

Seminole Integrated Wind-Water Demonstration System

Progress Report for September 2012

Submitted to

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1.0 INTRODUCTION AND OVERVIEW

1.1 Scope and Content This progress report is submitted jointly to the Texas Department of Rural Affairs (TDRA) and to the Texas Water Development Board (TWDB). TDRA formerly was called the Office of Rural and Community Affairs (ORCA). The report is submitted as part of TDRA contract number 728082 and TWDB contract number 0804830832. In addition to project funding from the TDRA and the TWDB, major participants include the City of Seminole, Texas Tech University and the US Department of Energy through Texas Tech University. The project was initiated in April 2009, and the completion date is currently set at March 2013.

1.2 Project Description This project addresses the continuing depletion of the Ogallala aquifer, the current principal source of potable groundwater for much of west Texas and northward through Kansas. The approach is to access, lift, and purify brackish, much deeper water-bearing formations in the Santa Rosa of the Dockum group. On the basis of preliminary evidence, these formations were believed to occur in Gaines County at depths ranging from 1500 to 2000 ft. There may also be water-bearing strata between 600 and 800 ft. Our drilling and geophysical investigation found potentially productive zones at 540-650 ft, 890-920 ft, and 1610-1770 ft. The purification will be accomplished using reverse osmosis (RO). The electrical energy required for the well lift pumps and those of the RO system will be supplied principally by a grid-connected wind turbine. The purified water is to be utilized as part of the municipal water supply of Seminole, Texas, a community with a population of about 7,000. Seminole is located in Gaines County in the southern panhandle of West Texas bordering New Mexico. The results are expected to be applicable to many other arid and semi-arid regions as well.

The project encompasses the following broad tasks:

- 1) The siting, permitting, drilling and characterization of a well drilled into the Santa Rosa, including site acquisition, pre-drilling hydro-geological investigations, permitting, logging, well completion and test,
- 2) The design and construction of required infrastructure, including well completion, site preparation, foundations and civil works to support the wind turbine, RO system and other system elements,
- 3) Installation and commissioning of a wind turbine including the foundation, electrical infrastructure, and liaison with the local utility,
- 4) The procurement, installation and commissioning of a commercial reverse osmosis system, including necessary permits, civil structures, electrical work and piping,
- 5) The design, permitting and construction of an evaporation pond or other means for dealing with the concentrate from the RO system,
- 6) Operation and characterization of the integrated wind-water purification system for a period of 12 months, and
- 7) Documentation and reporting of project results and performance.

2.0 SUMMARY OF ACTIVITIES THIS PERIOD

2.1 Overview Collaboration between the City of Seminole, WRC and WiSE researchers, and engineering/management consultants continued, and construction at the site continued. Most construction activities were completed, but startup of the RO system was postponed to October.

2.2 Site Construction West Texas Consultants (WTC) reported Tejas Partners' construction work completed. The building that houses the RO system now has lights and grid-based electricity. On-site plumbing and the lift station for the water leaving the building were completed, with input from Crane Environmental representative Jim Almond on the RO system effluent plumbing connections. Grid-based power is also available for the well.

2.3 Wind Turbine and Site Preparation The installation of the tower, nacelle, and blades was completed on March 13. The final electrical connections at the wind turbine and the meter boxes with Xcel Energy are all that remain to be done. WTC requested assistance from WRC and WiSE faculty to make sure the details of those connections are properly negotiated with Xcel. A meeting with representatives of WTC, Xcel, WRC, WiSE, and Real-Time Automation was scheduled at the site for October 2.

2.4 RO System The RO system was moved to the RO building in May. Startup of the RO system with representatives from Crane Environmental and PSC is currently scheduled for October 2 through 5. PSC will work with the City and WRC to get Texas Commission for Environmental Quality (TCEQ) approval for the 90-day demonstration after the water sample results were determined from the Santa Rosa well. It should be noted that it is possible to operate the system prior to the TCEQ demonstration period as long as the water is not used for potable purposes. The RO system also can operate with grid-based power.

2.5 Santa Rosa Well As noted last month, on August 1, the Santa Rosa well was pumped for one hour to allow collection of a water sample for laboratory analysis. Prior to starting the pump, the downhole pressure transducer/conductivity sensor/temperature sensor with datalogger indicated that the depth to water was only 96 ft, much closer than the 743 ft noted soon after the well was constructed. The pump was run for one hour, during which the water level in the well dropped to about 400 ft below ground surface. After the sample was collected, the pump was turned off, and the depth to water decreased to 116 ft within one hour. Ken Rainwater returned to the site the next day to program the datalogger to collect data at one-hour intervals, and the depth to water had returned to 96 ft. PSC received the water analyses from TraceAnalysis in Lubbock, and selected results are shown as SR-1 in Table 1 as compared to the City of Seminole's nearby Ogallala well shown in the TCEQ database as G0830012AK, shown here as AK. The SR-1 water is likely a mixture of waters from the three perforated zones in the well. Evaluation of the two sets of water analyses indicates the major differences between the two samples. The unexpectedly high water level in SR-1 might have been suspected to be caused by mixing of the shallow Ogallala water and the Dockum water if the well construction practices done to separate the aquifer had failed. Review of the ionic constituents shows that the SR-1 constituent concentrations could not have been affected by mixing with the AK water. It is unclear whether the high water level will persist after long-term pumping.

2.6 Local Outreach The kickoff workshop and media event is still being planned to explain the different aspects of the project for the local public and other interested parties. The workshop had been tentatively planned for late August, but is now postponed until all systems are operational. The WRC and WiSE staff will be contacting all contributing organizations for their interest and availability as the final date is confirmed.

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Table 1. Comparison of Santa Rosa Well SR-1 and Ogallala Well AK
(values in mg/L, except for pH standard units)

Parameter	SR-1	AK
pH	8.8	7.5
Calcium	7.85	94.9
Potassium	19.5	na
Magnesium	8.31	81.1
Sodium	829	95
Total Iron	1.01	0.01
Fluoride	<2.50	4.09
Chloride	424	243
Sulfate	747	213
Nitrate	0	6.75
Carbonate	19	0
Bicarbonate	210	148
Total Dissolved Solids	2330	891
Total Arsenic	<0.01	0.0189
Total Barium	<0.01	0.144
Total Cadmium	<0.01	<0.001
Total Chromium	<0.01	<0.01
Total Mercury	<0.0002	<0.0004
Total Lead	<0.01	<0.001
Total Selenium	<0.02	0.0229
Total Silver	<0.005	<0.01