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Rock County Rural Water District Aquifer Test Performs Multiple Functions

Editor’s Note: Rock County Rural Water is located in southwestern Minnesota and headquartered in Luverne, MN. They serve approximately 680 service connections and 3 small rural communities. To learn more about Rock County Rural Water visit: http://www.rcrwd.com/. 

Approach

The Rock County Rural Water District (RCRW) plans to construct a new well and increase their appropriation of water from 300 million gallons per year (mgy) to 400 mg. Prior to initiating the construction or the appropriation permitting process, RCRW consulted with Minnesota Department of Health representatives and Summit EnviroSolutions, Inc. (Summit). The discussion addressed several topics, including the affect of a new well on: existing area wells, surface water features (with special attention to endangered species issues), and the current Wellhead Protection Area (WHPA).

The opinion of those in attendance was that the current understanding of the aquifer(s) was not sufficient to address the body of questions being discussed. The group arrived at the conclusion that a pumping test needed to be performed in the vicinity of the proposed new well location to collect and analyze site/wellfield specific groundwater elevation data prior to constructing the new well. The data would also be supplied to the relevant regulatory agencies to assist in appropriations permitting decisions and the WHPA planning process.

A cost-effective aquifer testing plan was devised making use of existing measuring points and resources. Two observation wells had previously been installed near each of the existing production wells. Additionally, RCRW had previously been searching for means to reduce their data collecting, reporting and compliance costs, and had reached the decision to purchase pressure transducers/data loggers to equip their wellfield. These actions enabled a cost-effective approach for collecting sufficient data to meet the regulatory and aquifer resource management objectives.
Summit’s integrated solutions enhance data collection and analysis

Summit Envirosolutions, Inc. is an environmental consulting firm that specializes in water-related projects. In addition to providing consulting services for aquifer/well/wellfield issues, Summit has developed AquaTrueVue®, a software platform that automates the analysis of well field data to help environmental and water supply professionals use data more efficiently and to better understand aquifer dynamics.

For this project, Summit worked with RCRW to devise a comprehensive monitoring solution that would reduce costs, aid RCRW personnel with data collection/reporting requirements, and enable RCRW to continuously monitor the “health” of individual wells and their well fields. These benefits were realized in addition to the immediate project goals of determining whether the aquifer could support another well or wells in the current wellfield and, if so, locate sites that would accommodate an additional well with limited interference with existing wells.

The equipment purchased by RCRW was installed in the production well nearest the desired location for the new well and selected monitoring wells (figure at right). This equipment would automatically record barometric pressure and the groundwater elevations at each of the seven instrumented wells during the pumping tests.

The data collection began two weeks prior to the test pumping to acquire normal operational data and to establish non-pumping groundwater elevations as a reference for analysis of the test data. A “step-drawdown” test was performed on September 15, 2009 with pumping rates of 79, 154, 239 and 357 gallons per minute (gpm) for the four steps (hydrograph below). The pump was then shut off and the aquifer allowed to recover prior to beginning the longer term test.

A five day period was chosen for the longer term test and the pumping began on September 16, 2009 and continued to September 21, 2009. The aquifer recovered to an elevation higher than that measured prior to the test due primarily due to precipitation events that occurred during this time interval (hydrograph on page 20). The barometric pressure and precipitation are recorded during the test to allow for evaluation and compensation of water level changes in the well that result from these reasons. Once these changes are factored out, subtle changes to aquifer water levels attributable to stresses from the aquifer test can be analyzed.

Once collected, data were uploaded from the field into AquaTrueVue® software which organizes and stores the data in a format that can easily be queried by location, parameter, and date. Hydrographs can be compared to other environmental parameters such as barometric pressure, precipitation, river stage, etc. The data can also be exported to ArcGIS and other hydrogeologic analysis software.

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The AquaTrueVue® software allows the user to view real-time and historic hydrogeologic conditions of the instrumented well field, including well efficiencies, capture zones, specific capacity, and groundwater contours generated using sophisticated interpolation algorithms (figures below).

CONCLUSIONS
Analysis of the pumping test results showed that the aquifer contains an adequate supply of groundwater for a well with the anticipated rate and volume installed at the proposed location with minimal well interference effects on the existing wells. No adverse affects on surface water features including the Rock River, are anticipated, resulting in no change to the existing endangered species monitoring efforts currently in place by RCRW.

Additionally, the pumping test showed that additional water production (up to double the current well capacity) can be realized from the existing pumping well, thereby saving the costs associated with the design and construction of a new well, piping and appurtenances.