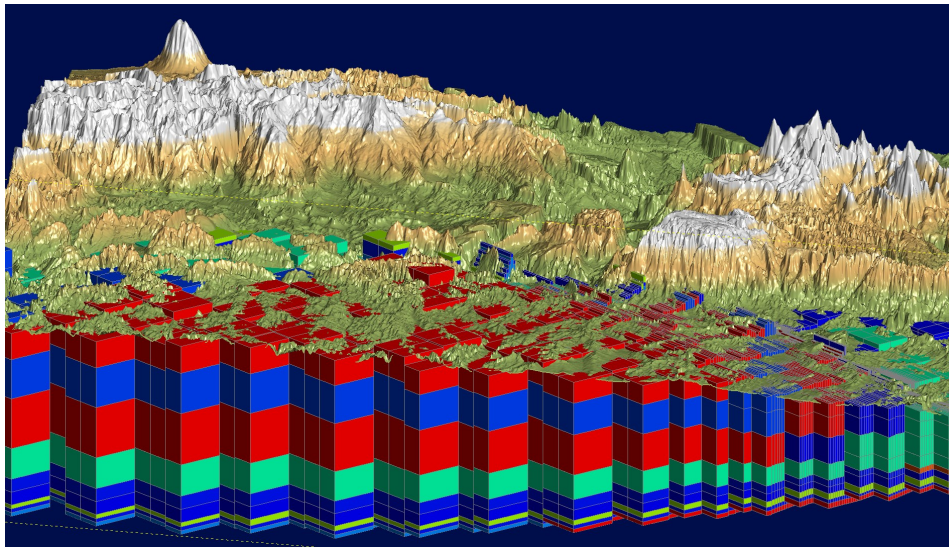
Framework Models



As part of INTERA's work on environmental, water resources, and waste isolation projects, we routinely integrate geological, geochemical, geomechanical, and hydrogeological properties of a zone of interest (e.g., aquifer, reservoir, storage zone) into 3-D geologic models. These models provide volumetric representations of the geologic framework of the zone of interest, and serve as the basis for dynamic aquifer or reservoir simulations. Using software tools such as Leapfrog Geo, INTERA is able to rapidly integrate, communicate, and interpret geological data. We use geologic models to determine the distribution of geologic units, structural features, and other controlling factors, such as porosity and permeability. Constructing the 3-D geologic architecture of an aquifer or reservoir is the first step in using geologic properties to constrain flow models. This approach takes much of the subjective guesswork out of constructing model layers and results in a model that is more realistic and representative of the actual subsurface conditions of the basin being modeled.

Identification of Potential Brackish Groundwater Production Zones in the Gulf Coast Aquifer System, Gulf Coast, Texas, USA

Challenge: To enable planners and decision makers to formulate better groundwater management strategies by providing more reliable estimates of fresh, brackish, and saline groundwater in one of Texas' largest aquifer systems.

Solution: INTERA collected and analyzed data to define geologic structure, sand intervals, salinity zones, and potential brackish production areas. We developed and implemented a methodology for estimating the vertical profile of total dissolved solids (TDS) concentrations using information extracted from geophysical logs. To establish a consistent and reliable set of formation resistivity values for quantifying and mapping estimated TDS concentrations across the Gulf Coast Aquifer System, we characterized the thickness and formation resistivities for 30,000 sand beds at 600 geophysical log locations. After combining the TDS concentrations estimated from geophysical logs with measured concentrations from 9,000 water wells, we delineated salinity zones (fresh, slightly saline, moderately saline, very saline, and brine). We then evaluated six potential brackish production areas that encompass several geological formations, span multiple counties, and contain brackish groundwater. To evaluate the capacity of the potential production areas to produce groundwater, five regional groundwater models were developed and used to simulate pumping from several candidate well fields located in the potential brackish production areas. Water levels, aquifer structure and thickness, and sand intervals from geophysical logs were used to calculate the groundwater volumes by formation.

Results: INTERA estimated the Gulf Coast Aquifer System contains 15,400 million acre-feet of groundwater (2,700 million acre-feet of fresh water, 3,650 million acre-feet of slightly saline, 2,800 million acre-feet of moderately saline, 4,800 million acre-feet of very saline, and 1,400 million acre-feet of brine). These estimates are supporting more informed state, regional, and local groundwater planning decisions.