

A Geologic Framework to Support Ground-Water Flow Model Development for Northern Arizona

Doug Rautenkranz, Don R. Pool, and Kyle Blasch
Water Science Center, U. S. Geological Survey, Tucson AZ

Increasing population in northern Arizona gives rise to concerns about the long-term availability of adequate ground-water resources to sustain both the human population and the natural environment. The Rural Watershed Initiative is a program jointly initiated in 1999 by the U.S. Geological Survey (USGS) and the Arizona Department of Water Resources (ADWR) to provide scientific data to facilitate rural water supply planning and management decisions. The Northern Arizona Regional Ground-Water Flow Model (NARGWFM) Project is a joint project between the USGS Arizona Water Science Center, Yavapai County, and ADWR, funded under the Rural Watershed Initiative, to develop a ground-water flow model for northern Arizona and northwestern New Mexico. The ground-water flow model (MODFLOWP) includes the Coconino and Redwall-Muav aquifers and adjacent alluvial basin aquifers.

As part of the NARGWFM work, a geologic framework model for northern Arizona and northwestern New Mexico has been built using Dynamic Graphics' EarthVision software to provide a three-dimensional visualization of hydrogeologic units important for modeling ground-water availability. The spatial extent of the geologic framework includes the watersheds of the Little Colorado, Colorado, Salt, and Verde Rivers.

The EarthVision geologic framework is intended for visualization of northern Arizona-northwestern New Mexico subsurface hydrogeology. The hydrogeologic surfaces resulting from the geologic framework model will be exported to explore their utility as input layers in the MODFLOWP ground-water flow model.

Input into the geologic framework model includes faults derived from geologic maps and tops of geologic units obtained from boreholes and mapped outcrops. Borehole information was selected from well log records archived by the Arizona Oil and Gas Commission and from water well drillers' logs in databases maintained by the Arizona Department of Water Resources. The hydrologic basement surface was defined as the top of crystalline rock derived from well logs and inversion of regional gravity and magnetic data sets. Geologic units have been combined into hydrogeologic units to reduce the complexity of the geologic framework, and to increase the utility of the EarthVision framework for ground-water flow model development. Important geologic units used in developing the hydrogeologic horizons for the EarthVision framework include 30 major Paleozoic and older stratigraphic units on the Colorado Plateau, Cenozoic alluvial basin deposits in the Verde and Chino Valleys, and hydrologic basement throughout the study area. These geologic units have been combined to generate seven subsurface hydrogeologic units important to ground-water flow. Upper Triassic and younger geologic units have been lumped except in the Verde and Chino Valleys.