

Investigating the Effective Factors on Changing Groundwater Levels of Safi Abad Plain of Esfarayneh

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Extended Abstract

Introduction: Based on human needs, the usage of underground is increasing. By the time of the 12th century, the use of these waters was carried out in traditional ways, but at the beginning of this century, the technique of exploitation is developed which is caused to be water withdrawal and made many problems such as the drying of the Qanats and springs. Because of the importance, the study of these resources has been chosen. The oldest studies in this regard are related to Greek philosophers. AbouiryhanBeiruni and HamdollahMostofi also conducted studies in this regard in Iran, also in this field Nayak (2006), Zang (2009) by Plutp (2011), Jang (2012), Sins (2014), Yang (2012), Zaho (2015) have been studied in recent years. In spite of the fact that nearly one century passes from the usage of underground water through Safi Abad plain, but its underground water has not studied. In this research, it is attempted to identify the factors which are affecting the level of underground water changing in the Safi Abad plain that its results can be used to control and manage its groundwater.

Materials and Methods: For doing this research, was first determined the scope of the study. Then Statistics data which are related to groundwater was obtained from the Regional Water Authority of North Khorasan province. The climate studies were performed by using Safi Abad and Esfarayen weather stations statistics. The information of smart meters was obtained through experts from the Regional Water Authority. The issues which are related to draw the diagrams and plans were done by using the mini-tab, Excel, spss and Adobe Illustrator software.

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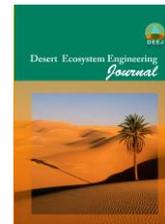
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Results and discussion: Safi Abad plain is located in the eastern part of Iran, in coordinates between 57-39° and 58° 06' eastern longitude, and 35°36' to 36°55' northern longitude. The hydrographs study of groundwater of this plain indicates that the groundwater levels were reduced significantly. In the early studies, it was assumed that in the reduction of groundwater of this plain were affected because of the factors such as rainfall, increasing in population, political issues, irrigation systems, and installing smart meters. On the basis of assumptions, the effect of rainfall was first studied. The average rainfall is 259 mm in this plain. The correlation between precipitation and groundwater level by SPSS software indicated that there is not the significant relationship between rainfall and groundwater. Also, the rainfall magnitude of 40 years was normal in this plain. In addition, water withdrawal is considered as another effective factor in this area, which is related with increasing population. The population of Safi Abad has doubled from 1335 to 1395. Moreover, with conversion Safi Abad to city, the population immigration from surrounding villages was led to an increase of in groundwater withdrawal of the plain. Fines for unauthorized water withdrawal also do not have a positive effect on controlling of groundwater in this plain because fines which are considered for these issues were not deterrent. Some researchers consider new irrigation techniques are useful to reduce water withdrawal. Although the use of these methods has increased on this plain, it does not prevent the depletion of groundwater level because farmers have cultivated another part of its land. The use of smart meters is one of the most recent groundwater controlling methods, which is considered. for the first time in this plain has been investigated, the effect of these meters which has installed in three stages. The first step was before the installation of the meters when the level of water had dropped sharply, after the installation of the meters, their effects were not very clear since the 2011 and for the first time the surface of the groundwater level in this plain was higher than the data line.

Conclusion: One of the plain where its groundwater level is decreasing is Safi Abad plain. In the early studies, it was assumed that this decrease is because of the factors such as precipitation, population increasing, the development of the Safi Abad and changing to the city, political issues, irrigation systems and installing smart meters. The study of rainfall statistics indicated that precipitation in this plain has not reduced in recent years, so that rainfall cannot be considered as a reason for this issue. The second assumption was related to the excessive overtaking of groundwater because of population growth. The population of Safi Abad has doubled from 1956 to 2016, which this increasing has doubled the water requirements. Elections have had an impact on this issue as a political result which is noticeable during the 1998-1997. Also, the fines which were considered for water withdrawal have not been able to overcome excessive consumption. The use of modern irrigation methods in this plain cause water saving consumption, but it has not been able to reduce groundwater withdrawal because farmers have been cultivated another part of this plain. But the installation of intelligent meters somehow is considered as the factor could reduce the water withdrawal which would prevent about 10 million cubic meters of unauthorized water withdrawal in the Safi Abad plain.

Keywords: Safi Abad plain, Groundwater, Smart meters.