

## Estimating of Groundwater Recharge Value for Al-Najaf City, Iraq

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**Abstract :** Groundwater recharge is a crucial parameter for any groundwater management system. The variability of the recharge rates and the difficulty in estimating this factor in many processes by direct observation leads to the complexity of estimating the recharge value. Various methods are existing to estimate the groundwater recharge, with some limitations for each method to be able for application. This paper focuses particularly on a real study area, Al-Najaf City, Iraq. In this city, there are few groundwater aquifers, but the aquifer which is considered in this study is the closest one to the ground surface, the Dibdibba aquifer. According to the Aridity Index, which is estimated in the paper, Al-Najaf City is classified as a region located in an arid climate, and this identified that the most appropriate method to estimate the groundwater recharge is Thornthwaite's formula or Thornthwaite's method. From the calculations, the estimated average groundwater recharge over the period 1980-2014 for Al-Najaf City is 40.32 mm/year. Groundwater recharge is completely affected the groundwater table level (groundwater head). Therefore, to make sure that this value of recharge is true, the MODFLOW program has been used to apply this value through finding the relationship between the calculated and observed heads where a groundwater model for the Al-Najaf City study area has been built by MODFLOW to simulate this area for different purposes, one of these purposes is to simulate the groundwater recharge. MODFLOW results show that this value of groundwater recharge is extremely high and needs to be reduced. Therefore, a further sensitivity test has been carried out for the Al-Najaf City study area by the MODFLOW program through changing the recharge value and found that the best estimation of groundwater recharge value for this city is 16.5 mm/year where this value gives the best fitting between the calculated and observed heads with minimum values of RMSE % (13.175) and RSS m<sup>2</sup> (1454).

**Keywords :** Al-Najaf City, groundwater modelling, recharge estimation, visual MODFLOW

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