



## **Urban groundwater resources and quality in the Kabul Basin, Afghanistan**

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Afghanistan was affected by a long period of wars from 1979 to 2002. As a result, much of the country's water-related infrastructure was destroyed and its maintenance came to a nearly complete halt. With the end of war Kabul became an emerging mega city. The population sharply increased from 1.8 million in 2002 to 3.2 million in 2005 due to a vast number of refugees. A severe drought lasting from 2000 to 2004 further complicated Kabul's water problems. The rapid increase of urban population causes a high pressure on soils and groundwater resources. Groundwater is now the major source for drinking water in the Kabul basin. Since only 20 % of the population have access to tap water, the rest depends on shallow wells equipped with hand pumps. The Kabul aquifers consist of high permeable sandy and gravelly sediments which were deposited by rivers draining the basin. Usually, the aquifers are covered by loess loams which form the major groundwater protection layer. Due to the need of basic construction material a wide spread informal brick production causes a penetration of this protective layer and increases the vulnerability of underlying aquifers. On behalf of the Federal Foreign Office of Germany, BGR together with Afghan experts gathered information on the groundwater resources of the Kabul basin. Water quality was tested by an extensive sampling and analysis programme. Since Kabul's typical continental climate practically precludes any groundwater recharge directly from precipitation, direct ex-filtration from rivers after the snowmelt and foothill infiltration at the rim of the basin is therefore the main recharge process. Interaction between groundwater and surface water also controls to a wide extend the quality of groundwater resources. Draught and rising population have not only lead to an overexploitation of the resources and falling groundwater levels, but the shallow groundwater underneath the city has received also a tremendous amount of pollutants due to a lack of proper waste and sewage disposal. More than 86 % of all households only have simple cesspits.

Common indicators of wastewater influence are elevated concentrations of nutrients such as nitrate, sulphate and faecal bacteria. The high infant mortality can at least be partially attributed to the insufficient water hygiene. The drought has aggravated this problem since pollutants are not being flushed out. The results of our study indicate that only artificial recharge of peak surface water runoff and decentralised sanitation will help to ease the situation.