

Seminole Integrated Wind-Water Demonstration System

Progress Report for December 2012

Submitted to

Texas Department of Agriculture
Att: Travis Brown
Tel 512-936-7878
PO Box 13231
Austin, TX 78711

Contract No. 728082

Texas Water Development Board
Att: Sanjeev Kalaswad
Tel 512-936-0838
PO Box 13231
Austin, TX 78711-3231

Contract No. 0804830832

Submitted by

City of Seminole
Att: Tommy Phillips, City Administrator
Tel 432-758-3676
302 South Main Street
Seminole, Texas 79360

January 15, 2013

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. Most construction activities have been

completed, and startup of the RO system occurred in early October. Final details of wind turbine and well pump adjustments are being worked out.

2.2 Site Construction West Texas Consultants (WTC) reported Tejas Partners' construction work as completed previously. The building that houses the RO system has lights and grid-based electricity. On-site plumbing and the lift station for the water leaving the building are complete, and 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 were installed in December. The wind turbine should be commissioned, including the first operation, emergency brake test, and other startup testing in January.

2.4 RO System The RO system was moved to the RO building in May. Startup of the RO system with Keith Summerford of Crane Environmental and PSC took place on October 2 through 5. The RO system currently operates with grid-based power. City of Seminole staff members are currently operating the well and RO system for about 30 minutes to one hour three to five times per week to keep the membranes moist. Figure 1 below demonstrates the variations in depth to water and total dissolved solids (TDS) concentration recorded by the downhole Aqua Troll from November 3 to December 15. It is interesting to see that the TDS at the pump varied from about 2000 mg/L when the pump has been off for a day or so to over 10,000 mg/L not long after the well pump is turned on. This behavior demonstrates mixing of water from at least two producing zones within the well. It is most likely that the deepest water producing zone has the highest TDS concentration, and this water appears to move upward in the well after the water level has been taken downward when the pump is operating.

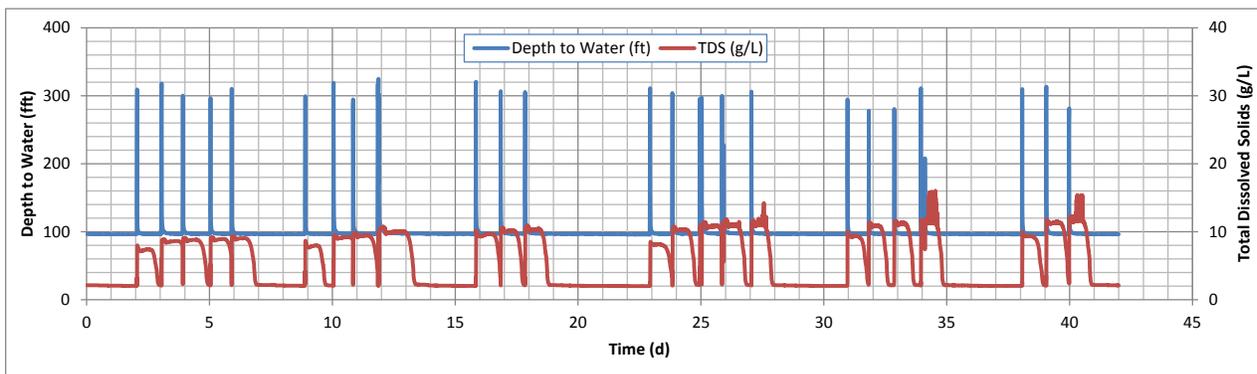


Figure 1. Depth to water and total dissolved solids variations from November 3 to December 15

2.5 Santa Rosa Well As noted previously, the recent static water level in the well has remained at approximately 96 ft below ground surface, much higher than the 750 ft below ground surface shortly after the initial well construction and pump test. Under the current conditions, the pump set at 900 ft below ground surface is subject to much higher intake pressures than the initial conditions, so the discharge from the pump is a much higher pressure than the design conditions for the variable speed booster pump between the well pump and the RO system. To allow controllable flow and pressure during the system start-up period and the short-term operations since, part of the flow is bypassed to the land surface. The WRC and PSC identified a variable frequency drive (VFD) addition to the well pump controls to allow pressure control at that

Seminole Integrated Wind-Water Demonstration System Progress Report for December, 2012

position, which should allow properly pressurized flows with the currently high static water level as well as lower static water levels if the well behavior tends back to the deeper static water level seen initially. For example, operating the pump at 45 Hz instead of the current 60 Hz can still provide the target 50 gpm at the pressure required at the inlet to the RO system. Ken Rainwater contacted David Anderson of Anderson Welding Pump & Machine, Inc., to confirm his company's capability to procure and install the appropriate drive and pressure transducer combination, as well as a sand separator. The WRC is negotiating with the Llano Estacado Underground Water Conservation District to fund this purchase, planned for early January.

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 WRC and WiSE staff will be contacting all contributing organizations for their interest and availability as the final date is confirmed.

Distribution:

Sanjeev Kalaswad, TWDB
Travis Brown, TDRA
Tommy Phillips, City of Seminole
Kay Howard, Howco
Pam Groce, SECO
Judy Reeves, Cirrus
Chad Tompkins, WTC
Zane Edwards, PSC

Leonard Nail, PSC
Amy Cook, TTU
Ken Rainwater, TTU
Phil Nash, TTU
John Schroeder, TTU
Lori Barnes, LEUWCD
Daniel Albus, PSC