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Comprehensive evaluation of skimming wells – An alternate technology for environmentally sustainable irrigation in the Indus basin of Pakistan

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The term 'skimming well' is a new horizon in the field of groundwater engineering. It is a relative term primarily used for the extraction of overlying fresh groundwater with minimum disturbance to the underlying saline groundwater. The purpose of the paper is to highlight the role of skimming wells in sustainable groundwater abstraction for irrigation purposes, identification of gaps in the existing practices and suggestions for the future.

In Indus basin, the natural groundwater is deep and saline because of marine origin of the hydro-geologic formation. Percolation of irrigation and rainfall waters has formed fresh groundwater lenses on top of this saline groundwater. The most serious problems in the Indus basin are upconing due to uncontrolled abstraction of this valuable resource and salinity and water logging due to which 25% of agricultural potential has been lost. Amongst various measures in controlling water logging and salinity in the Indus Basin, the use of skimming wells is more appropriate as on one hand it provides relatively fresh groundwater for irrigation purposes and on the other it is an economical way of drainage to prevent water logging.

Skimming wells technology is an effective and cheap means of on-farm irrigation and drainage, because it lowers the water table locally. A wide variety in skimming wells design, installation procedures and operational methodologies are available. Performance of these wells depends on a number of parameters like strainer diameter, pen-

etration depth ratio, distance between strainers, horizontal distance of strainers from suction point, and the thickness of fresh water lens below the strainers. Studies in different areas of the Indus basin revealed that continuous operation of a skimming well for 12 to 14 hours reduced the well discharge up to 30 % and deteriorated water quality whereas intermittent pumping helps in maintaining the requisite discharge and pumped water quality for a longer period. Furthermore, a single strainer well that is operated at a discharge rate between 32 to 180 m^3/hour can be operated successfully if the thickness of the freshwater lens is over 20 meter whereas multi-strainer skimming wells having 4 to 8 strainers can be installed where the thickness of the freshwater lens is over 10 meter without compromising the quantity and quality of pumped water.

The above “narrated evidences” depict the absence of proper design parameters, technical specifications, installation procedures, and operational methodologies in the Indus basin of Pakistan. Much work has been done on skimming wells, yet the scientific criteria of skimming wells design, installation and operation are still missing, which sometimes cause inappropriate selection and operation of wells resulting in high cost on one hand and environmental problems on the other. This study suggests the need of sound hydro-geologic and hydro-salinity analyses at adequate scales under different pumping scenarios in a physically accurate and useful manner so that effective design, pumping rates and operation modes could be devised.