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A case study on the artificial water-storage test for securing additional groundwater resources to irrigate greenhouse facilities

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This study was conducted to identify additionally secured groundwater amounts by applying an artificial water-storage method using an injection well with a depth of 14 m in one high-density greenhouse facilities zone, South Korea. Eight monitoring wells were placed in a shape of dual circles around the injection well in an alluvial plain. Distances among the wells were designated to be 7 m. Soil profiling data exhibited that a groundwater-bearing layer consisting of sands and gravels was located from – 12.0 to – 6.0 depths below ground-surface in the plain. Results of slug-tests for each well demonstrated a hydraulic conductivities ranging in 1.5∼9.6 x 10-3 cm sec-1, indicating characteristics of a relatively high permeable layer. A step injection-rate test on the permeable layer with 20, 40, 60, 80, 100, and 125 m3 day-1 of injection rates for each step, respectively, resulted in a specific groundwater-level rising (Sr/Q) with a range from 0.013 to 0.030 day m-2. During the step test, the increase of groundwater level on monitoring wells within inner and outer circles were identified to be ∼0.09 and ∼0.06 m, respectively. A constant-rate injection test with an injection rate of 100 m3 day-1 during eleven consecutive days exhibited a rising of groundwater levels in the inner and outer circles to be ∼0.45 and ∼0.37 m, respectively, which explained an enormous storage capacity of the permeable layer. During the constant-rate injection test, most of hydro-physical properties including pH, EC, and temperature was stable in dual monitoring wells whereas dissolved oxygen (DO) value slightly increased due to an injection of surface water with high DO concentrations. Results of this study demonstrated artificial storage of groundwater successfully generated in the alluvial aquifer in this zone. In addition, an artificial water-storage method would be effective to secure additional groundwater resources against high-demand on groundwater resources on the greenhouse facilities zone. For more safety use of stored groundwater, a detailed monitoring on the change of groundwater-quality due to an increase of DO concentrations should be required.

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