

# **Seminole Integrated Wind-Water Demonstration System**

## **Progress Report for November 2011**

### **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 was recently extended to 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 are 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.

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, site infrastructure design progressed, and capitol purchases moved forward. The major current site event was the Santa Rosa well construction.

**2.2 Site Layout and Balance of System Design** West Texas Consultants (WTC) continued work on the infrastructure for the demonstration project, including concentrate management through discharge to the City's wastewater treatment plant, which will require a sewer line and lift station to move the flow, and the building and associated amenities at the site. The lift station is being sized to allow it move both the produced permeate water and the concentrate to the Seminole wastewater treatment plant during the demonstration period. This capacity can also allow the City to eventually use it to move up to 50 gpm of concentrate if the RO capacity is expanded to 150 gpm, which was the steady flow rate maintained for most of the pump capacity test by the well driller. The draft plans for the site, including the pad, building, tanks, and other appurtenances, were completed and are under final review. The resulting specifications should be ready to go out for bid in December.

**2.3 Wind Turbine Procurement and Site Preparation** The turbine nacelle and blades were previously received in Seminole. WTC completed the geotechnical work for the foundation design and submitted it to the City in late June. The lattice tower was ordered from the manufacturer, with delivery expected by November, with erection to follow immediately. The tower manufacture reported that an important part was damaged at the galvanizer and had to be replaced. The vendor now confirms shipping of the tower members in early December.

**2.4 RO System Procurement** The RO system and spare parts from Crane Environmental were received in Seminole in late December. The equipment will remain in storage at the City warehouse until the RO building is built, later in 2011. We are currently in communication with representatives from Crane about the logistical details of start-up of the RO system after installation. PSC will work with the City and WRC to get Texas Commission for Environmental Quality (TCEQ) approval for the demonstration project after the water sample results are determined from the Santa Rosa well. PSC is interacting directly with WTC for logistical details for the final sizing and placement of the RO building and associated piping and water storage issues, which are included in the site specifications mentioned above.

**2.5 Santa Rosa Well Procurement** West Texas Water Well Service (WTWWS), from Midland, Texas, performed well development and pump testing in early August. During September, WTWWS and PSC cooperated in identification of appropriate pump/motor combinations for this application. The static depth to water of less than 750 ft, combined with the observed depth to water during pumping of 930 ft at a flow rate of 150 gpm for 36 hr, demonstrated that the pump required for the target 50 gpm flow rate would need much less vertical lift capacity than the conservatively assumed preliminary estimate. The pump selected was a Grundfos Model 85S200-18, 20 hp pump to deliver 50 gpm at 900 ft of total dynamic head. The pump was installed in November. Completion of the well installation is planned in December, including the addition of a downhole pressure transducer/conductivity sensor/temperature sensor with datalogger to monitor water levels and gross water quality.

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