Investigation about the Effective factors on Pressure Drop in Hydraulic Data in Guilan Plain

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Extended Abstract

Introduction

Groundwater is one of the essential resources for supplying requirements of drinking water, agriculture and industry. This resulted in establishment of civilization in plains and lands where are far from rivers of freshwater.

Regarding low amount annual rainfall in Iran and loss of water as a result of evaporation, volume of water production is about 128 billion cubic meters. From this volume about 83 billion cubic meters form surface water resources and 45 billion cubic meters join the groundwater by penetration. In recent decades, the growth of population and the need for water resources have led to an increase in exploitation to these essential sources hidden in the heart of the earth.

Study area of this research is located in southern coast of Caspian Sea in Guilan Province. The research problem is that in some wells the coefficient of pressure drop shows negative figures whereas in some other wells these figures are positive. It is not clear that what is the effect of these changes on exploitation of water resources of the aquifer and how much this effect is and in what field it may be. This research tries to recognize the factors that affect this phenomenon besides recognizing the effective reason in negative coefficient of pressure drop in aquifer and lining of wells and determining scientific results and its applied effects.

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Methodology

In this research, field method and using step back test has been applied to find the reason of the negativeness of pressure coefficient in available wells in the plain. Thus, through providing necessary conditions, digging operation and pumping of more than 600 deep wells have been supervised and controlled. More than 300 regions were directly controlled. Geographical features in some of sample wells in the region were taken and the selected points were specified on the map by using ArcGIS. Statistics and information related to geographical and geomorphologic conditions and geology of location of the wells and testing scope of pumping in the selected wells were collected and was analyzed in the form of graphs by SPSS program. Then, the results were analyzed and all wells were classified in separate groups and those with similar situation in the view of pressure drop coefficient were assigned in the same groups. Finally, the selected wells have been classified in three different groups.

In the next step, the features of wells in each level such as geographical and geomorphological conditions, geology of constituting sediment layers in location of the wells, texture of surface water and layers in location of them, technical and expert characteristics of the company, the quality of digging and supervising system were all evaluated and compared. Common aspects of well was distinguished in each group. Then, after recognition and regarding the common aspects of the wells belonging to each group it had been concentrated on the wells which had negative coefficient of pressure drop.. Being sure about the result, besides repeating considerations on the ground, they have been controlled and evaluated and in some cases the test has been performed again.

Results and Discussion

Doing pumping test for determination of hydraulic features of groundwater aquifer and well is one of the usual methods. In this case, the pumping test has been done in two different methods: one is pumping by fixed rate (shuttle test) for determining aquifer coefficient and pumping by varying rate (step pumping) for determining well's coefficients. Therefore, the well's coefficient specification has been possible just by using the result of pumping with varying rate (step pumping). So, in this research by paying attention to the importance of the coefficients, the data of step pumping is used for determining features and situations of well and aquifer. Before starting test first the water level in the wells has been measured. Then, by doing the operations of digging and tubing of a well, washing and exiting of the fine-grained materials remained in it has been done by pure water and pumping method. After providing suitable condition for water arrival from aquifer layers into the well, water pumping operations has been continued with different engine turn until the water level became fixed. During this period water level was measured based on a predetermined timetable. The process of water level changes and its constancy was distinguished and from the results (result related to the first step of the test) the coefficient related to aquifer has been computed. After being sure about the constancy of the water level (reaching the water level to the dynamic level), well's rate and in another word engine's turn has been increased and the act of measuring water depth from the surface up to the constancy of water level in well has been continued as before. This plan has been implemented

at least in four steps with 4 different rates as 4 engine's turns. In the next step, the result of step pumping was analyzed and after finishing field operations and recording figures it was abstracted in related table.

After designing the mentioned table, the coefficient of pressure drop in aquifer (B) has been obtained by using the curve of especial drop to the rate that the mentioned crossing point of the curve connect with the widths axis with drawing the related curve. From obtaining pressure drop in aquifer, the pressure drop in lining network of well (C) was obtained by using y_2-y_1 (x_2-x_1) that is, in fact, the slope of especial drop curve to the rate. Finally, after calculating B and C, the table of brief result of pumping is provided.

Conclusion

Considerations show that available problems in taking groundwater in Guilan Plain is related to the nature of the region in terms of sediment texture and hydrologic characteristics of the plain, humanistic factor, the performance of feeding, unsuitable quality of digging and also exploitation methods. The groundwater feeding is through different sources such as rivers and networks of irrigation channels, floodgate and pools of growing fish that are extensively in the plains, and also free aquifers situated on semi-confined aquifer that have hydraulic balance state. These sources were useful and can have positive function at increasing the age of economic exploitation of a well. However, due to unfamiliarity of most experts with the mentioned phenomenon and varying performance of this phenomenon in different seasons, the wells affected by the mentioned elements will be faced with damages and sometimes it is so severe that may destroy the well.

Considering the effective factors on the pressure drop of hydraulic data in Guilan's Plain by pumping method indicates that the step back method is better for determining hydraulic coefficient of well. It is suggested that to use this pumping method instead of step pressure. Because for determining the features and real situation of wells and aquifers especially in plains and coast region, implementing step pumping through step drop is suitable. The data gained from pumping which has been done on more than 600 wells were tested by step drop and approved these results. The lack of observing technical principles for digging leads to the increase of pressure drop in well's lining network and causes a speed at the entrance of water to the wells. Therefore, this will change the physical conditions of water. This may lead to transformation of sodium bicarbonate soluble in water to insoluble carbonate which by sedimentation on the well's lining and general pack of the back of lining's tube and tracks of lining network (shell investing) will increase pressure drop of lining network. Moreover, it decreases discharge of the wells and intensifies shell investing action which leads to a decrease in economic life time of exploitation.

Keywords: Aquifer, Feeding, Groundwater, Guilan's Plain, Hydrology, Pressure Drop.