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Testing of the applicability of managed aquifer recharge (MAR) in a well in an alluvial plain in a semi-arid region: An application on the Upper Litani Basin in Lebanon

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Groundwater resources management has been a growing concern and scheme as the consequences of climate change and other anthropogenic forces have heavily impacted freshwater resources, especially in semi-arid regions. The adoption of managed aquifer recharge (MAR) still remain at its earliest stages of assessment in developing countries, e.g., Lebanon, where only a few studies have been conducted. Groundwater is subject to contamination and depletion due to over-exploitation, poor management, and climate change. Regional conflicts and the current refugee status have amplified the need for accessible uncontaminated freshwater resources in the semi-arid Bekaa region, where water quality is expected to deteriorate further as dry regions become drier. Thus water availability poses a challenge on sustainability. In this present work, a preliminary integrated hydrological model is being developed using MIKE SHE (DHI, 2016) for the entire upper Litani Basin catchment in order to simulate flow based on different components and parameters characterizing the climate, atmosphere, saturated and unsaturated zone to assess degree of groundwater depletion, and the availability of water resources for recharge. It further investigates the feasibility and application of the Aquifer Storage and Recovery scheme devised for a well drilled in the Miocene semi-confined aquifer consisting of coarse alluvial deposits in the Litani Basin, Bekaa (a semi-arid region) in Lebanon, which will store surface run off during the winter, to be utilized for agricultural irrigation purposes in the summer. An experimental borehole has been drilled in the framework of a project “Strengthening Lebanese Water and Agriculture Sector” financed by the Dutch Government. The system was implemented in 2017-2018, in order to maximize well yield efficiency and reduce groundwater depletion and overexploitation. The components of the MAR system consists of a water intake reservoir and pipeline system housed in an operating container securing infiltration to and abstraction from the installed well. The small scale subsurface characterization of aquifer properties was done using grain size analysis of borehole cuttings and several pumping tests to assess transmissivity in the recharged aquifer at the borehole scale. Physico chemical and water level data is being collected from the borehole and its surrounding to assess hydraulic and hydrochemical variations from injected surface water.