

## Water trial concludes second day

BY RUTH HEIDE

ALAMOSA — After a 65-million-year history lesson on Tuesday, an expert witness in the state water rules trial spoke about the connection between groundwater pumping and land subsidence.

Hydro-geology expert Eric Harmon of HRS Consultants spent the entire second day of the trial on the witness stand and will resume that position on Wednesday as proponents for the state's proposed rules continue to question him.

The state's proposed rules govern new withdrawals from the confined aquifer of the San Luis Valley. Objections were filed to the rules, and a trial is being held in Alamosa to determine the rules' merits.

Harmon spoke extensively on Tuesday about the San Luis Valley's complex hydro-geology and his involvement over the years in various projects in the Valley.

He described the formation of the San Luis Valley over time and described the composition and connection of the Valley's streams and aquifers.

Harmon said 65 million years ago, the San Luis Valley did not exist but began to take shape as it is known today about 27 million years ago.

Because of the Valley's relatively new existence in geological time, Harmon said, the clay layers underneath the surface are highly porous, having not been deeply buried and compacted over time. He testified the porosity of the clay could be reduced and the clay layers compacted either temporarily or permanently if the water table is lowered. He said pumping groundwater reduces that water table.

Harmon said subsidence can occur when the artesian pressure drops below where it has historically been and the clay layers are compacted.

Harmon's firm was involved for more than five years in the development of the groundwater model Rio Grande Decision Support System which is key to the state's water rules case.

"Every time we collected more data what it pointed out to us is how complex the system is," Harmon said. "The more we looked at it, the more complex it became."

He said more than 40,000 pieces of information were collected, and much time was spent in review and quality control. "I don't believe this level of data analysis ... had ever been done in the Valley."

After suggesting more information needed to be collected, Harmon received permission to drill 15 new monitoring wells in the confined aquifer throughout the Valley. The project cost \$1.3 million, and the wells remain permanently in place for continued data collection and monitoring. Harmon supervised the drilling and data collection from the additional wells which measured a variety of factors underneath the Valley's surface.

One of those factors was land compaction related to the pumping of groundwater. Fourteen of the 15 wells were fitted with a device to measure compaction to the nearest 1/1000th of an inch.

In nearly all cases, Harmon said he saw a positive correlation between compaction and the amount of draw down of the confined aquifer due to pumping.

"We certainly do see measurable compaction from this data," Harmon said.

He said two types of compaction occur. One is reversible and recoverable as occurred in this case.

The other type is permanent and irreversible. That type of compaction results in a permanent rearranging of the underground clay layers, Harmon explained. "They are compacted and there is a permanent rearrangement and permanent loss of porosity because of that compaction." He added once compaction is permanent, it will not recover even if the confined aquifer head rises to where it was before.

Opponents to the state's case objected to land subsidence being brought into the discussion because they said it was not relevant. District Judge O. John Kuenhold noted their continued objection but allowed Harmon to testify on the subject.

At the conclusion of the trial the judge will have to decide whether the state's proposed rules stand or not.