

## The effect of morphogenic and geomorphic features on the identification of groundwater quality zones in Rey city, Tehran province

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### Summary

The city of Rey, located in Tehran province, is one of the most populous parts of the country and features a dry climate. This city is located at the crossroads of five important rivers of Tehran province and a large number of sewage channels and canals of Tehran metropolis. In this study, the number of various groundwater contaminants such as total hardness, sulfate, nitrate, magnesium, calcium, EC, and TDS for about 27 drinking and non-drinking water wells and the quality characteristics of the soil around the wells were investigated. Qualitative values were proportional and at the end, all data with morphogenic characteristics of landforms such as alluvial barracks, floodplain, debris area, headward erosion, etc. by multivariate and univariate tests were statistically evaluated. The results showed that the water parameters of wells in the central areas of Rey city due to the presence of the Tehran effluents canal, the morphology of basins, and waterway density in the north and west of the area were above average. Also, drilled wells in the western part of the study area have been affected in terms of quantity and quality by the southern alluvium of the Bibi Shahrbanoo platform. These formations, due to having low permeability layers such as marl and sandstone, do not play an effective and beneficial role in feeding the groundwater aquifer, and on the contrary, they largely prevent the feeding of groundwater aquifers downstream. On the other hand, due to the chemical nature of marl formations and very slow movement of infiltrating waters through them and the possibility of having enough time to contact the bedrock and the necessary conditions for obtaining ions, especially cations and anions, we can say the type of texture and formation of the region. It has adverse effects on groundwater quality and in some cases causes groundwater salinity. It is worth mentioning that the average thickness of sediments near Taghiabad is about 175 meters, while this amount reaches 200 meters in the area of Ghaniabad wells. The reason for this is the presence of several alluvial fans in the eastern part of the area. Therefore, it is possible to drill a new well in the north of Ghaniabad wells because this area has a suitable floor rock depth and an electrical conductivity of fewer than 2000 micro siemens per centimeter.

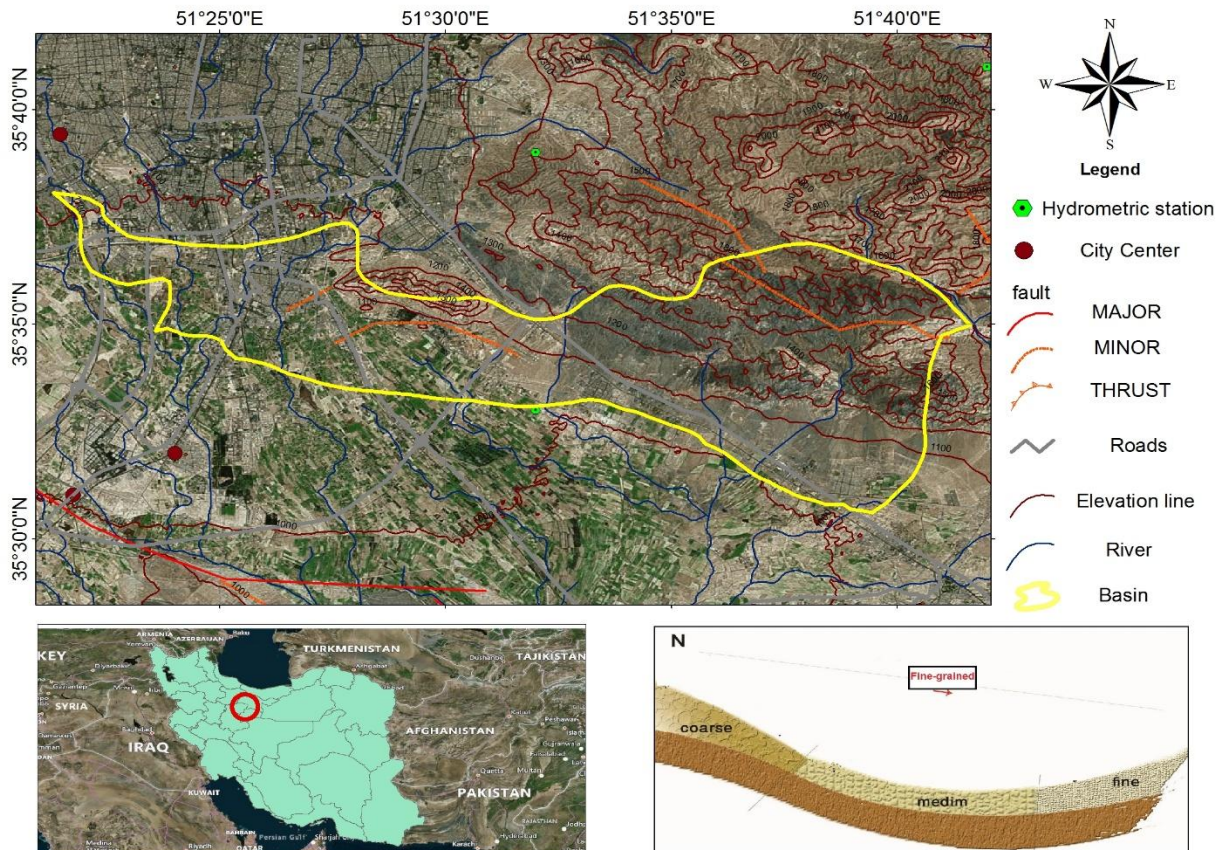


Figure number 1: Map of the study area Ray County, Iran

### Theory / Method / Workflow

The study area includes the central part of Rey city and is located at 51. 21 °E to 51. 32 °E longitude and, 35. 35 ° N to 35. 35 ° N latitude. This area consists of 20 towns and villages. The required flow of this area is supplied from groundwater sources and currently, the number of active wells is equal to 15 wells. There are also two wells in Mahmudabad village, which are responsible for supplying water to this village separately. To conduct research, the qualitative characteristics of 17 drinking water wells and about 10 non-drinking water wells were studied. The quality parameters of the studied water include total hardness, magnesium, calcium and sulfate, EC, TDS water nitrate, which has been received from the Water and Sewerage Organization and Iran Water Company. Also, the properties of soil quality parameters were obtained by Calcimetry, PH meter, EC meter, photometric film, spectrophotometer, and sulfate ion measuring device in a geomorphology laboratory. Then, the data correlation was calculated by parametric and non-parametric statistical tests as well as multivariate tests. To determine the effect of climatic factors, the long-term average monthly and annual rainfall and temperature in the synoptic station for 10 years were received from the Meteorological Organization and its correlation with groundwater changes in wet and drought periods was calculated by SPSS software. Finally, the morphogenic characteristics of the study area were identified by Landsat 8 and Sentinel 2 satellites in the optical

spectrum and were proportional to groundwater quality changes, and the suitable area for drilling new wells was identified by spatial patterns obtained from the indicators.

## **Results, Observations, Conclusions**

Based on the morphogenic characteristics obtained from satellite images and geological maps, it was determined that Bibi Shahrbanoo platform is located in the western zone of the study area. The platform is stratigraphically composed of dolomitic and marl limestones and extends to all western, eastern and southern flanks. Therefore, it can be said that drilled wells in the western part of this complex, such as Taghiabad wells, have been affected by the southern alluvium of this slope in terms of quantity and quality. The results showed that on average the nitrate status of well water was more than allowed. The reasons for this are the existence of Tehran effluents canal and the shape of the drainage network in the north and west of the area and the existence of agricultural lands in the center of the study area.

In general, in areas with low agricultural density, nitrate concentration is usually not high compared to areas with high agricultural density. Also, the concentration of some other parameters such as total hardness, magnesium, calcium, and sulfate is higher than the maximum of the world standard, which indicates that the water hardness in wells in this range is high. The presence of sediments and calcareous formations, especially on the southern slope of Bibi Shahrbanu Mountain, are among the factors that have increased water calcium and magnesium in wells in the city of Rey. This has especially increased the amount of calcium and magnesium in the water of western wells in the study area. In addition, the existence of residential and industrial centers such as cement and brick factories in the northeast of the region and the use of chemical fertilizers in the southern and eastern farms of Bibi Shahrbanu Mountain has increased the amount of groundwater sulfate. In general, it can be said that temporary hardness and permanent hardness are the quality characteristics of groundwater in this region.

## **Novel/Additive Information**

This study aimed to identify areas in the southern part of Tehran where new wells can be drilled. For this purpose, morphogenic characteristics and soil sedimentation patterns were used. As a result of this study, it was found that due to the presence of northern faults in the northern limestone structures of the region (Bibi Shahrbanu Mountain) and the recognition of the contact of the formation and alluvial layer, proper discharge is possible in the northern limestone structures (Bibi Shahrbanu Mountain), but to achieve it needs water purification equipment. It was also found that in the north of Islamabad wells, it is possible to drill a new well because this area has a suitable floor depth and electrical conductivity is less than 2000 micro siemens per centimeter, which seems to be the case if the well is completely drilled (drilling to the bottom stone). The flow rate should be increased to at least 20 liters per second. Also, to eliminate water hardness and nitrate, the use of a water treatment package and two-network or construction of a separate system to supply drinking water to villages, especially in the area of western wells, the study area is recommended.

## **Acknowledgements**

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