Problems of groundwater development in Zahedan City, Iran

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ABSTRACT: Zahedan City with a yearly rainfall of about 95 mm lies in the most arid area in the eastern part of Iran close to Pakistan border. This city with a population of more than 500,000 has the highest rate of population growth among the big cities of the country. Water demand in the city is estimated at 140 million liters/day in summer. At present, all of water supply in the city is obtained from groundwater. Groundwater is provided from an aquifer with an area of 120 km^2. The monitoring of groundwater levels exhibits a decreasing trend of water level.

Groundwater pollution and problem in water supply appear to be some of the most important reasons inhibiting the sustainable economic development of the city. The quality of groundwater deteriorated sharply during recent years. The main reasons responsible for the deterioration of water are as follows:
(i) Movement of saline water from the east part of the aquifer and interaction in the sweet water aquifer in the west part.
(ii) Lowering of the groundwater table, because the wells pumping from groundwater has exceeded natural recharge in the Zahedan basin since 1980.
(iii) Rapid growth of the city population in the recent years and aquifer pollution by human activities is serious in this city.
(iv) Uncontrolled and unplanned development of the city in western part over the aquifer providing fresh water has led real problem of overdraft or over exploitation.
(v) The city has not any sewerage system and it is one of the main factors that increase groundwater pollution. However, liquid wastes may enter into the groundwater, either directly through deep wells or indirectly by percolation.

Key words: contamination, groundwater, population growth, Zahedan

INTRODUCTION

Zahedan city with a population of more than 500,000 has the highest rate of population growth among the big cities of the country. The city is one of the newest cities among big ones in Iran. Its official establishment began in 1923, 8 years after finishing the Zahedan-Koweiteh, Pakistan railway construction. The fast development of the city was due to special geographical situation. Since many immigrants came from suburbs to this city and neighboring Baluch settled gradually. High population rate has changed the city population from 17497 in 1956 to 419518 in 1996.

Rapid development of this city in the last decades, low yearly rainfall and not correct using of groundwater and its pollution caused many problems in preparing drinking water. At present, the poverty of water sources and low quality of supplied water have been known as the most important obstacle in the way of social and economical development in Zahedan. Therefore, it is essential to ascertain the process that control the quality and quantity of groundwater.

ZAHEDAN GROUNDWATER SOURCES

Zahedan groundwater is provided from an aquifer with an area of about 120 km^2 on the north of Zahedan basin. The Zahedan basin with 1675 km^2 area begins from Qatar Khanjak in Zahedan road to Khash in south and leads to Lar river in north. The watershed is drained by Lar river and Zahedan is near to the Lar river. The watershed are surrounded by flysch formation in east and north parts, and granite and granodiorite in south and west parts. Flysch formation mainly compose from sandstone and shale

Average rainfall in the Zahedan basin is 95 mm per year, mainly in the winter, and potential evaporation averages approximately 2800 mm. Natural recharge of the aquifer in not know clearly. As noted by Lerner et al. (1990) and Custodio et al (1998), one of the key difficulty associated with the assessment of groundwater resources is the estimation of natural recharge.

DISCUSION

The factors responsible for the deterioration of groundwater are discused in this part**.** In the city the traditional focus has been on estimation water quality, not on assessing its quality. For this reason the information on groundwater contamination is poor.

The quality of ground water has shown a downward movement from 1987 to 1996. The city network water that is being supplied from groundwater is undrinkable now. For example, during the period mentioned above, the average value of total dissolved solids (TDS) reached 3635 ppm from 2299 ppm and electrical conductivity (EC) reached 5370 μmhos/cm from 3537 μmhos/cm.

The quality of groundwater deteriorated sharply in the recent years (Lashkaripour, 1999). The main reasons responsible for the deterioration of water are the following:

(i) Movement of saline water from the east part of the aquifer due to the city's developing and spreading on west and south west parts on groundwater sources. This factor caused the groundwater to be polluted in a restricted area which city's drinking water wells had been dug there. Unfortunately, nowadays, the city's development has been in this area and many installations such as hospital, jail, university, gas station, school, and etc. are being constructed. The sewer leaking of these installation will cause the groundwater to be more polluted in the near future.

(ii) The lack of city sewerage system in Zahedan is one of the main factor that increase groundwater pollution. Because, liquid wastes in the city may enter to groundwater, either directly through deep wells or indirectly by percolation. It cases increase in diseases due to degrading water quality.

(iii) Groundwater pumping has exceeded natural recharge in the western part of aquifer and groundwater level has declined from 1980. This factor causes movement of saline water from east and south eastern parts and interaction in the drinking water sources in the western parts. This process affected the quality of network water. The low quality and saline water of the eastern part of the aquifer is due to supplying water from flysch formation and its neighboring with evaporate deposits.
(iv) The location of city landfill in the eastern part of the city in the edge of Zahedan-Pakistan road is one of the other groundwater polluting factor. There is the probability of polluted water and dangerous contaminating water entering into groundwater sources from waste deposit. It influences on the aquifer in northern and ghetto areas of the city and effects many people's health.

The mentioned parameters cause the city network water to become undrinkable gradually in the recent years. It is necessary to stop future deterioration and promote sustainable groundwater development. Because the more pollution of this aquifer will cause the groundwater to become unusable even for non-drinking and agricultural uses in the near future.

At present, about 1.6 million liters/day drinking water is obtained from groundwater sources and it does not meet the citizen's needs. Therefore, from 1998 forty water tankers have carried the drinking water from Ladiz village close to Taftan mountain about 80 km in the eastern part of the city.

As mentioned above the water of the network existing in the city has become undrinkable since last decade. Consequently, the drinking water is available in 13 stations in various places in the city that is distributed by a separate network. There are some people that supply their own drinking water by themselves from these stations. Moreover, 200 personal tankers and about 500 venders with handy carts do this too (Rahdari, A. 1998). Nowadays many people make a living by selling drinking water in Zahedan.

At present a great federal project by the Ministry of Power is under construction for drinking water supply. This project will transfer water from Chah-Nemah reservoir to Zahedan by a pipeline in the length of 191 km. Chah-Nemah reservoir is in the northeast of Zahedan close to Zabol city, and it is fed by Hirmand river. Hirmand river originates in Hendokosh mountains in the east of Afghanistan. By completion of the project at the end of 2000, the majority of Zahedan Water's customers will begin receiving Hirmand water.

CONCLUSIONS

Zahedan city in the east of Iran has a great importance as a social and political center for Sistan and Baluchestan province. Groundwater is the sole water source for the city. The available water sources of Zahedan does not meet the ever-increasing demands of this city. Whereas, it is necessary to do a comprehensive research for supplying drinking water for a long term.

Aquifer are not well protected and become salinized or contamination through human activities that often bear no relationship to groundwater development. Valuable part of aquifer has been destroyed by incorrect aquifer development and management. For example, uncontrolled and unplanned development of the city in western and southwestern parts over drinking water sources of aquifer has led real problem of over

exploitation and groundwater pollution. It is necessary to prevent the city to be more developed and spreaded on this area.

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