Tuscan Aquifer INVESTIGATION

Final Report Excerpt:
Aquifer Performance Test Summary

For the Lower Tuscan Aquifer (LTA) project, aquifer properties were estimated from a constant-rate aquifer test by fitting mathematical models to **drawdown data** (change in water level due to pumping) through a procedure known as curve matching. The software package AQTESOLV™ was used to analyze the drawdown data collected for the LTA project. A detailed discussion of the use of the AQTESOLV™ software package is presented in Aquifer Performance Test Report provided on CD in Appendix A of the Final Report.

Based on the conceptual hydrogeologic model and visual assessment of drawdown curves, quantitative curve matching was performed to assess aquifer parameters for the zones with drawdown curves that adequately addressed the assumptions for type curve analysis using appropriate common published solutions available in AQTESOLV™. This quantitative analysis is presented in detail in the Aquifer Performance Test Report. To calculate aquifer parameters, drawdown curves developed from the aquifer test from pumping wells and observation wells are compared to type curves developed from mathematical solutions of the flow equation (i.e. Moench 1985). Type curves developed from these methods are based on specific assumptions about the characteristics of the aquifer. If the actual aquifer characteristics are distinctly different from these assumptions, then the drawdown curves observed for wells during the test will not match the type curves and aquifer parameters cannot be calculated. However, departures from the type curves can provide important qualitative interpretations of the aquifer characteristics that are essential for construction of future groundwater models developed for the basin as a management tool, design of subsequent aquifer tests, and design and construction of future irrigation and groundwater supply wells.

Based on the conceptual model and response of the observation wells, the Moench solution Case 1 (M&T Ranch and Esquon Ranch) and Case 3 (Hackett Property) best represents conditions of the aquifer tests performed. The following table summarizes the result of T, S, and K values calculated using this solution for observation wells used for each of the aquifer tests.

Summary of aquifer parameters calculated using Moench (1985) solutions.

	T (feet2/day)	S (unitless)	K (feet/day)
Hackett Property	2,322 to 3,078	0.00004 to 0.00009	66 to 88
M&T Ranch	11,550 to 20,540	0.0003 to 0.0005	321 to 571
Esquon Ranch	12,230 to 23,650	0.00004 to 0.001	41 to 79

The reported K values listed in the table are consistent with sand to sandy gravel units as reported for each of the aquifer zones tested for the LTA project. Reported S values for the observation wells are consistent with the interpretation of a confined aquifer.

Transmissivity, represented by a "T", is a measure of the ability of an aquifer to produce water and is equal to hydraulic conductivity (K) times the thickness of the aquifer (represented with a "b"), or **T = Kb**. As such, a T value for a 10 foot thick well-sorted sand with a K value of 100 would be the same as a 100 foot thick fine sand with a K value 10. Units of T are feet squared per day (ft^2/day). Typically, T values of less than 100 ft^2/day will supply only enough water for domestic wells or other low-yield purposes. In wells with T values greater than 1,300 ft^2/day, the production yields are typically sufficient for industrial, municipal, or irrigation use.

Storativity, represented by an "S", is a physical property that characterizes the capacity of an aquifer to release groundwater. Specifically, it is defined as the volume of water an aquifer releases from or takes into storage, per unit surface area per change in head and is a unitless number. The storativity of a confined aquifer typically ranges from 0.00005 to 0.005, whereas for unconfined aquifers storativity ranges from 0.1 to 0.3 (Todd, 1980).

In summary, for the Hackett Property, the aquifer test demonstrated that there are at least two primary aquifers hydraulically disconnected (designated deep and intermediate zones). The test also showed that the intermediate aquifer interacts with a shallow aquifer through a leaky aquitard and that there is significant storage within the aquitard consistent with observations made during drilling of the observation well. For the M&T Ranch, the aquifer test demonstrated that at least two primary aquifers are hydraulically connected (shallow and deep zones) and the aquitard separating these zones contains significant storage. For Esquon Ranch, the aquifer test demonstrated that the primary LTA is hydraulically connected to the aquifer within the upper Ione Formation through indirect pathways. The shallow aquifer zone of the LTA in this area is not hydraulically connected with the lower zones of the LTA.