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Anthropogenic and Natural Effects On Qualitative Changes in Groundwater Around Mamlou Dam (Iran)

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Abstract : *Water has many different physical characteristics as color, turbidity, TDS, etc. on the other hand, chemical characteristics of water as alkalinity, acidity and hardness can effect on its quality. Physicochemical characteristic observation of groundwater resources as actual sources, based on chemical analysis of dry and wet period of 2016 and transferred to GIS software and analysis in quality observation is conventional in such researches. In this research physicochemical parameters for 16 wells from 16 villages have been experienced. The parameters were: TDS, Cl, SO4, Nitrate and Ca. Finally, GIS map have been compared with geological and agricultural maps to find the result of high concentration of some parameters. It has been received from results that some problems as turbidity is natural but some other as Nitrate has anthropogenic source. For either kinds of problems, solutions as cap on wells or cementation are suggested.*

Keywords: *Chemical Characteristics, Physical Characteristics, Groundwater Quality Index, Geographical Information Software (Gis), Well Water.*

INTRODUCTION

Groundwater is the most vital natural resource, which forms the core of the ecological system. It has become the major source of water supply for drinking, domestic, household, agricultural, industrial, recreational, and environmental activities etc. This has led to an increase in the demand of water supply which is met mostly from the exploitation of groundwater resources. Nowadays groundwater is a very important concern for mankind since it is directly linked with human safety. Determination of physical, chemical and bacteriological quality of groundwater is important for assessing various usages. Variation in groundwater quality in an area is a function of physical and chemical parameters that are greatly influenced by natural processes such as geological formations and anthropogenic activities. (Selvakumar et al., 2017)

In this research, focus of drinking water quality is on turbidity, fluride, calcium and SO4.

Turbidity is a phenomenon that shows amount of water trancparency and it is a character related to water appearance (Shariatpanahi.M, 2012).

Turbidity is a nonspecific measure of the amount of particulate material in water (e.g., clay, silt, finely divided organic and inorganic matter, microorganisms) and is measured by detecting the amount of light

scattered by particles in a sample, relative to the amount scattered by a reference suspension. Turbidity has been used for many decades as an indicator of drinking water quality and as an indicator of the efficiency of drinking water coagulation and filtration processes.

Fluoride occurs naturally in most soils and in many water supplies. For more than 40 years, fluoride has been added to supplies lacking sufficient natural quantities, for the purpose of reducing dental caries. However, acute overdosing in the 20 to 200 mg/L range, due to equipment failure in fluoridating systems, can result in nausea, diarrhea, abdominal pain, headache, and dizziness.

The MCL for fluoridating systems is 2.0 mg/L, but the safe and effective target range established by the Public Health Service Ad Hoc Subcommittee on Fluoride (1991) is between 0.7 and 1.2 mg/L, depending on temperature and pH. (Letterman, 1999)

Calcium is usually found in natural water and its concentration is depends on the rocks and soils which water passes. This element usually is in some salts as carbonate, bicarbonate and sulphate although in saline waters it is in combination of Chloride and nitrate. Calcium with bicarbonate can increase temporary hardness. Sulphate, chloride and nitrate can make permanent hardness. Calcium is one of the most important elemnts in human food but calcium concentration in water is negligible in comparison of other resources and most of it sediments. (Shariatpanahi, 2012)

Range of sulfate concentration in nature is very diverse. It can penetrate to surface or ground water from many sources as seawater and industrial wastewater as tannery. Also H2S from factory chambers spread into air and can be solved in rain water as sulfate. Sulfate can affect water taste but during the time human can get used to this ion. With aeration it can be removed from water. (Shariatpanahi, 2012)

High concentrations of sulfate in drinking water may cause transitory diarrhea. Acute diarrhea can cause dehydration, particularly in infants and young children who may already have a microbial diarrheal condition.

Adults living in areas having high sulfate concentrations in their drinking water easily adjust, with no ill effects. (Letterman, 1999)

The presence of sulfate in drinking water can cause a noticeable taste, and at very high levels. (Dhanasekarapandian et al., 2016)

It is essential to supply drinking water for any society and in this research we just work on quality of groundwater in some villages near Tehran in Iran not the quantity.

Study area

Geographical coordination of site is between 39° 44' to 39° 68' north latitude and 56 ° to 60° eastern length. Analysis was done in dry and wet seasons of 2016. Research location was some villages around Mamlou dam which includes areas in Damavand and Pardis.

Methodology

Well selection

By consideration that all wells are near Jajroud River and Mamlou dam and these wells are source of potable water for the villagers, 16 wells from 16 villages have been selected randomly to study on their physical and chemical qualitative parameters. Name and location of villages are as below table.

Table 1: wells coordination

name	y	x
Louman	35.629	52.209
Masha	35.761	52.034
Kaldasht bala	35.677	52.052
Seyedabad	35.63	52.372

Moqanak	35.561	52.261
Hesar bala	35.679	52.04
Vadan	35.639	52.083
Viraneh	35.492	52.209
Jaban	35.629	52.259
Chenaran	35.706	51.99
Eslamabad	35.658	52.046
Estalak	93.51	56.256
Zerehdar	35.623	51.881
Saeedabad	35.734	51.696
Khosroabad	35.757	51.697
Garmabsard	35.467	52.349

Location of wells are seen in following map:

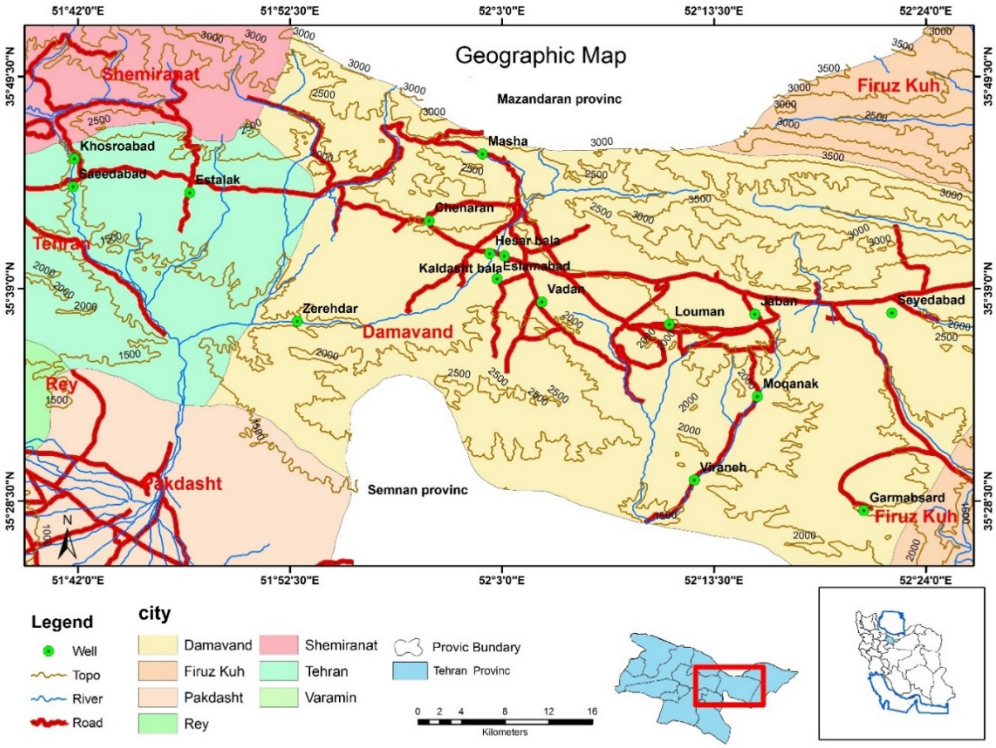

Figure 1: Geographical location of wells

Analytical procedure

For sampling, we used Plastic vessels for chemical sampling and water samples were transferred to water organization laboratory. In this research, all samplings were manual. First, PE vessels were used (1.5 liter at least). Vessels were washed by detergents and raw water and distilled water. Then vessels were dried and filled with water samples in locations and labeled with location, time and some in situ parameters as pH and temperature. Samples were conserved in refrigerator to transfer to laboratory. In laboratory, used vessels

were washed by nitric acid and distilled water.

All experiments were done based on Standard method for the examination of water and wastewater, 1998.

Results and Discussions

In Viraneh village there are lots of salty and gypsum rocks which are full of Ca and SO4.
About turbidity, is is seen that this parameter is high in Masha just in wet period. The ground layers in this area is rock and there is no soil so because of no proper cap on wells, surface water full of turbidity can enter to wells.
In Islamabad and Kaldasht bala, Fluride is more than other areas because there is green tuff stone which is concluded Fluride and this kind of rocks can be ionaized in contact of air. Unfortunately, in Vadan, Nitrate is high because wellwaters are located near farmlands and fertilizers penetration increases this anion in groundwater. So anthropogenic conditions affect the water quality in Vadan. Nitrate is high in Estalak too, because some wellwaters are located near residential area. So by wastewater penetration to wells, Nitrate increases.
Then, we checked out the water quality in dry period of 2016:
It is seen that Sulfate is as wet period. But Turbidity in Masha is not high because there is no surface water to penetrate to wells in dry period. But Turbidity in Estalak and Zerehdar is high. Because the ground layers in this villages have clay in some parts. When watertable is high, clay can absorb water but in dry period, watertable becomes lower and clay will be dry and fall into wells.

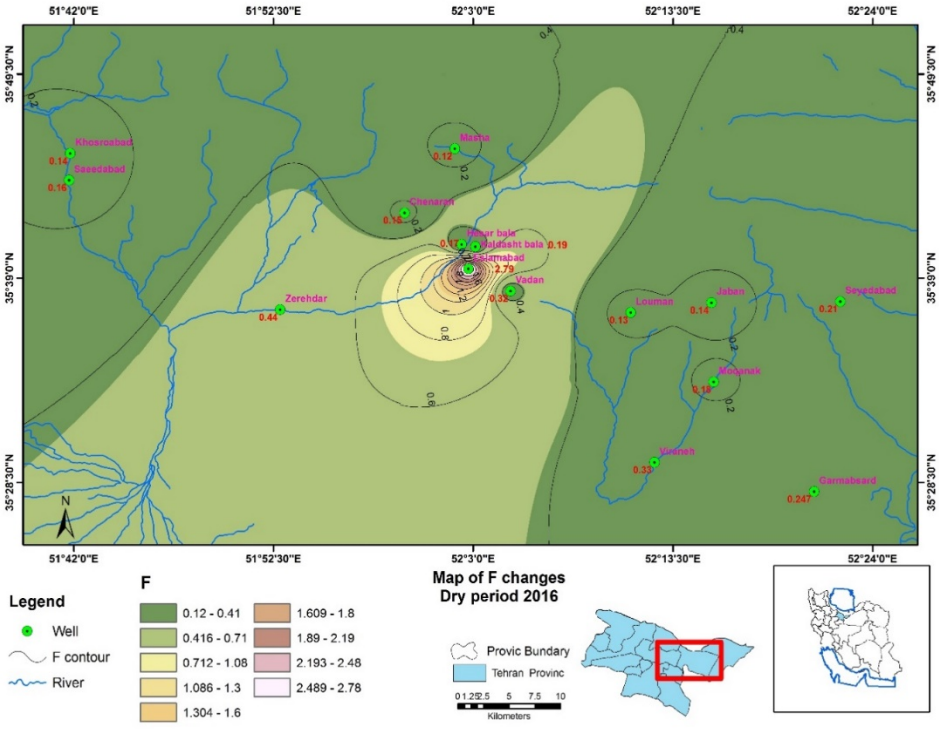

Figure 2: Fluride concentration (mg/L) in dry period of 2016 in dry period of 2016

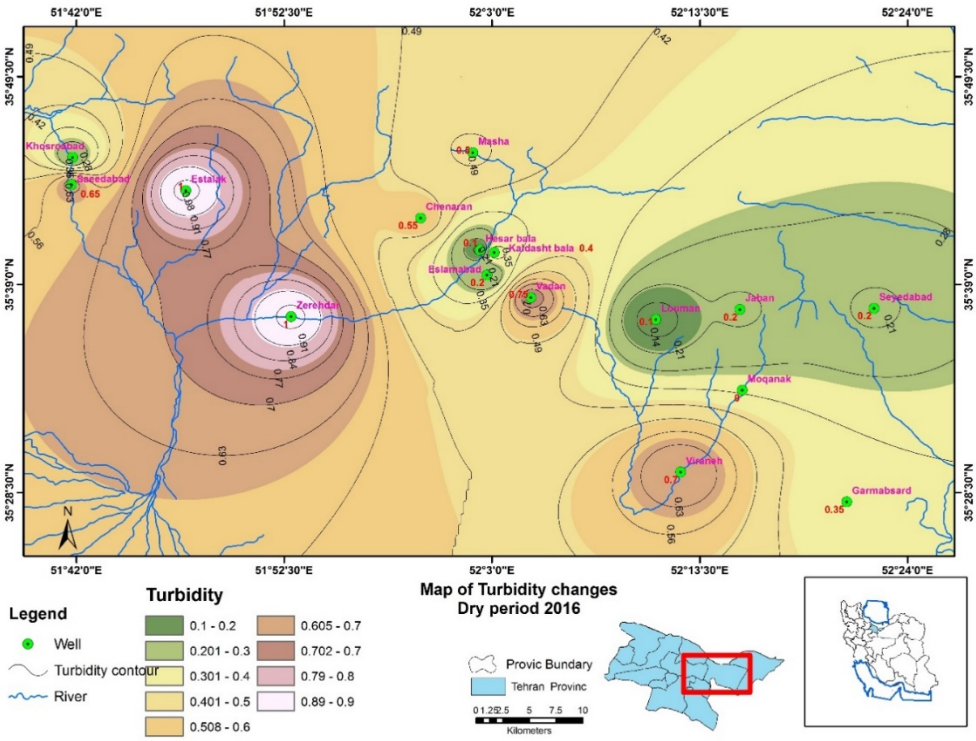

Figure 3: Turbidity concentration (mg/L) in dry period of 2016

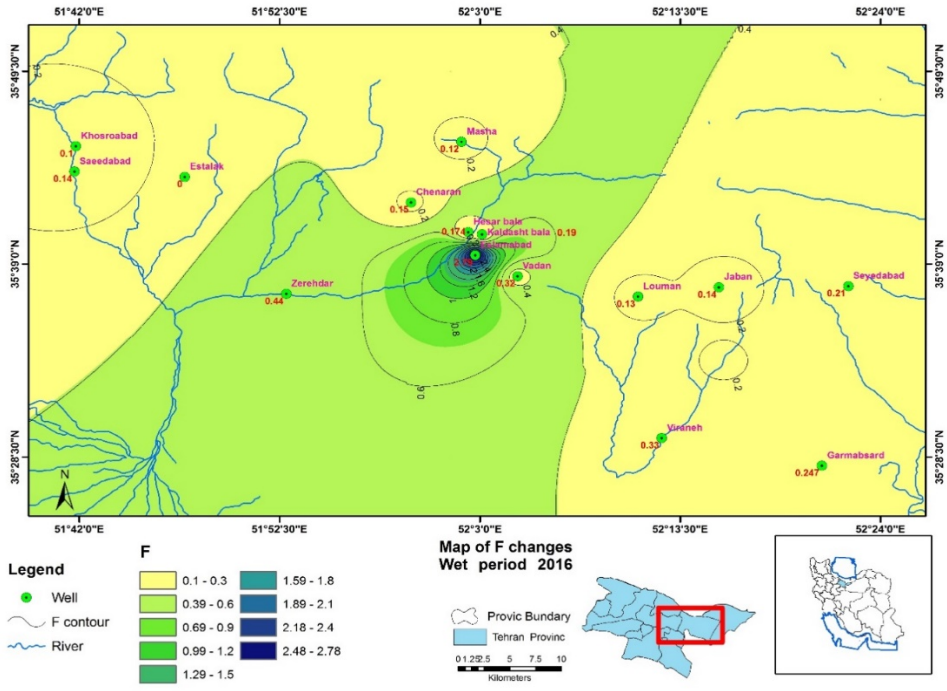

Figure 4: Fluride concentration (mg/L) in wet period of 2016

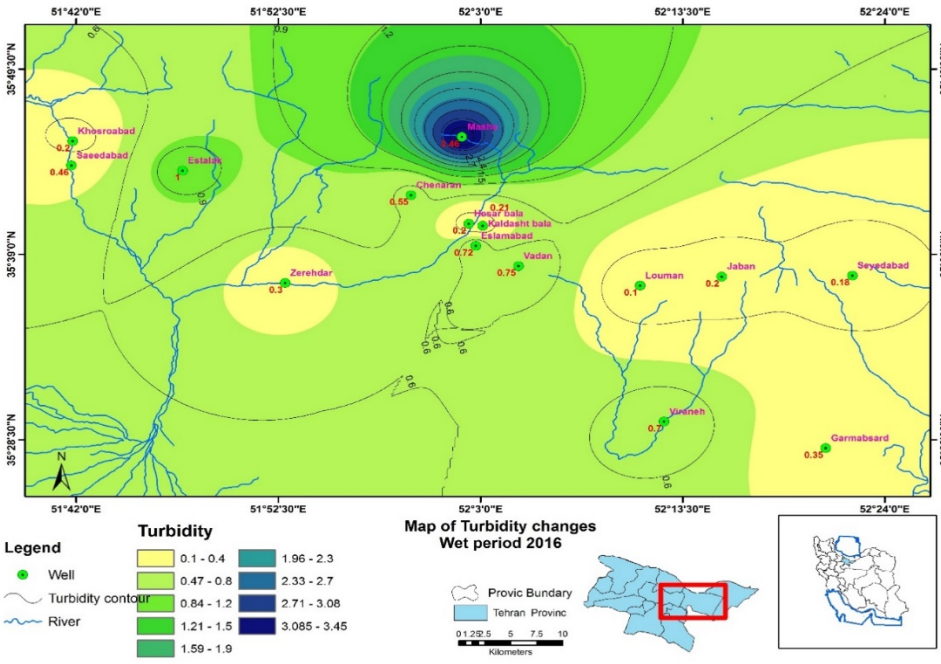

Figure 5: Turbidity concentration (mg/L) in wet period of 2016

Conclusion

Unfortunately, Garmabsard and Viraneh has not good condition for drinking water so their drinking water must be supplied from another source as surface water or special treatment must be used for the groundwater water. Groundwater quality for drinking is average in Zerehdar, Estalak and Vadan. So if water follows previous trend maybe they will have problem in near future.

In wet period GWQI is still high for Viraneh so this village has serious problem with groundwater quality for drinking usage. And it is average in Zerehdar, Estalak and Vadan. Also this is important that groundwater movement is from north-west to south-east and it is obvious that ions soluted in water is more in south-east.

GWQI in Vadan is not good enough because of Nitrate and it is related to anthropogenic situation. So wells near farmland should not be used for drinking water.

By making proper caps for wells in Masha, it is prevented surface drainage penetrate to wells and increase the Turbidity. Its turbidity is due to the character of soil in that area and it is not related to human.

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