Managed aquifer recharge using ASR-wells for sustainable use of groundwater resources in alluvial coastal aquifer in Eastern India

Hartmut Michael Holländer, Dr.-Ing., Commonwealth Scientific and Industrial Research Organisation (CSIRO), Glen Osmond, SA, Australia

Coauthors: Mull, Rolf; Panda, Sudhindra Nath

Project was completed at:
Institute of Water Resources Management, Hydrology and Agricultural Hydraulic Engineering, Leibniz University of Hannover, Appelstrasse Hannover, Germany

ABSTRACT

The groundwater use especially for agricultural purposes is rising rapidly since several years in developing countries. This is leading often to a decline groundwater table in the past resulting in several environmental problems. In coastal plains these problems are connected with saltwater intrusion, reduction of the groundwater quality and thus also the irrigation water quality. In order to find ways for a sustainable groundwater use regarding groundwater quality and water demand for irrigation, an investigation was started to manage excess water during monsoon season. This water can be used for managed aquifer recharge (MAR).

Alluvial coastal plains contain often aquifers which are overlain by aquicludes. Therefore, direct recharge methods need to be used. ASR-wells (Aquifer Storage & Recovery) can be used to infiltrate water during monsoon season and to pump during dry season for irrigation purposes. Due to the pumping in dry seasons the groundwater table would be lowered temporally, and more storage capacity would be presented. Therefore, a groundwater management concept was developed. The excess water was calculated and a field layout including ASR-wells and canals was developed. Analytical calculations of clogging due soil particles and nutrients in the injection water were conducted. These results were tested in a field study in Kharagpur, Eastern India.

The groundwater management concept shows a potential infiltration capacity of nearly 450 mm/a. Although the groundwater table will be lowered during the dry season, the saltwater intrusion is calculated to be relative small. If one ASR-well is supplying 2 to 3 ha and the depth to groundwater table is about 5 m, the average excess water can be completely stored. Smaller agricultural area connected to an ASR-well result in a less economical situation.

The field experiments showed that the infiltration capacity was not reduced by clogging throughout the infiltration cycles. The pumped groundwater was used for irrigation but was leading to silt deposition in the submersible pump.

The results show that the concept is able to secure a sustainable groundwater management for coastal aquifers. Technical problem using ASR-wells have to be solved before the system can be introduced on field scale.