Potential for Vertical Flow Between the Edwards and Trinity Aquifer, Barton Springs Segment of the Edwards Aquifer

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Within the Barton Springs/Edwards Aquifer Conservation District, the Trinity Aquifer is increasingly used as a source of water as pumping limits have been placed on the Edwards Aquifer. Proper management of these aquifers requires an understanding of factors affecting the hydraulic relationship between the two aquifers.

To better understand the relationship between the various units of the Edwards and Trinity Aquifers, the District drilled two 5-inch diameter boreholes to 1,120 ft (Ruby Ranch) and 1,375 ft (Antioch) in Hays County in the recharge and confined zones, respectively (**Figure 1**).

A specialized multiport system was installed in each borehole which spans the Edwards and Trinity Aquifers with 14 monitor zones in the Ruby Ranch well, and 21 monitor zones in the Antioch well. Data collected from the Ruby Ranch well include water levels, geochemistry, isotopes, and permeability. Only water levels, and a few total dissolved solids (TDS) samples, have been collected to date from the Antioch well. A wireline tool is used to collect samples and measure potentiometric pressures in each sample zone (**Figure 2**). This tool and the equipment permanently installed in the well are manufactured by Westbay® Instruments (a Schlumberger company) of Vancouver, Canada.

Water-chemistry and isotope data were collected from the 13 sampling zones of the Ruby Ranch well and reveal, in general, two fresh groundwater systems separated by a brackish groundwater system. The zones can be further characterized into three distinct hydrochemical facies: calcium bicarbonate, calcium sulfate, and an intermediate facies (**Figure 3**). The calcium sulfate facies has the highest levels of sulfate, magnesium, calcium, and TDS and is associated with zones in the upper member of the Glen Rose Formation. The lowest TDS zones are in the Edwards Group units, the Cow Creek Limestone in the Ruby Ranch and Antioch wells, and a rudist-reef unit in the lower member of the Glen Rose Formation in the Ruby Ranch well. Zones with low TDS generally have relatively higher hydraulic conductivity, which would conceivably enhance the flushing of dissolved constituents from groundwater within those zones. Tritium and percent modern carbon (pmC) indicate that the Edwards Group zones contain relatively young groundwater. The Trinity contains relatively old groundwater with no tritium values detected and less than 40% pmC.

Significant head differences (up to 75 feet), distribution of hydrochemical facies, and isotopic signatures suggest that there is very little, if any, vertical flow between the Edwards and Trinity units (**Figure 3**). Faults in the area do not appear to create pathways for vertical flow, nor do they appear to necessarily create barriers to lateral flow. Lateral flow is the dominant process in the Edwards and Middle Trinity Aquifers. Relay-ramp structures, which are common in the Balcones Fault Zone (**Figure 1**), provide a mechanism for lateral continuity within most

lithologic units, and therefore allow for the lateral flow of groundwater from the recharge areas to these wells. The most likely recharge areas are where the Middle Trinity units outcrop in the Blanco River Valley, about 15 miles to the west of the Ruby Ranch well.

Similar head values and similar responses to precipitation (recharge) suggest that the uppermost zone of the Upper Glen Rose (Zone 11, Ruby Ranch well) is in hydraulic connection with the Edwards Aquifer. Groundwater geochemistry in this zone also appears to change depending upon head values in relation to the zone below. The connection may be lateral (due to fault juxtaposition) or possibly by virtue of some localized vertical flow, along faults or fractures.

References

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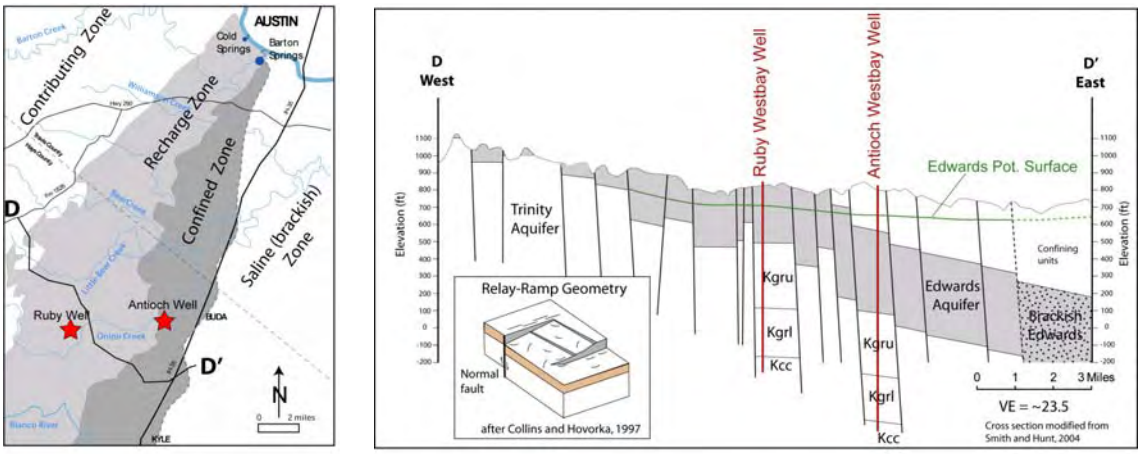

Figure 1. (Left) Hydrologic zones of the Barton Springs segment of the Edwards Aquifer and the location of the two multiport wells. (Right) Cross section of the study area showing the relation of the Edwards and Trinity Aquifers and the approximate location of each well. Inset figure is a diagram showing the geometry of relay-ramp structures that are common in the study area. [Kgru = Upper Glen Rose formation; Kgrl = Lower Glen Rose formation; Kcc = Cow Creek formation]

Figure 2. Picture showing data collection at the Ruby Ranch Multiport well. The wireline tool is lowered to each zone where it can measure a pressure and take a sample. Inset picture shows the sampling tool in a cut away of the casing.

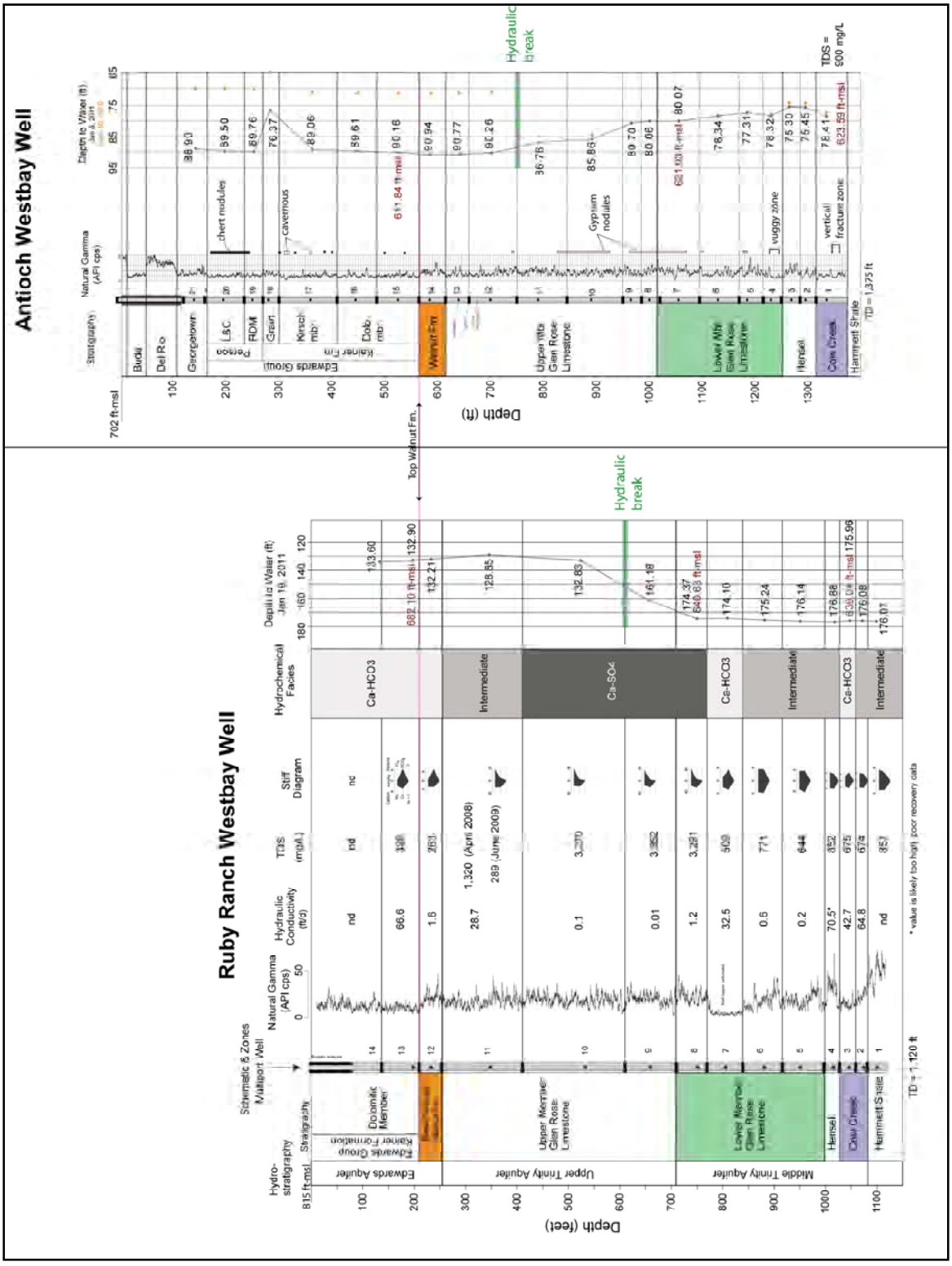

Figure 3. Diagram showing the hydrostratigraphy, multiport well construction and results of water chemistry and water level sampling for the Ruby Ranch and Antioch wells.