Quantifying the water resources of the Arbuckle-Simpson aquifer requires understanding the distribution of the lithologic units. In that geologic framework, the hydraulic properties of the units need to be evaluated. We have constructed a three-dimensional (3-D) EarthVision™ (EV) geologic framework model that characterizes the distribution of the Arbuckle-Simpson aquifer within the Hunton anticline area. The model helps to visualize the hydrologic connectedness of the water bearing units across fault zones and allows the exploration of the inner geometries of fault blocks. This preliminary model contains five geologic layers, more than 40 major and minor faults, and depicts the basic shape and form of the aquifer from the surface to the igneous basement. The construction of the 3-D EV model involved integrating field studies that include outcrop geology, available geologic and geophysical data from existing maps, data from over 300 boreholes, and various geologic and hydrogeologic reports. Over 30 surface geologic contact points were extrapolated into the subsurface in areas lacking well control.

The storage of the aquifer was evaluated near the surface using direct push techniques and electrical resistivity imaging. This near surface zone of soil and rock is referred to as epikarst as it forms the outer layer of the karstic Arbuckle strata. The near surface epikarst zone consisted of sediments with high porosities whose storage capabilities rival that of deeper Arbuckle water-bearing units. The storage in the deeper portions of the aquifer is being evaluated using tidal analysis. The water level changes induced by the movements of the sun and moon are being used to determine the storage and hydraulic conductance of the deeper Arbuckle hydrostratigraphic units.

In order to evaluate the effects of fracturing on the flow of fluids in the aquifer, several data sets were integrated. Mapped fault data was combined with stream lineament data to interpret areas of the aquifer which may behave similarly due to consistent fracture patterns. This was also evaluated using outcrop and geophysical data to develop an overall picture of fracturing in the aquifer. The aquifer appears to be fractured from the surface to depth, but the connectivity of the fractures is limited and many portions of the aquifer have few transmissive fractures providing confining portions of the aquifer.