pipe shall have a minimum 5½-inch inside diameter (ID), and the airline shall have a minimum 1¼-inch ID in order to accommodate adequate air flow.

- E. The drilling rig, pumping equipment, and auxiliary equipment used for this project shall be well maintained, and shall meet the standards of the 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.
- F. 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. 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.

## 2.02 WELL INSTALLATION MATERIALS

The materials to be installed in each of the ASR wells 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 screen materials must be approved by the CONSULTANT prior to installation. The final length of the well casing and screen may be adjusted by the CONSULTANT based on analyses of the borehole data. Prior to installation, the CONTRACTOR shall submit certified test reports of the surface, blank, and screen casing to the CONSULTANT to demonstrate compliance with the physical and chemical properties of the well casing steel that are specified herein.

- A. Surface Casing:
  - 1. The surface casing for the ASR wells shall be new, and manufactured in accordance with American Society for Testing and Materials (ASTM) Specification A53 Grade B steel or ASTM Specification A139 Grade B steel. This casing shall have a 30-inch outside diameter (OD) and have a minimum 0.375-inch wall thickness.
  - 2. The minimum length of the surface casing shall be 40 feet, to allow for a minimum 1-foot stickup above land surface.
  - 3. 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 surface casing steel that are specified herein.
- B. Cement Grout Slurry:
  - 1. The surface casing 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. For information purposes, an example sand cement mix design is presented in Appendix B.
  - 2. 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/ft<sup>3</sup>).
  - 3. 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 of cement).

4. Accelerator additives, such as calcium chloride, shall not exceed 2 percent by weight of the cement. Water used for preparing the grout slurry shall be potable.
5. The water source and specific constituents of the cement grout must be approved by the CONSULTANT.
6. 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.

C. Well Casing:

1. The blank well casing for the ASR wells shall be composed of new Type 304 L stainless steel, manufactured in accordance with ASTM Standard A778. The well casing shall have an 18-inch outside diameter and have a 0.312-inch wall thickness.
2. The total length of the blank well casing (including the bottom sump, pump galley, and stickup) will be 114 feet for each well (see Figure 2).
3. 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). Ends of casing lengths shall be as described in Section 3.02.E.6.
4. The bottom sump 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 open-ended.
5. 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.

D. Well Screen:

1. The well screen for the Tumbleweed ASR wells shall be composed of new Type 304L stainless steel, manufactured in accordance with ASTM Standard A778 with addition of horizontal openings (Figure 2). 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 3.02.E.6.
2. The well screen shall have an 18-inch nominal diameter and 0.312-inch wall thickness, with horizontal louvered openings. The horizontal louvered openings shall be factory-installed in the well screen with an approximate 3-inch slot length, in rows that are spaced approximately 1 inch apart in the vertical direction. There shall be 14 perforations per circle to provide 168 openings per linear foot. The screen slot size shall be 0.060 inches, and the open area of the screen shall be no less than 27.6 square inches per lineal foot or 4.3 percent.
3. The anticipated length of the well screen shall be 235 feet for each well (see Figure 2).
4. 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.

E. Sounding Tube and Transducer Tube:

1. The wells shall each be equipped with an external sounding tube and an external transducer tube to facilitate the collection of water levels from the wells. The sounding and transducer tubes shall be 2-inch nominal diameter schedule 40, constructed of new Type 304 L stainless steel.
2. The total length of each sounding tube and each transducer tube, including the 4-foot stickup, shall be approximately 339 feet (see Figure 2). The lower 235 feet of each sounding tube and each transducer tube, with the exception of a 40-foot section adjacent to the pump galley, shall be perforated with vertical slots 0.030-inches in width by 2-inches in length, in 8 rows with 16 slots per foot.
3. The bottom of the sounding tube and the transducer tube shall be capped with a bottom plate consisting of the same composition and same wall thickness as the casing.
4. Prior to installation, the CONTRACTOR shall submit certified test reports to the CONSULTANT to demonstrate compliance with the physical and chemical properties of the sounding tube and transducer tube steel that are specified herein.

F. Filter Pack:

1. The filter pack shall be Colorado Silica Sand or equal, 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 consist of well-rounded particles with an average density of not less than 2.5 grams per cubic centimeter, and have a uniformity coefficient no greater than 1.5. Not more than 1 percent by weight of the material shall have a density of 2.25 grams per cubic centimeter or less. The filter pack shall contain no more than 2 percent by weight thin, flat, or elongated pieces (pieces in which the largest dimension exceeds three times the smallest dimension) determined by hand-packing. The filter pack material shall be free of shale, mica, clay, dirt, loam, and organic impurities of any kind, and shall not contain iron or manganese in a form or quantity that will adversely affect the water quality.
2. The filter pack grain size will be retained by a 9 mesh U.S. Standard sieve and pass through a 6 mesh U.S. Standard sieve.
3. 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.
4. The filter pack material shall be contained in a temporary storage area at the well site in such a manner as to prevent contamination.
5. The filter pack material shall be bagged in approximately 3,000-pound (about one cubic yard) "super sacks".
6. Each bag must be labeled with its actual weight. Any filter pack material delivered unbagged or unlabeled will be rejected.

G. Bentonite Seal:

1. The bentonite seal material shall consist of sodium bentonite pellets or bentonite chips. The bentonite seal material shall contain no hazardous material or gypsum.

2. A sample of the bentonite material shall be provided to the CONSULTANT for approval no less than 24 hours prior to installation.

H. Cement Grout Seals:

1. The cement grout seal material shall consist of a 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 shall not exceed 50 percent by volume of the cement. Non-pozzolanic aggregate or sand may not be added to the cement grout. For information purposes, an example pozzolan cement mix design is presented in Appendix B.
2. 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/ft<sup>3</sup>). 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.
3. 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.
4. 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.

## 2.03 WELL ABANDONMENT MATERIALS

The materials necessary to abandon the ten (10) vadose zone recharge wells are described below. The CONTRACTOR shall be responsible for the timely delivery of the fill and seal materials and other materials to the well site, as determined by the CONSULTANT, and as required to complete the well abandonment operations. The fill and seal materials must be approved by the CONSULTANT prior to installation.

A. Cement Grout Seals:

1. The cement grout seal material shall consist of a 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 shall not exceed 50 percent by volume of the cement. Non-pozzolanic aggregate or sand may not be added to the cement grout. For information purposes, an example pozzolan cement mix design is presented in Appendix B.
2. 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/ft<sup>3</sup>). 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.
3. 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.
4. 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.
- B. Fill Material:
1. The fill material shall consist of clean fine sand or clean pea gravel.
  2. Samples of the fill material shall be submitted to the CONSULTANT for approval, prior to delivery of the material to the well site.
- C. Bentonite Seal Material:
1. The bentonite seal material shall consist of sodium bentonite pellets or bentonite chips. The bentonite seal material shall contain no hazardous material or gypsum.
  2. A sample of the bentonite material shall be provided to the CONSULTANT for approval no less than 24 hours prior to installation.

### **PART 3 EXECUTION**

#### **3.01 REPORTS, LOGS, AND RECORDS**

- A. General:
1. The CONTRACTOR shall keep an accurate and legible daily log and record of all drilling, construction, testing, and abandonment describing all geologic material encountered during drilling, the depths at which changes in formation occur, and all difficulties or unusual conditions encountered.
  2. The log and record shall also show the method of completing the well, including the lengths of the well casing, well screen and sounding/transducer tube 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.
- B. Daily Driller's Report:
1. During the drilling of the borehole, well construction, and abandonment operations, a detailed driller's report shall be maintained and provided daily to the CONSULTANT at the well site. The daily driller's report shall be recorded on forms approved by the CONSULTANT.
  2. The report 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 or hard drilling conditions; 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.
  3. CONTRACTOR personnel will submit the report to the CONSULTANT daily.
- C. Driller's Log:
1. During the drilling of the borehole, the CONTRACTOR shall prepare a detailed driller's log in compliance with the requirements of the Arizona Department of Water Resources (ADWR).

2. 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.
  3. The lithologic log prepared by the CONSULTANT will be made available to assist the CONTRACTOR in the preparation of the driller's log.
  4. A copy of the driller's log shall be furnished to the ENGINEER and to the CONSULTANT upon completion of drilling and filed with ADWR as required by the rules and regulations of ADWR.
- D. Well Abandonment Completion Report
1. During the abandonment of each recharge well, the CONTRACTOR shall prepare a detailed report in compliance with the requirements of ADWR.
  2. A copy of the Well Abandonment Completion Report shall be furnished to the ENGINEER and to the CONSULTANT upon completion of abandonment and filed with ADWR as required by the rules and regulations of ADWR.
- E. Penetration Rate Log:
1. 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.
  2. This log shall be available for review by the CONSULTANT throughout the drilling program, and a copy of the log shall be delivered to the CONSULTANT daily.
- F. Drilling Fluid Record:
1. 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 3.01.H.3.
  2. The drilling fluid record shall be available for review by the CONSULTANT and OWNER throughout the course of drilling, and the log shall be delivered to the CONSULTANT upon completion of each day's work activities.
- G. Drilling Fluid Control Plan:
1. 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 must be certified by the National Sanitation Foundation.
- H. Drilling Fluid Testing:
1. 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 1-hour travel time of the site during all drilling and well construction operations. Drilling fluid tests shall be performed by the drilling fluid

engineer SUBCONTRACTOR 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:

- a. (1) every 24 circulating hours;
  - b. (2) when significant changes to the drilling fluid are made;
  - c. (3) whenever borehole conditions appear to have changed or when problems arise; and
  - d. (4) at the request of the CONSULTANT.
2. 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.
  3. The CONTRACTOR shall maintain current records at the site at all times to show:
    - a. (1) the time, depth, and results of all drilling fluid tests;
    - b. (2) all materials added to the system, (i.e., kind, amount, time, and depth); and
    - c. (3) variances or modifications from the agreed upon fluid program such as time, depth, reason, and authorization.
  4. 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 mud pit at the site shall have a minimum depth of 6 feet, and a total volume no less than 3 times that of the reamed borehole (minimum of approximately 3,900 cubic feet; e.g., 6 x 22 x 30 or equivalent necessary to meet the volume requirements), unless otherwise approved by the CONSULTANT. The pit 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 pit must be approved by the CONSULTANT.

I. General Requirements:

1. During the drilling and reaming of the borehole, and the installation of the ASR wells, 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. A Material Safety Data Sheet (MSDS) 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:
  - a. Protection of water-bearing and potential water bearing formations exposed to the borehole;
  - b. Representative samples of the formation materials and groundwater;
  - c. Maximum development capacity and optimum potential yield of the completed well;
  - d. Inhibition of the formation and prevention of formation-caused drilling problems (e.g., heaving sands, swelling clays, lost circulation);

- e. Protection of the integrity of the boring during drilling and well installation operations; and
- f. Complete and accurate geophysical logging of the boring.

J. Lost Circulation:

1. "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.
2. 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 Contractor Unit Price Schedule (Appendix A; Rig Hourly Rate with Crew), in lieu of footage compensation. The OWNER will also provide compensation at a rate of cost plus 15 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.
3. 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 Section 3.01.1.1 of this Specification.

K. Penetration:

1. 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 Contractor Unit Price Schedule (Appendix A; Rig Hourly Rate with Crew), in lieu of footage compensation. The OWNER will also provide compensation at a rate of cost plus 15 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.
2. 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.

3. Upon invocation of this Section, the CONTRACTOR will trip the drill string out of the hole for inspection of the drill bit by the CONSULTANT. The conditions of this Section shall apply only if the CONSULTANT'S inspection 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 inspection 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 inspection reveals excessive wear or improper bit type, the provisions of this clause will not be invoked.

### 3.02 WELL DRILLING AND INSTALLATION

#### A. Surface Casing Installation:

1. The surface casing borehole for each of the ASR wells may be drilled using a rotary drilling method or by use of the bucket auger (solid stem auger) drilling method.
2. The surface casing borehole shall be drilled to a minimum 36-inch diameter, to a depth of approximately 39 feet bls. The CONSULTANT reserves the right to direct the drilling of the surface casing borehole to a greater depth depending on geologic formations and other subsurface conditions at the well site.
3. During the drilling of the surface casing borehole, the CONTRACTOR shall collect and preserve for the CONSULTANT samples of the drilled cuttings at 10-foot intervals from the land surface to the total depth of the borehole.
4. The surface casing material shall conform to the specifications described in Section 2.02.A.1.
5. The surface casing shall be placed from 1 foot above ground surface to at least 39 feet bls. The surface casing shall be maintained centered in the hole before the occurrence of the initial set of the cement grout.
6. The surface casing cement grout seal material shall conform to the specifications detailed in Section 2.02.B.
7. The cement grout weight shall be measured prior to installation, as an indicator of the cement-water mix ratio.
8. 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 the specific constituents of the cement grout to the CONSULTANT prior to placement of the grout.
9. 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.
10. The cement grout slurry shall be placed in the annulus between the casing and borehole wall from the base of the surface casing to 10 feet below ground surface. The CONTRACTOR shall be responsible for maintaining an equalization of pressures inside and outside of the casing to the extent necessary to prevent collapse of the surface casing. 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 drilling method, the surface casing grout seal may be placed in two separate installations. The remainder of the annulus shall be temporarily filled with clean soil to completely extend to the ground surface. The method of grout installation must be approved by the

CONSULTANT.

11. A minimum curing time for the surface casing grout seal is 12 hours, and the cement grout shall obtain a compressive strength of 500 pounds per square inch (psi).
12. The CONTRACTOR will be required to work continuously, on a 24-hour per day, 7-day per week basis, while installing and grouting the surface casing.

B. Pilot Borehole Drilling:

1. A pilot borehole shall be drilled for each of the ASR wells from a depth of approximately 39 feet below land surface (bls) to the total borehole depth of 450 feet bls. The pilot borehole shall have a diameter no less than 16 inches and no greater than 17-1/2 inches, unless otherwise approved by the CONSULTANT. The pilot boring shall be drilled using the methods described in Section 1.03.D.1, and in compliance with the drilling fluid control program described in Section 3.01.G.
2. During the drilling of the pilot borehole, the CONTRACTOR shall collect and preserve for the CONSULTANT samples of the drilled cuttings at 10-foot intervals from the land surface to the total depth of the borehole. Each cutting sample shall be collected from a CONSULTANT-approved sample catching device, which shall be cleaned of all cuttings after each sample is taken.
3. A sump-type or baffle type sample catching device shall be provided by the CONTRACTOR. Prior to the start of drilling, the CONTRACTOR shall submit details of the proposed formation sampling method to the CONSULTANT. The sampling program and equipment must be approved by the CONSULTANT.
4. The drilled cuttings samples shall be placed in 4-1/2 inch x 6-inch cloth sacks (HUBCO or equal) furnished by the CONTRACTOR. Additionally, each sample shall be laid out in a sample storage area on a water-proof tarp or ground cloth, in descending order, for a visual record of the borehole stratigraphy. The storage area must allow samples to be maintained in sequence and unmixed until they have been examined and logged by the CONSULTANT. After examination by the CONSULTANT, the drilled cuttings shall be removed from the site and disposed of by the CONTRACTOR.
5. During the drilling of the pilot borehole, plumbness and alignment tests shall be performed by the CONTRACTOR using an inclinometer (TOTCO tool or CONSULTANT-approved alternate) at 100-foot intervals. A 3-degree unit shall be used with the inclinometer.
6. During the drilling of the pilot boring, all operations shall be conducted on a 24-hour per day, 7-day per week basis.

C. Geophysical Logging:

1. Geophysical logging will be conducted from a depth of 39 feet to the total borehole depth at the cessation of pilot borehole drilling. The geophysical logging company will be contracted by the CONTRACTOR for the pilot hole logging and for the final caliper log. After the pilot boring has been reamed to its final diameter, a final caliper log will be conducted to confirm the borehole diameter. The geophysical logging, including the pilot hole logging and the final caliper log, shall be conducted under the observation of the CONSULTANT. The geophysical logging suite for the Tumbleweed ASR wells will include the following logs:
  - a. Spontaneous Potential and Resistivity Logs (Electric Log);

- b. Acoustic Log (Sonic Log);
  - c. Natural Gamma Ray Log;
  - d. Caliper Surveys (2 surveys: pilot borehole and reamed borehole);  
and
  - e. Guard Log.
2. The CONTRACTOR shall keep the borehole full of drilling fluid at all times during geophysical logging, to stabilize the borehole and provide log integrity.
  3. 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.
  4. The geophysical logging company SUBCONTRACTOR must be approved by the CONSULTANT, and all geophysical logging shall be conducted under the observation of the CONSULTANT. At the request of the CONSULTANT, the geophysical logging SUBCONTRACTOR will conduct 50-foot repeat sections of any or all geophysical logs to demonstrate accuracy and repeatability of the geophysical data. The repeat sections shall be conducted at no cost to the OWNER. The geophysical logging company SUBCONTRACTOR shall provide five (5) field copies of each geophysical log to the CONSULTANT at the site, immediately following the completion of geophysical logging. Within 10 working days following completion of the geophysical logging, 12 final copies of each geophysical log shall be provided to the CONSULTANT, as well as an electronic original of the logging data in Windows metafile (\*.wmf) or enhanced metafile (\*.emf) format. The quality and clarity of the geophysical logs must be approved by the CONSULTANT.

**D. Borehole Drilling:**

1. After the completion of geophysical logging in the pilot borehole, the borehole shall be reamed to a 26-inch diameter to a depth of 355 feet for each of the ASR wells. The CONSULTANT reserves the right to direct the drilling of the borehole to a greater or lesser depth, depending on geologic formations and other subsurface conditions encountered during the pilot borehole drilling and logging. The boring shall be reamed using the methods described in Section 1.03.D.1, and in compliance with the drilling fluid testing and reporting requirements of Section 3.01.F and Section 3.01.H.
2. During the reaming of the borehole, all operations shall be conducted on a 24-hour per day, 7-day per week basis.
3. Upon completion of the reamed borehole to its final depth and diameter, as determined by the CONSULTANT, and upon completion of the caliper log of the reamed hole, the CONTRACTOR shall immediately commence well installation operations, and shall conduct all installation operations on a 24-hour per day, 7-day per week basis.

**E. Casing Installation:**

1. During the installation of the well casing and screen, the boring shall be kept full of drilling fluid of the type specified in Section 3.01.H and be free from any obstructions detrimental to completing the casing and screen installation.
2. The well casing and screen shall be set centered in the hole so as not to interfere in any way with the grout seal, filter pack, well installation, or maximum efficient operation of 16-inch diameter pumping equipment within the well casing or

- screen.
3. The sounding tube and transducer tube will be installed just prior to or at the same time as the well casing and screen.
  4. 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 shall be set by the CONTRACTOR at the depth intervals specified by the CONSULTANT.
  5. Stainless 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 on the portion of the well casing above the total depth of the sounding/transducer tubes. The casing and screen shall be hung in suspension until the filter pack and upper cement grout seal have been installed.
  6. Joints in the Well Blank and Louvered Casing:
    - a. Joints in the well blank casing and louvered casing shall be field welded in accordance with applicable provisions of the American Water Works Association (AWWA) Standard C206 for welded joints. A welding sequence will be followed that will avoid excessive distortion. The appropriate welding rods shall be used for the connection of Type 304L stainless steel joints of well casing.
    - b. The ends of the casing lengths shall be ground, or sufficiently scarfed, to remove sharp edges or burrs.
    - c. Each casing section shall be beveled at one end to allow complete penetration of the welds.
    - d. If the casing sections are joined with welding rings, the welding collar shall be of the same wall thickness and physical and chemical properties as the corresponding casing sections, it shall have a minimum 5-inch length, and shall fit the outside diameter 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.
    - e. 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.
    - f. 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.
    - g. All welding shall be performed by an experienced welder.
    - h. 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 strict accordance with all applicable provisions of this Section of this Specification.

**F. Annular Materials Installation:**

1. Bottom Cement Seal:
  - a. The cement grout weight shall be measured prior to installation as an indicator of the cement-water mix ratio.

- b. The grout seal shall be placed to completely fill the annular space outside the well casing from the bottom of the reamed borehole to 5 feet above the bottom of the well casing (a 15-foot cement seal is anticipated). The final depth of the top of the lower cement seal may not vary by more than  $\pm 3$  feet. If the depth of the top of the lower seal varies by more than  $\pm 3$  feet, the CONTRACTOR will take corrective actions to comply with this standard at no cost to the OWNER.
  - c. 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.
  - d. The cement grout shall be placed by pumping through a tremie pipe. The discharge end of the tremie shall be continuously submerged in the grout until the zone to be grouted is completely filled.
  - e. The CONTRACTOR is responsible for preventing excessive differential pressures that may cause casing collapse during the grouting operations. The well casing shall be hung in tension throughout the initial grouting operation, until the cement grout has cured sufficiently. The minimum curing time for the cement grout seal shall be 12 hours or the cement grout obtaining a compressive strength of 500 psi.
  - f. The specific method of installation must be approved by the CONSULTANT.
2. Filter Pack:
- a. Filter pack shall be placed from the top of the lower cement seal, and shall completely fill the annulus in the specified interval. The specific method of filter pack placement and the filter pack material must be approved by the CONSULTANT.
  - b. During the time of placement, fluid circulation shall be maintained through a CONSULTANT-approved swab block located approximately 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. The CONTRACTOR is responsible to avoid bridging of the filter pack sand during its installation.
  - c. 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.
  - d. The level of the filter pack shall be measured periodically during placement, as required by the CONSULTANT.
  - e. Placement of the filter pack will be continuous, except when additional precautions are necessary to prevent bridging, or measurements of the filter pack level are being conducted.
  - f. The quantity of filter pack material placed in the annulus shall not be less than that of the computed volume. Upon completion of the filter pack placement, excess filter pack material will be judged as an indication of voids in the sand envelope, and corrective measures shall be undertaken at the CONTRACTOR's expense.
  - g. Simultaneous with the installation of the filter pack sand, a granular hypochlorite or similar disinfectant shall be added to the filter pack sand at

the rate of 1/2-pound per cubic yard of filter pack material, based on 70 percent chlorine content. If a lesser strength hypochlorite or other chlorine product is used, the quantity shall be adjusted accordingly.

- h. 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.

3. Bentonite Seal:

- a. A 5-foot bentonite seal shall be installed in the well annulus to fill the void between the casing and borehole, from the top of the filter pack to approximately 5 feet above the filter pack.
- b. The bentonite seal shall be installed simultaneous with the reverse circulation of drilling fluids down the annulus, until such time that the annulus has been sealed and circulation can no longer be maintained.
- c. The specific method of installing the bentonite must be approved by the CONSULTANT.

4. Upper Cement Grout Seal:

- a. The cement grout weight shall be measured prior to installation as an indicator of the cement-water mix ratio.
- b. The grout seal shall be placed to completely fill the annular space outside the well casing from the top of the bentonite seal to 10 feet below land surface.
- c. 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.
- d. The cement grout shall be placed by pumping through a tremie pipe. The discharge end of the tremie shall be continuously submerged in the grout until the zone to be grouted is completely filled.
- e. The CONTRACTOR is responsible for preventing excessive differential pressures that may cause casing collapse during the grouting operations. The well casing shall be hung in tension throughout the initial grouting operation, until the cement grout has cured sufficiently. The minimum curing time for the cement grout seal shall be 12 hours or the cement grout obtaining a compressive strength of 500 psi.
- f. The specific method of installation must be approved by the CONSULTANT.

G. Well Development:

- 1. Well development shall initially be accomplished by simultaneously swabbing and airlift pumping.
- 2. The well development shall proceed from the bottom of the louvers to the top of the louvers, at a rate of no less than 7.5 minutes per foot of screen, not to exceed total quantity, unless otherwise directed by the CONSULTANT.
- 3. During swab and air-lift development, a discharge rate of no less than 50 gpm must be maintained.
- 4. The specific methods and equipment for well development must be approved by the CONSULTANT.
- 5. Subsequent to the swabbing and airlift development, the well shall be further developed by pumping and surging to remove additional fine sediment from the

well bore. The specific pump-and-surge development method must be approved by the CONSULTANT.

6. The pump-and-surge development program is anticipated to have a 12-hour duration, with pumping rates ranging from 500 to 2,000 gpm.
7. Development water shall be contained and/or disposed of by the CONTRACTOR as specified in Section 1.05.E. Re-use of discharge water will not be allowed.

H. Well Plumbness and Alignment:

1. Tests for plumbness and alignment shall be made by the CONTRACTOR during the drilling of the pilot borehole, and after the construction of the well is complete. If the well fails the final plumbness and alignment test, the CONTRACTOR must correct the plumbness and alignment to the satisfaction and approval of the CONSULTANT and OWNER. Plumbness and alignment correction costs will be borne by the CONTRACTOR.
2. In accordance with AWWA Standard A100, the maximum allowable horizontal deviation (drift) from vertical shall not exceed 12.0 inches per 100 feet of depth. The CONTRACTOR shall guarantee that when completed, the well shall be sufficiently straight and plumb to permit the free installation and operation of a 30-foot long vertical turbine pump with a 16-inch diameter set at approximately 10 feet above the total depth of the well. To demonstrate compliance with this requirement, the CONTRACTOR shall furnish all labor, equipment, and materials to conduct plumbness and alignment tests to the satisfaction of the CONSULTANT. Tests for plumbness and alignment must be approved by the CONSULTANT and the OWNER.
3. During the drilling of the borehole, plumbness and alignment tests shall be performed by the CONTRACTOR using an inclinometer (TOTCO tool or equal) at a minimum of 100-foot intervals. A 3-degree unit shall be used with the inclinometer.
4. After completion of well construction, the CONTRACTOR shall conduct a final plumbness and alignment test by use of a gyroscopic survey or dummy test, as determined by the OWNER. The plumbness and alignment test shall be witnessed by the CONSULTANT. The final plumbness and alignment test must indicate compliance with the plumbness and alignment requirements of AWWA Standard A100, and must be approved by the CONSULTANT and OWNER in order to be acceptable. The plumbness and alignment company SUBCONTRACTOR and the specific tool to be used must be approved by the CONSULTANT. The gyroscopic survey tool shall be centralized in the well, and the geophysical logger SUBCONTRACTOR shall conduct a 30-foot repeat section to demonstrate accuracy and repeatability of the gyroscopic data. The repeat section shall be conducted at no additional cost to the OWNER.
5. The CONTRACTOR shall submit a written report of the results of the plumbness and alignment tests to the CONSULTANT. The written plumbness and alignment report shall include numerical values of the well deviation, and also graphical diagrams of the well alignment from both a profile perspective (both Northing and Easting views) and a vertical perspective. The CONTRACTOR shall provide to the CONSULTANT five (5) draft copies of the plumbness and alignment report upon completion of the gyroscopic survey, and 12 final copies of the report as well as an electronic original of the logging data in Windows metafile (\*.wmf) or enhanced metafile (\*.emf) format within 10 days thereafter. The quality and clarity of the gyroscopic logs must be approved by the CONSULTANT. The report must

- be furnished to the CONSULTANT prior to acceptance of the well.
6. The OWNER may waive the requirements of plumbness and alignment if: (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.

I. Final Well Video:

1. After the completion of well construction, development, and testing, the CONTRACTOR shall provide a color video survey of each well to document the integrity and structure of the well.
2. The video survey will be conducted under the observation of the CONSULTANT, and the quality and clarity of the well video must be acceptable to the CONSULTANT.
3. The video survey camera shall include both downward-looking and side-view capabilities.
4. Two copies of the DVD disc of the final well video for each well shall be provided by the CONTRACTOR to the CONSULTANT prior to acceptance of the wells.

J. Covering Plate and Access Port:

1. After completion of all testing and surveys, the well shall be temporarily capped with a low-carbon steel covering plate. 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.

### 3.03 WELL TESTING

A. General:

1. The well testing shall consist of a 10-hour step-discharge test and a 24-hour constant rate aquifer test, which will be followed by a minimum 4-hour water-level recovery period for each of the wells.
2. The CONTRACTOR shall obtain and record water level measurements at ½-hour intervals throughout the duration of the 24-hour constant rate aquifer test, or as directed by the CONSULTANT.
3. The CONSULTANT and ENGINEER reserve the right to extend or shorten the test duration.

B. Test Equipment:

1. During the step-discharge test and constant rate aquifer test, the CONTRACTOR shall furnish pumping equipment capable of pumping at a rate of 2,500 gpm, with a pumping lift (not including pipe friction losses) of 300 feet below land surface (bls).
2. The pumping equipment shall include satisfactory throttling devices or valves such that the discharge can be adjusted to various rates.
3. The test pump setting shall be determined by the CONSULTANT based on the final well design. The anticipated setting of the test pump inlet for the wells is 240 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.
4. A plastic tarp and berm shall be placed beneath the pump rig during mobilization

to protect the site against oil or hydraulic fluid spills or leaks, and will remain beneath the pump rig until demobilization. A plastic tarp and berm shall also be placed beneath any other stationary equipment such as fuel tanks.

5. The pump equipment shall not be removed from the well until after the completion of the water-level recovery test.
6. The CONTRACTOR shall provide flow meters and totalizers. The CONSULTANT must approve the test pump, motor, metering equipment, and accessories.

C. Pump Discharge:

1. The CONTRACTOR shall operate the test pump(s) 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. The discharge shall be controlled and maintained at the specified rate for the entire test duration with an accuracy of plus-or-minus 5 percent.
2. The pump discharge shall be measured with a calibrated orifice and manometer. A propeller-type or magnetic inductive-type flowmeter shall also be installed in the discharge pipe as an alternate method of discharge measurement. The discharge water shall be conveyed through a straight pipe without any bends, valves or other obstructions for a distance of no less than 10 pipe diameters upstream and 5 pipe diameters downstream of all in-line flowmeters (unless otherwise recommended by the manufacturer of the meter). The discharge pipe shall be oriented in such a manner as to ensure that the pipe remains full of water at the flowmeters at all times during pumping. The discharge measurement device(s) must be approved by the CONSULTANT.
3. The CONTRACTOR shall also furnish equipment for measurement of the sand production during pumping. The sand measurement device shall be a Rossum Sand Sampler, or equal, in accordance with AWWA Standard A100. The discharge flow measurement device(s) and sand measurement device must be approved by the CONSULTANT.
4. The discharge water from the well shall be directed to a point of discharge that has been approved by the CONSULTANT. The anticipated discharge point will be an irrigation lateral on the south side of Tumbleweed site no more than ¼ mile from either drilling site. The discharge piping shall be watertight and capable of conveying the specified flow rates for the specified pumping periods.
5. The CONTRACTOR is responsible for providing adequate piping for the actual distances to the discharge points. The OWNER shall obtain any necessary AZPDES permits related to the discharge of water from pumping tests.
6. 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.

### 3.04 ABANDONMENT OF EXISTING RECHARGE WELLS

- A. The specific procedure for abandonment of the well shall be in accordance with ADWR Article 8, Rule R12-15-816, and must be approved by the CONSULTANT. The well abandonment methods described below assume that the well casings have no collapses, and that no foreign objects or debris will need to be removed from the well through fishing operations prior to abandonment. For reference, the preliminary well design for a typical well abandonment is included as Figure 3. As-built drawings for the recovery wells were not available. However, for costing purposes it can be assumed

that they are similar to previous wells. Therefore, an as-abandoned drawing for RW-2 is included as Figure 3.

- B. The CONTRACTOR shall not commence abandonment operations of the ten (10) vadose zone recharge wells until after completion of the ASR wells, and must obtain approval from the CONSULTANT prior to commencement. If any downhole equipment is encountered, the CONTRACTOR shall remove it prior to the abandonment of each well. The piping shall be removed from well back to the 24-inch line, and the vault lid, spring, and hatch arms shall be returned to the OWNER.
- C. For costing purposes, assume each well is constructed with an 18-inch schedule 40 or schedule 80 PVC casing to a depth of approximately 125 feet bls, and contains two 2-inch (approximately) sounding tubes installed to unknown depths (see Figure 3). Each casing, gravel feed tube, or sounding tube shall be abandoned as described below.
- D. A tremie pipe shall be installed to the total depth of each well casing, through which fill and seal materials will be installed. Three intervals of clean fine sand or clean pea gravel shall be installed in each well casing (from the bottom of the well casing to 70 feet bls, from approximately 65 feet to 45 feet bls, and from approximately 40 feet to 25 feet bls). These depths may be adjusted slightly by the CONSULTANT prior to commencement of abandonment activities.
- E. Two 5-foot thick bentonite seals (composed of sodium bentonite chips) shall be installed in each well casing (from approximately 70 feet to 65 feet bls and from 45 feet to 40 feet bls).
- F. One 25-foot thick cement grout seal shall be installed in each well casing to fill it from land surface to 25 feet bls (or from the top of the existing vault to 25 feet below the top of the vault), per ADWR's well abandonment guidelines. Water used for preparing the grout slurry shall be potable.
- G. The gravel feed tube(s) and sounding tube(s) shall be filled in entirety with cement grout.

#### **PART 4 MEASUREMENT AND PAYMENT**

##### **4.01 BASIS OF MEASUREMENT AND PAYMENT**

- A. Compensation for all work specified to be performed under this specification will be made under the payment items presented in this Section (Part 4). 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, or lump sum basis, as designated.

##### **4.02 DESCRIPTION OF PAYMENT ITEMS**

- A. Payment schedule for well construction, development, and testing of the ASR wells and abandonment of the recharge wells is presented in the Contractor Unit Price

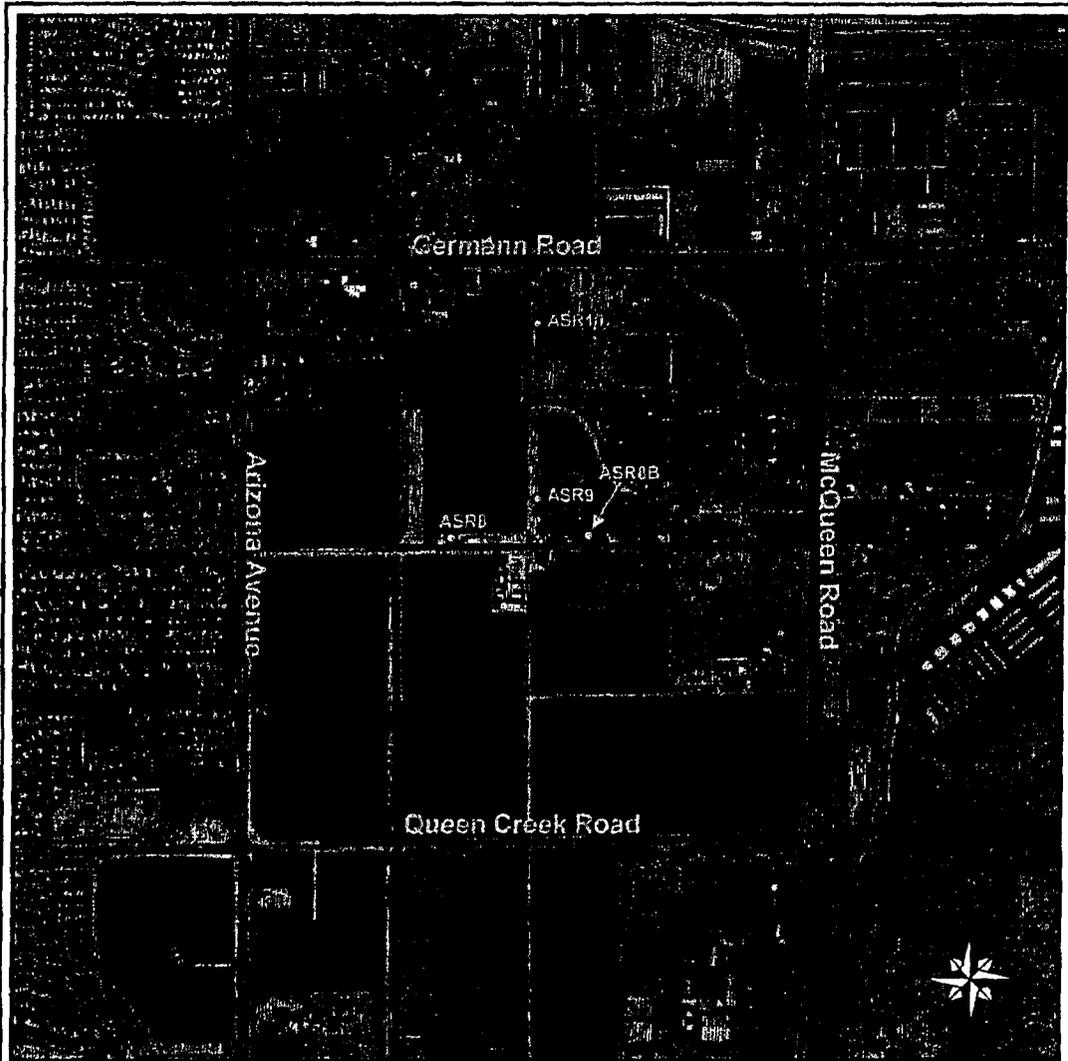
Schedule (Appendix A). A separate unit price schedule is provided for TW-ASR10 as this well may or may not be completed. A detailed description of each item of the payment schedule is presented below.

1. **Item 1 – Mobilization and Demobilization** consists of moving and assembling all drilling, testing, and support equipment at the job site, removing or transferring the equipment from the job site when the work is completed, and job site cleanup. Item 1 also includes all labor, equipment, and material costs associated with the covering plate and access port, as described in Section 3.02.J. Payment will be made on a lump sum basis. Half of the mobilization fees may be billed after mobilization to the site. The remaining portion may be billed upon approval of job completion.
2. **Item 2 – Mobilization and Demobilization between ASR sites** consists of moving and assembling all drilling, testing, and support equipment at the job site and moving equipment from one well site to the next, removing or transferring the equipment from the job site when the work is completed, and job site cleanup. Item 1 also includes all labor, equipment, and material costs associated with the covering plate and access port, as described in Section 3.02.J. Payment will be made on a lump sum basis. Half of the mobilization fees may be billed after mobilization to the site. The remaining portion may be billed upon approval of job completion.
3. **Item 3 – Surface Casing Construction** consists of all labor, equipment, material, and SUBCONTRACTOR costs associated with drilling the surface boring, and placement of the surface casing and surface grout seal in accordance with Sections 2.02.A, 2.02.B, and 3.02.A. This item includes: drilling a 36-inch diameter surface borehole to 39 feet; providing a 30-inch diameter steel surface casing; installation of the surface casing; and installation of the surface casing cement grout seal. Payment will be made on a linear-foot basis.
4. **Item 4 – ASR 8 Site Preparation** consists of leveling and grading of the site. Payment will be made on a lump sum basis.
5. **Item 5 – ASR 9 Site Preparation** consists of leveling and grading of the site. Payment will be made on a lump sum basis.
6. **Item 6 – Pilot Hole Drilling** consists of all labor, equipment, and material costs associated with drilling a maximum 17½-inch diameter pilot hole for each well in accordance with Section 3.02.B. Payment will be made on a linear-foot basis.
7. **Item 7 – Geophysical Logging** consists of all labor, equipment, material, standby time, and SUBCONTRACTOR costs associated with geophysical logging, as specified in Section 3.02.C. Payment will be made on a lump sum basis.
8. **Item 8 – Borehole Reaming** consists of all labor, equipment, and material costs associated with reaming the pilot hole for each ASR well to a 26-inch diameter in accordance with Section 3.02.D. Payment will be made on a linear-foot basis.
9. **Item 9 – 18-Inch Stainless Steel Well Casing** consists of the material cost of the well casing, as specified in Section 2.02.C. Payment will be made on a linear-foot basis.
10. **Item 10 – 18-Inch Stainless Steel Well Screen** consists of the material cost of the well screen, as specified in Section 2.02.D. Payment will be made on a linear-foot basis.
11. **Item 11 – 2-Inch Stainless Steel Sounding Tube and Transducer Tube** consists of the material cost of the sounding tube and transducer tube, as specified in Section 2.02.E. Payment will be made on a linear-foot basis.

12. **Item 12 – Casing and Screen Installation** consists of all labor and equipment costs required for the installation of the well casing, screen, and sounding/transducer tubes, including welding requirements, logs, and records, as specified in Section 3.02.E. Payment will be made on a linear-foot basis.
13. **Item 13 – Silica Sand Filter Pack** consists of all labor, equipment, and material costs to furnish and install the filter pack, as specified in Sections 2.02.F and 3.02.F2. Item 10 also includes the disinfection of the filter pack, as specified in Section 3.02.F.2. The Item 10 filter pack volume as indicated in the Contractor Unit Price Schedule (Appendix A) is based on the calculated volume plus a 30 percent overage. Payment will be made on a per ton basis.
14. **Item 14 – Bentonite Seal** consists of all labor, equipment, and material costs to furnish and install the bentonite seal, as specified in Sections 2.02.G and 3.02.F.3. The Item 11 annulus material volumes as indicated in the Contractor Unit Price Schedule (Appendix A) are based on the calculated volume plus a 30 percent overage. Payment will be made on a per cubic foot basis.
15. **Item 15 – Cement Grout Seals** consists of all labor, equipment and material costs to furnish and install the cement grout seals (bottom seal and upper annular seal) in accordance with the requirements of Sections 2.02.H, 3.02.F.1, and 3.02.F.4. The Item 12 cement grout material as indicated in the Contractor Unit Price Schedule (Appendix A) is based on the calculated volume plus a 30 percent overage. Payment will be made on a per cubic yard basis.
16. **Item 16 – Air Lift/Swab Development** consists of all labor, equipment, and material costs associated with well development by swabbing and air-lift pumping, as specified in Section 3.02.G. Payment will be made on an hourly basis.
17. **Item 17 – Pump/Surge Development** consists of all labor, equipment, and material costs associated with pump-and-surge development, as specified in Section 3.02.G. Payment will be made on an hourly basis.
18. **Item 18 – Plumbness/Alignment Test** consists of all labor, equipment, material, and SUBCONTRACTOR costs associated with the testing for plumbness and alignment, as described in Section 3.02.H. Payment will be made on a lump sum basis.
19. **Item 19 – Final Well Video** consists of all labor, equipment, material, and SUBCONTRACTOR costs associated with the final well videos, as described in Section 3.02.I. Payment will be made on a lump sum basis.
20. **Item 20 – Furnish, Install, and Remove Well Test Pumping Equipment** consists of all labor, equipment, material, and SUBCONTRACTOR costs associated with furnishing, installing, and removing the pump equipment for the well testing activities, as described in Sections 3.03.B and 3.03.C. Payment will be made on a lump sum basis.
21. **Item 21 – Pump Tests** consists of the cost of all labor, equipment, materials, and SUBCONTRACTORS associated with the well testing, as described in Section 3.03.A. Payment will be made on an hourly basis.
22. **Item 22 – Vadose Zone Abandonment and Equipment Salvage** consists of all labor, equipment, material, and SUBCONTRACTOR costs associated with removing existing pump equipment and abandoning the recharge wells, as described in Sections 2.03 and 3.04. Payment will be made on a lump sum basis.
23. **Item 23 – Project Allowance** is to be used on a as-needed basis with prior approval from OWNER.

24. **Item 24 – Rig Hourly Rate Without Crew (Allowance Item)** consists of the cost of maintaining equipment if a work stoppage occurs at the well, which is not due to any fault of the CONTRACTOR or SUBCONTRACTORS. Payment for any standby time is subject to approval by the CONSULTANT and OWNER. Payment will be made on an hourly basis.
25. **Item 25 – Rig Hourly Rate With Crew (Allowance Item)** consists of the cost of maintaining equipment and personnel if a work stoppage occurs at the well, which is not due to any fault of the CONTRACTOR or SUBCONTRACTORS. Payment for any standby time is subject to approval by the CONSULTANT and OWNER. Payment will be made on an hourly basis.

## FIGURES

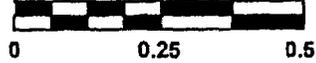


**Well locations\*:**

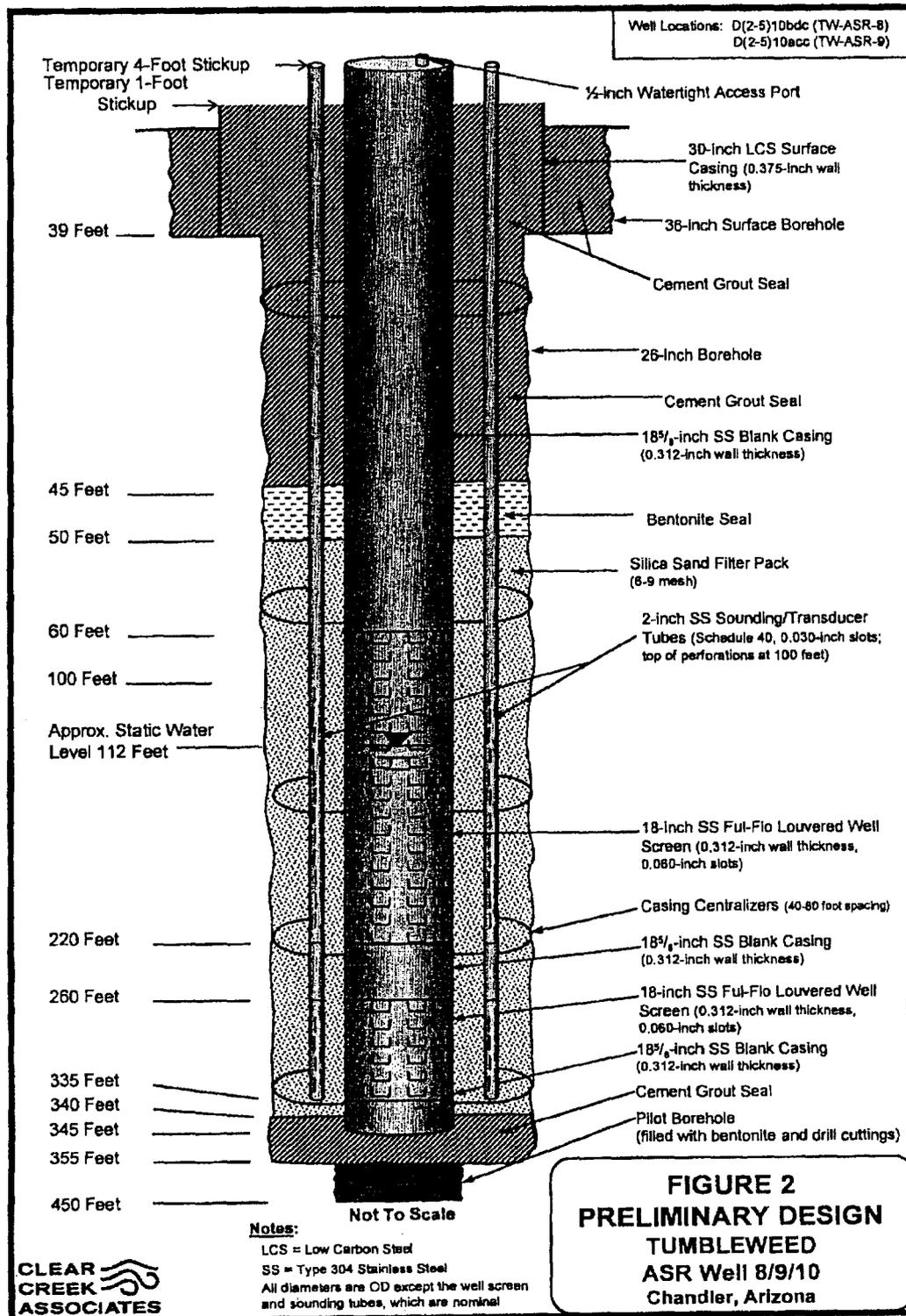
TW-ASR8	D(2-5)10bdc	RW-15	D(2-5)10acd
TW-ASR9	D(2-5)10acc	RW-16	D(2-5)10acd
TW-ASR10	D(2-5)10abb	RW-17	D(2-5)10adc
TW-ASR8B	D(2-5)10acc	RW-18	D(2-5)10abb
RW-9	D(2-5)10acc	RW-19	D(2-5)10abb
RW-13	D(2-5)10acc	RW-24	D(2-5)10acc
RW-14	D(2-5)10acc	RW-25	D(2-5)10acd

\*TW-ASR indicates ASR Well; RW indicates recharge well.

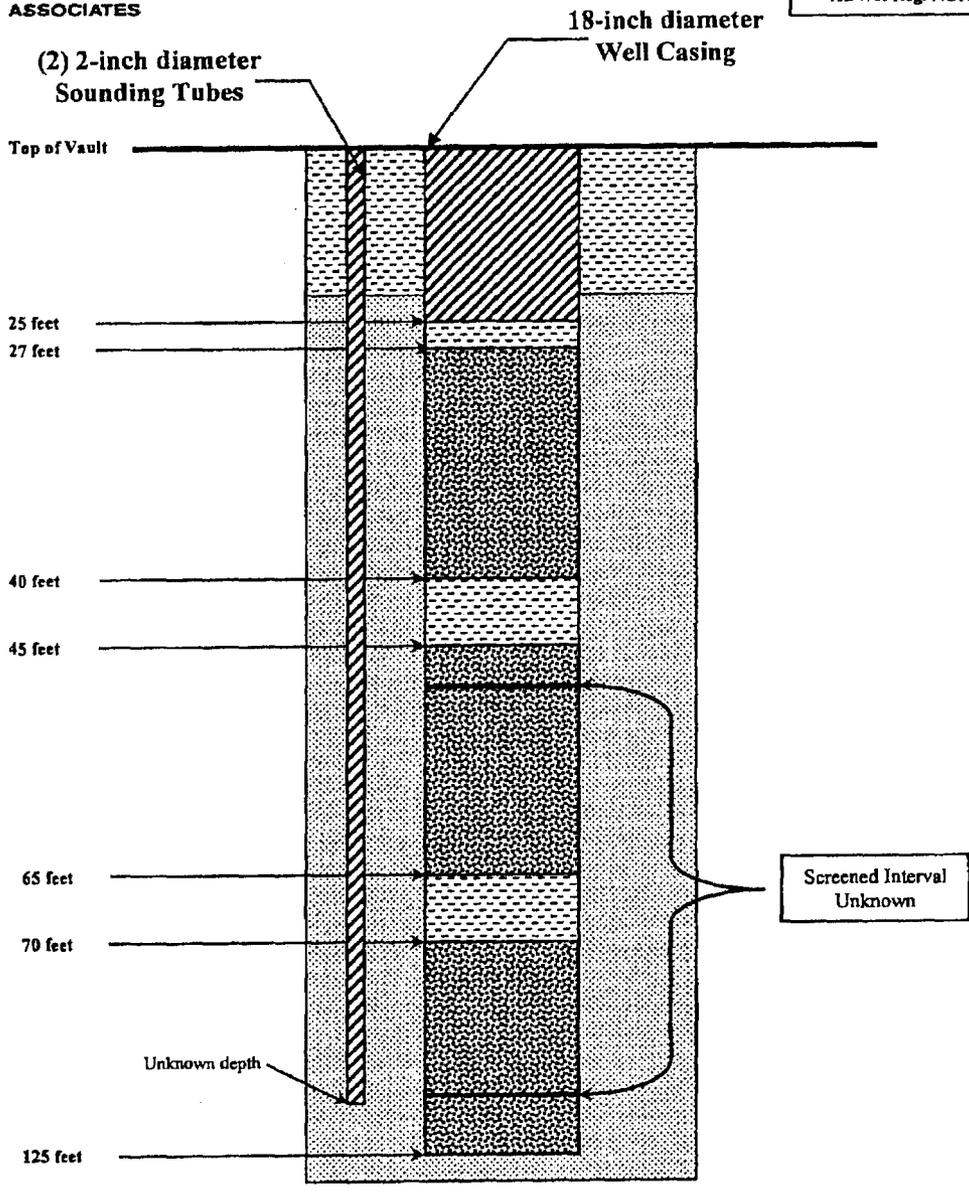
**Approximate Scale (Miles)**



**FIGURE 1  
LOCATION MAP  
TUMBLEWEED  
ASR Wells 8/9/10  
Chandler, Arizona**



**CLEAR CREEK ASSOCIATES**



Not To Scale  
(Depths measured from top of vault)

Explanation	
	Cement Grout
	Sand
	Bentonite
	Filter Pack

**FIGURE 3**  
**AS-ABANDONED DRAWING**  
**RW-2 (Typical)**  
**Chandler, Arizona**

**APPENDIX A**  
**CONTRACTOR UNIT PRICE SCHEDULES**

**APPENDIX B**  
**CEMENT MIX DESIGN EXAMPLES**

### SAND CEMENT MIX DESIGN EXAMPLE

1 sack of cement = 1 bulk ft<sup>3</sup> \*  
 = 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/cm<sup>3</sup> and the specific gravity of sand aggregate equal to 2.65 gm/cm<sup>3</sup>.

Conversion: (specific gravity) (62.4) = lb/ft<sup>3</sup>

Materials	Pounds of Material	Factor (Absolute ft <sup>3</sup> /lb)	Absolute Volume (ft <sup>3</sup> )	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 ft<sup>3</sup> = 127 lb/ft<sup>3</sup> (17 lb/gal)

Slurry Yield = 1.76 ft<sup>3</sup>/sack cement

Slurry Yield = 15.34 sack cement/yrd<sup>3</sup>

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

### POZZOLAN CEMENT MIX DESIGN EXAMPLE

1 sack of cement = 1 bulk ft<sup>3</sup>\*  
 = 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/cm<sup>3</sup> and the specific gravity of pozzolan equal to 2.46 gm/cm<sup>3</sup>.

Conversion: (specific gravity) (62.4) = lb/ft<sup>3</sup>

Materials	Pounds of Material	Factor (Absolute ft <sup>3</sup> /lb)	Absolute Volume (ft <sup>3</sup> )	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/ft<sup>3</sup> (14.7 lb/gal)

Slurry Yield = 1.14 cu ft/sack cement and pozzolan

Slurry Yield = 23.68 sack cement and pozzolan/yrd<sup>3</sup>

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

\*\* 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.

EXHIBIT B

NAME OF CONTRACTOR Layne Christensen Company

CITY OF CHANDLER

TUMBLEWEED AQUIFER STORAGE AND RECOVERY WELLS BASE SERVICES

**CONTRACTOR UNIT PRICE SCHEDULE**

Tumbleweed ASR Wells Base Services					
NO.	DESCRIPTION	EST. QTY	UNIT	UNIT PRICE	EXTENDED PRICE
1	Mobilization/Demobilization	1	L.S.		45,580
2	Mobilization/Demobilization between ASR well sites	2	Each	18,100	36,200
3	Vadose Zone Abandonment and Equipment Salvage	10	Each	10,000	100,000
TOTAL (Items 1-3 Inclusive)				\$ 181,780.00	
				(In Numbers)	
One hundred eighty one thousand seven hundred eighty					Dollars
				(In Words)	
				NO	Cents
				(In Words)	
<b>LIST OF TAX EXEMPT ITEMS:</b>					
<p>Note: CONTRACTOR is required to fill in all blank spaces with an entry.</p> <p>The Contractor's Total is based upon unit prices and allowances. If there is an error in the Unit Costs or other computed totals by the CONTRACTOR, it shall be changed and the unit price amounts shall govern. The written word amounts shall take precedence over the figure amounts. Contractor Unit Prices shall include all costs for the required labor, equipment, and materials, and the amounts will also include all applicable Federal, State, County, and local taxes.</p> <p>Quantities are not guaranteed. Final payment will be based on actual quantities used. 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.</p> <p>The filter pack, bentonite, formation stabilizer, and cement grout material volume estimates are based on 30 percent over the calculated annulus volume.</p> <p>Any standby time (Rig Hourly Rate) is subject to the approval of the Consultant or Owner.</p> <p>Notes are applicable to all cost sheets.</p>					



Technical Specifications  
Tumbleweed ASR Wells 8&9  
Chandler, Arizona

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September, 2007  
014012

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*James M. Hawes*  
9/19/07

NAME OF CONTRACTOR Layne Christensen Company

CITY OF CHANDLER

TUMBLEWEED AQUIFER STORAGE AND RECOVERY WELL 9

CONTRACTOR UNIT PRICE SCHEDULE

Tumbleweed ASR Well 9					
NO.	DESCRIPTION	EST. QTY	UNIT	UNIT PRICE	EXTENDED PRICE
1	Surface Casing Construction	40	L.F.	400	16,000
2	ASR 9 Site Preparation	1	L.S.		2,000
3	Pilot Hole Drilling	500	L.F.	75	37,500
4	Geophysical Logging	1	L.S.		4,500
5	Borehole Reaming (to 26-inches)	500	L.F.	70	35,000
6	18-Inch Stainless Steel Well Casing	200	L.F.	499	99,800
7	18-Inch Stainless Steel Well Screen	300	L.F.	650	195,000
8	2-Inch SS Sounding Tube and 2-Inch SS Transducer Tube	750	L.F.	39	29,250
9	Casing and Screen Installation	500	L.F.	7	3,500
10	Silica Sand Filter Pack	40	Tons	790	31,600
11	Bentonite Seal	12	C.F.	95	1,140
12	Cement Grout Seals	15	C.Y.	475	7,125
13	Air Lift/Swab Development	75	Hours	375	28,125
14	Pump/Surge Development	24	Hours	275	6,600
15a	Gyroscopic Plumbness/Alignment Test	1	Each	3,500	3,500
15b	Dummy Plumbness/Alignment Test	1	Each	1,000	1,000
16	Final Well Video	1	Each	2,500	2,500
17	FI&R Well Test Pumping Equipment	1	Each	15,000	15,000
18	FI&R Well Discharge Piping	500	L.F.	5	2,500
19	Pump Tests	48	Hours	275	13,200
20	Project Allowance	1	L.S.		\$15,000
21	Rig Hourly Rate without Crew	24	Hours	150	3,600
22	Rig Hourly Rate with Crew	24	Hours	300	7,200
<b>TOTAL (Items 1-22 Inclusive)</b>				<b>\$ 560,640.00</b>	
				(In Numbers)	
Five hundred sixty thousand - six hundred and Forty					Dollars
				(In Words)	
				NO	Cents
				(In Words)	
<b>LIST OF TAX EXEMPT ITEMS:</b>					



Technical Specifications  
Tumbleweed ASR Wells 8/9/10

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*[Signature]* James M. Hausler  
9/19/07

NAME OF CONTRACTOR Layne Christensen Company

CITY OF CHANDLER

TUMBLEWEED AQUIFER STORAGE AND RECOVERY WELL 10

CONTRACTOR UNIT PRICE SCHEDULE

Tumbleweed ASR Well 10					
NO.	DESCRIPTION	EST. QTY	UNIT	UNIT PRICE	EXTENDED PRICE
1	Surface Casing Construction	40	L.F.	400	16,000
2	ASR 10 Site Preparation	1	L.S.		2,000
3	Pilot Hole Drilling	500	L.F.	75	37,500
4	Geophysical Logging	1	L.S.		4,500
5	Borehole Reaming (to 26-inches)	500	L.F.	70	35,000
6	18-Inch Stainless Steel Well Casing	200	L.F.	499	99,800
7	18-Inch Stainless Steel Well Screen	300	L.F.	650	195,000
8	2-Inch SS Sounding Tube and 2-Inch SS Transducer Tube	750	L.F.	39	29,250
9	Casing and Screen Installation	500	L.F.	7	3,500
10	Silica Sand Filter Pack	40	Tons	790	31,600
11	Bentonite Seal	12	C.F.	95	1,140
12	Cement Grout Seals	15	C.Y.	475	7,125
13	Air Lift/Swab Development	75	Hours	375	28,125
14	Pump/Surge Development	24	Hours	275	6,600
15a	Gyroscopic Plumbness/Alignment Test	1	Each	3500	3500
15b	Dummy Plumbness/Alignment Test	1	Each	1000	1000
16	Final Well Video	1	Each	2500	2500
17	FI&R Well Test Pumping Equipment	1	Each	15,000	15,000
18	FI&R Well Discharge Piping	2,500	L.F.	5	12,500
19	Pump Tests	48	Hours	275	13,200
20	Project Allowance	1	L.S.		\$15,000
21	Rig Hourly Rate without Crew	24	Hours	150	3,600
22	Rig Hourly Rate with Crew	24	Hours	300	7,200
TOTAL (Items 1-22 Inclusive)				\$	570,640.00
				(In Numbers)	
Five hundred seventy thousand - six hundred forty				(In Words)	Dollars
				No.	Cents
				(In Words)	
<b>LIST OF TAX EXEMPT ITEMS:</b>					

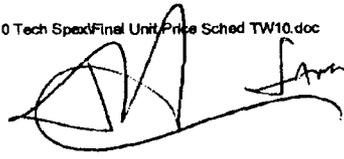


Technical Specifications  
Tumbleweed ASR Wells 8/9/10

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September, 2007  
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 James M. Hansen  
9/12/07