



University of Zabol  
Graduate school  
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Department of Irrigation Engineering

**The Thesis Submitted for the Degree of M.Sc (in the field of  
Irrigation and Drainage Engineering)**

**Estimation of the spatial distribution of  
Groundwater Quality of Birjand Plain  
with Geostatistical –Artificial Neural  
Network combined Method**

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May 2013

## **Abstract**

From the most essential cases in qualitative management of underground water sources is water qualitative estimate by using of taken data from the network of observant wells. It is necessary that regarding taking of surface of the underground water in plains as pointy in observant wells to extend the information resulted from the pointing taking to surface for calculation the average amount of qualitative amounts of underground water in plains and estimate the qualitative amounts of water. Always, the using of the models of the statistical-ground have accompanied with error, since, in most cases, function of worth is not including all estimated experimental points. The aim of the accomplishment of this research is to survey the use of the compound method of the statistic-ground and the best artificial nervous system with genetic algorithm in finding middle qualitative amounts of the underground water. First, in this research, the use of Kriging model was chosen for estimated qualitative amounts of the underground water of birjand plain that located in Southern Khorasan province with certain geohydrology conditions. These, in continue, were drawn with election of the appropriate landscape changing half model of the plans resulted from the Kriging model.

Then, during a regular networking in plain area, the qualitative data of the underground water that have been estimated by the Kriging method, and have been extracted as textual file and have been applied in compound with nervous system way. The compound of the chosen statistical-ground method with artificial nervous systems, showed this compounding algorithm have the better performance and caused to improve the pointing estimated of qualitative amounts of the underground water for estimate the amounts of the nitrate, nitrite, sodium, calcium, magnesium of the underground waters of Birjand plain. Also, this method has the standards of the more appropriate estimated than statistical-ground methods alone. The results showed that in estimate the amounts of nitrate-sodium, magnesium and calcium of the underground water of Birjand plain, MLP nervous system whit instruction algorithm of Levenberg-Marquardt by coefficient, respectively, 0/96, 0/997, 0/93 and 0/98 and for nitrite amounts, GFF nervous system with instruction algorithm of Levenberg-Marquardt by coefficient 0/905 have the standards of the more appropriate estimated for compound with the statistical ground method. Finally, the best results of the artificial nervous system in compounding with statistical-ground method by using of genetic algorithm in estimate of the amounts of the qualitative elements of the underground water that has been studied in this research was effective and minimized the error in the estimate process.

**Keywords:** Birjand Plain, Geostatistical, Artificial Neural Network, Groundwater Quality