

# Groundwater Recharge Estimation Using Water Budget and Geostatistical Methods (Case Study: Ghaemshahr Aquifer)

## Abstract

Groundwater is a low cost resource and accessible almost anywhere in a plain compare to surface water, therefore, it has been used extensively in most places. It is important to study this renewable and valuable resource very carefully in order to manage it correctly. Water balance study is one of the methods to know the groundwater potentials in a region, comprehensively. Using conventional and traditional methods to calculate groundwater budget needs working with large amount of data and information, spending several hours and using many man-powers. Using new technologies such as geostatistics and geographic information system (GIS) provide the spatial distribution of groundwater potentials. In addition, a database can be developed which has the ability to be updated, regularly.

Ghaemshahr-Joybar aquifer located in the south of Caspian Sea is one of the largest aquifers in Mazandaran Province and has a good potential of ground/surface waters. The recharge parameters in this area are recharges from rainfall, Talar and Siahrood rivers, agricultural pumps, canals, ponds, return flow from agricultural, domestic and industrial wells. The discharge parameters are deep and semi-deep wells, evaporation, and drainage. In this study, water year 2003-2004 was selected to be the base for water balance calculations. That year was divided into two seasons, dry and wet, in order to increase the accuracy of calculations.

Using geostatistical tools in ArcGIS and Ordinary Kriging estimator, spatial distribution of rainfall, evaporation and volume changes in groundwater storage were calculated in pixel sizes of 100×100 m. Then, the raster maps of all input and output parameters were developed again with pixel sizes of 100×100 m. At the end, the water budget of the aquifer showed that total recharge and discharge to aquifer are 200.66 and 185.67 million m<sup>3</sup>/year, respectively. Therefore, volume change in aquifer storage is 14.98 million cubic meters per year which shows the positive trend in groundwater reservoir. In addition, the calculation shows that there is a potential to increase the groundwater extraction about 30 million cubic meters per year in this aquifer.

**Keywords:** Groundwater budget, Geostatistic, Ghaemshahr – Joybar aquifer, GIS.



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