The estimation of regional hydraulic conductivity is essential for the sustainable development and efficient management of groundwater. This paper presents a new physical method of estimating hydraulic conductivity based on the water level fluctuation model developed by Park and Parker (Park E., and J.C. Parker, 2008. A simple model for water table fluctuations in response to precipitation. J. Hydrol., 356: 344-349). The developed procedure was validated by comparison with the hypothetical numerical model for a variety of hydraulic conductivities, aquifer inclinations, and the heterogeneities. The model was found to be highly reliable when using water level data far from the hydraulic boundaries. The results show that the monitoring data obtained over a range of relative distances of an observation location (x) to the flow domain (W), x/W > 0.2 avoided the boundary effects. A correction factor was also proposed based on the deviation analysis of the calibrated K and f/n (ratio of recharge to precipitation divided by porosity). The results from the basal inclinations and the heterogeneities cases suggest that the estimated hydraulic conductivity is representing regional property rather than the local one. To confirm the validity of the proposed procedure, it was applied to the coastal aquifer of Jeju Island, Korea. The calibrated hydraulic conductivities were consistent with the results from previous studies. These results show that the proposed method is an effective and economical means to estimate hydraulic conductivity of large supporting volumes of subsurface aquifers with the convenient use of recharge and groundwater level data.