Assessment of Groundwater Supply and Quality in the Kabul Basin, Afghanistan

Mack, T.J\(^1\), Chornack, M.P.\(^2\), Coplen, T.B.\(^3\), Plummer, L.N.\(^3\), Rezai, M.T.\(^4\) and Verstraeten, I.M.\(^3\)

\(^1\) U.S. Geological Survey, Pembroke, NH, USA  
\(^2\) U.S. Geological Survey, Denver, CO, USA  
\(^3\) U.S. Geological Survey, Reston, VA, USA  
\(^4\) Afghan Geological Survey, Ministry of Mines and Industry, Kabul Afghanistan

Increasing numbers of refugees and rapid population growth in recent years in the Afghanistan capital Kabul, have led to increased groundwater withdrawals and widespread drying of wells. Multi-year droughts, potential climate change, and observations of increasing temperatures, earlier snowmelt runoff, and diminishing glaciers, in conjunction with increased withdrawals, have led to heightened concerns for water availability in the Kabul Basin.

The U.S. Geological Survey, with support from the U.S. Agency for International Development, has collaborated with the Afghanistan Geological Survey and Ministry of Energy and Water on water-resource investigations since 2004. This collaboration led to the compilation of historic and recent water-resources data, creation of monitoring networks, and analysis of remotely-sensed data. An assessment of groundwater availability was completed in 2009, through the use of hydrogeologic data analysis and groundwater-flow simulation.

This study included analysis of the geohydrologic framework, water quality, and recharge characteristics of the Kabul Basin. Based on CFC, tritium, and stable hydrogen and oxygen isotopic data, most of the water in the shallow aquifer appears to have been recharged since 1970 by snowmelt-supplied leakage from rivers and river-fed irrigation. A lesser proportion of recharge occurs from groundwater inflow through the adjacent mountains that border the basin.

Most of the groundwater flows through a shallow (less than 100-m thick), highly permeable aquifer. However, this aquifer is locally contaminated due to a lack of waste treatment and management. Water in the deeper (up to 1,000-m thick), aquifer is estimated through carbon-14 analysis to be more than 1,000 years old and may provide a limited source of water for municipal use. Changing climates appear to be altering the seasonal recharge pattern in this basin creating a longer dry season and reducing water availability. The results of this study provide information necessary to make water-resource management decisions in the Kabul Basin.