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Oak Creek Utility Corporation Tank

Design Report

AEC Project Number: 07OAK01

September 17, 2009

WS-02061A-09-0400

FINAL

**Oak Creek Utility Corporation
Design Report
Proposed Water Storage Tank Improvements**

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AEC Project #07OAK01

Date: September 17, 2009

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Exhibit 1: Vicinity Map
Exhibit 2: Site Plan

Appendix A: Preliminary Cost Estimate
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Introduction

The Oak Creek Tank Project is located in Oak Creek Canyon, Arizona approximately 20 miles south of Flagstaff along HW 89A, see Exhibit 1. The proposed improvements will be within Lot 73A at the end of Julie Lane.

This Design Report documents our understanding of the design criteria to be used as the basis for preparing the plans, specifications, and engineering estimate and describes the proposed design for the Oak Creek Tank Project.

The design criteria presented in this document include a new storage tank, new booster pumps, foundation section, electrical service, and a chlorine pump.

ADEQ has required Oak Creek Utility Corporation to provide additional potable water storage capacity for Twin Springs Terrace, see Appendix E for ADEQ Engineering Report. In order to comply with ADEQ requirements, Oak Creek Utility Corporation has retained Arizona Engineering Company to prepare plans, specifications, and an engineer's estimate for a new storage tank and booster pumps for the water system.

The current water system is supplied by an on-site well that pumps directly to a 2,000 gallon hydroneumatic tank. In order to comply with ADEQ rules, the Oak Creek Utility Corporation must replace the existing tank with a new storage tank capable of storing one day of water use. The existing tank is not designed to provide storage and the well pump currently supplies system pressures. New booster pumps will be required to provide system pressure with the addition of a true storage tank. The existing well pump will feed the proposed storage tank and the dual booster pump package will pressurize the distribution system from the new tank. The water system supplies water for approximately 45 lots.

Utilities within the project limits include Oak Creek Utility Corporation water lines, APS power lines, and Quest telephone lines. These utilities are located underground on-site and in the road in the cul-de-sac.

The estimated construction cost for these improvements is \$ 92,715. See Appendix A for an engineer's cost estimate for the improvements.

Design Assumptions

It is our understanding that the following assumptions will govern the design of this project:

- ADEQ, Coconino County and AWWA design standards will be applied for this project.

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- The tank is sized based on meter record high use for the month of June, which is 190 gal-day/service. 45 total lots at build out, yields a storage of 8,550 gal. Using a standard tank size we recommend using a 10,000 gallon tank.
- The system does not have any fire hydrants and is not required to supply fire protection water. Therefore, fire flow will be negated.
- Hydraulic calculations to size pumps are based on service area elevations. A computer generated hydraulic model was not prepared.
- Grading, drainage, and utility improvements are limited to on-site improvements.
- There are no existing mainline pressure reducing valves within the subdivision.

Design Criteria

Design criteria that will be used for the Oak Creek Tank Project are presented in this section. ADEQ and Coconino County criteria that apply to the project are presented in this section. The following design criterion was established for this project:

- Tank Size: 10,000 gallons
- The new system will be designed in order to maintain the existing pressure and pumping rate conditions. The following parameters will be used for design:
 - A design flow rate of 50 gpm
 - The elevations of the tank (4020), highest house (4015), and lowest house (3875).
 - Single phase 240V electric power is available at the site
 - Existing 4" waterline main
 - Well depth of 210'
 - Lot number 73A size of 6386 SF.
 - AWWA Standard D100-05- Welded Carbon Steel Tanks for Water Storage
 - ADEQ Attachment A, Engineering Report for Oak Creek Utility Corporation, Docket No.'s WS-02061A-04-0835 & -0836 (See Appendix F)
 - Coconino County Zoning Ordinance

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Proposed Design

A 10,000 gallon storage tank will be fed by the existing site well. Provisions for a new chlorine pump and tank will be made to inject liquid chlorine into the new storage tank for disinfection if required. A package booster pump, with 2 pumps, will supply pressure to the system. The booster pump will have variable frequency drives to meet the low system demand.

Well

Comparing current operating parameters with the calculated demand of the proposed water system, we determined that the existing well pump does not need to be replaced. Based on conversations with Nathan Whitte from Northern AZ Pump, an 8 foot lane is necessary to access and maintain the well pump. To accommodate these 8 feet and the tank footprint, the existing chain link fence will be relocated east and south to provide sufficient access.

Using calculations from the current operating pressure, flow rate, water table depth, and well pump depth, the existing pump can be utilized in the new system. See Appendix C for calculations.

Chlorine Pump

The system does not currently require chlorination. Since the water will be stored in a 10,000 gallon tank before entering the distribution system, provisions for emergency disinfection will be provided. A 35 gallon liquid chlorine barrel, metering pump, and injection piping will be provided in the design.

Tank

Three different tanks were researched for this project for cost and reliability. These are bolted steel tanks, welded steel tanks, and fiberglass tanks. From the research, steel tanks have a comparable material cost to fiberglass tanks, but should last longer under the Arizona sun. It will not be necessary due to the relatively small size of the tank to install interior or exterior ladders.

A plastic tank was not considered for this project due to the life span and potential to pass sunlight and promote microbiological growth.

Tanks can be colored to match surroundings or to clients needs. Tank color will be chosen by Oak Creek Utility Corporation. Using steel tank manufacturer's recommendations and from the Geotechnical Report a ABC foundation with steel retaining ring will be used. A concrete slab is not necessary for a steel tank in this application.

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The tank has a bottom fee inlet to prevent freezing. The system does not require chlorination, but provisions for emergency chlorination have been provided. The inlet and outlet are located on opposite sides of the tank and an inlet fitting has been provided for mixing and to direct inlet flow away from the outlet.

The tank will contain the following components:

- 4" Inlet
- 4" Outlet
- Man way per AWWA D100-05 Section 7.4
- Vent per AWWA D100-05 Section 7.5
- Overflow per AWWA D100-05 Section 7.3
- Water level target board
- Float Control Sensors for well pump control.
- Fall Protection Roof Clip
- FDA potable water approved resin

See Plans for tank size and specifications.

Geotechnical

- The geotechnical design for this project will be per recommendations from the Geotechnical Report prepared by Speedie and Associates dated August 25, 2008 (See Appendix D). Per Addendum 1 dated October 1, 2008 of the Geotechnical Report by Speedie and Associates, "...the slope is inherently stabled...in the current configuration with or without the additional load of the new water tank."

The report has the following recommendations:

- Native soils should be removed to a depth of 2 feet below proposed pad elevation.
- Replaced structural fill should be placed on subgrade that has been properly prepared and compacted to 95%.
- Structural fill should be per geotechnical recommendations.

Booster Pumps

A site investigation was performed to assess current pressure on the system. From that investigation, the houses at the top of the hill experience about 40-46 psi. The lower houses at the bottom experience pressures 110+ psi. Using calculations to model the system, we determined that booster pumps will be needed to provide sufficient pressures at the higher houses (approximately 1/3 of the houses). These pumps will be set to maintain the existing pressures at the lower houses so that they do not exceed the existing pressure of 110 psi. 110 psi is higher than normal recommended operating pressures of about 85 psi. We confirmed existing pressures

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at lower houses with a pressure gauge. These pressures are required to maintain minimum pressures at the top elevations. We are proposing to match existing system pressures and there has been no evidence of system or home failures due to the high operation pressure.

The pumps will be designed for 105' of head or about 45 psi at a 50 gpm flow rate. The pumps will not be sized to handle peak flow and fire flow as there are no fire services provided on the system. Two pumps will be needed, a primary pump and a backup pump. The booster pumps will be housed in an 8'X10' premanufactured building. These booster pumps will be Variable Frequency Drive (VFD) pumps due to potential for low demand periods. See Appendix B for calculations. VFD pumps provide an efficient way of adding pressure to the system when the system experiences a gradual drop in pressure without having to turn on to full speed or going through an entire cycle. VFD's allow the pump to change its flow rate depending on the demand. This decreases wear on the pump and saves energy. See Appendix C for VFD specifications.

Cellular Tower and Equipment

Cellular equipment on site will remain as-is. The Oak Creek Utility Corporation is to coordinate improvements with cell tower companies.

Electrical Meter Improvements

New electrical service equipment will be required on site to operate the new pumping equipment. The existing power supply of single phase 240V power is adequate but a new electrical panel will be required. The new electrical equipment will be specified as furnish and install on the construction plans.

Conditional Use Permit (CUP)

The Oak Creek Utility site is located in zone AR, Agricultural Resident. The purpose of an agricultural residential zone is "intended to designate areas of the County for low density residential use on a minimum lot size of one acre where those light agricultural activities can be conducted which are related to rural family living and pursuits." This project will maintain that purpose. According to the Coconino County Zoning Ordinance Section 20 for a public utility sub-station, a conditional use permit is required to build the new tank. A conditional use permit was issued by the County in July, 2009.

Oak Creek Tank Improvements
 Final Cost Estimate
 AEC# 07OAK01

Removals and Relocations	QTY	Unit	Unit Price	TOTAL
Remove and Salvage Existing Hydro Tank	1	LS	\$500	\$500
Remove and Dispose Existing Tank Footings	30	SF	\$10	\$300
Remove and Dispose of Existing Pipe and Valves	1	LS	\$1,000	\$1,000
Remove and Dispose of Existing Fence and Gate	1	LS	\$1,000	\$1,000
Remove and Dispose of Existing Well Pump Controller and Electrical Service	1	LS	\$1,000	\$1,000
Remove and Relocate Existing Water Meter	1	LS	\$500	\$500
Abandon Existing Electric	1	LS	\$500	\$500
			SUBTOTAL	\$4,800
Building Construction				
Pump House and Foundation	1	LS	\$4,000	\$4,000
Chlorination Equipment and Meter Assembly	1	LS	\$2,000	\$2,000
New 6' Chainlink Fence	80	LF	\$30	\$2,400
New 6' Chainlink Fence - 12' Single Swing Gate	1	EA	\$450	\$450
New 6' Chainlink Fence - 3' Wide Swing Gate	1	EA	\$250	\$250
			SUBTOTAL	\$9,100
Tank, Pipe and Pump Constuction				
13' Diameter, 12' High 10,000 Gallon Steel Water Tank, installed	1	LS	\$20,000	\$20,000
15' Diameter AWWA Type '5' Foundation	1	LS	\$2,500	\$2,500
Grundfos Model ME-2-CRE-10, 3hp, single phase GCP Duplex booster pump station or equal with controls, installed	1	LS	\$30,000	\$30,000
Pipe Insulation	1	LS	\$500	\$500
2" Type 'K' Copper Waterline	27	LF	\$80	\$2,160
Connect to Existing 4" ACP Waterline	1	EA	\$500	\$500
2" CPVC Schedule 80 Waterline	6	LF	\$100	\$600
2" Insulated CPVC Schedule 80 Waterline	1	LS	\$500	\$500
Water Level Indicator	1	EA	\$1,500	\$1,500
Temporary Above Ground Waterline	66	LF	\$40	\$2,640
Temporary 100 Gallon Bladder Tank	1	LS	\$1,000	\$1,000
			SUBTOTAL	\$61,900
Electrical Construction				
Heater and Thermostat	1	LS	\$1,500	\$1,500
New Electrical Service and Meter	1	LS	\$5,000	\$5,000
New 3" Schedule 80 PVC Electrical Conduit and Wire	60	LF	\$50	\$3,000
New Well Pump Controller and Starter	1	LS	\$3,000	\$3,000
			SUBTOTAL	\$12,500

PROJECT SUBTOTAL \$88,300

5% Contingency \$4,415

TOTAL PROJECT COST \$92,715