

## Qualitative modeling of drinking water wells of the villages in central section of Malard County in GIS.

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### ABSTRACT

In recent decades, different natural and human factors cause critical conditions, air pollution and loss of underground water in most areas of country such as Tehran province. Investigation on water resources and its pollutions and also modeling in software environment such as geographical information system (GIS), provides a suitable environment in order to supply clean and sanitary water from qualitative viewpoint and providing from probable contaminations before doing any executive operations and determining areas for constructing new drinking water wells.

**Methodology:** In this research in order to study and qualitative modeling of underground water, physicochemical analyses information of nineteen wells in the villages of Mallard County along three period of one year (2011, 2012 and 2013) has been investigated.

**Findings:** results achieved by maps of interpolated model of the rate of each parameter shows that the physicochemical quality of underground water in this area from north to south and also from east to west decreases because we are facing to increasing contaminants due to rising surface stone and stream of underground water and contiguity to the Shour River and reducing sedimentary texture and fine-grained sediments accompanying with intrusive pollutions of sewage absorption and lack of self-purification (Due to reducing sedimentary deposit). This is confirmed through maps of slope of earth of the areas in the same latitude and slope of north surface of underground waters.

**Outcome:** According to the results and studying maps of qualitative model of underground water of the area and also compared to national and international standards, we can categorize parameters such as hardness, TDS, nitrate, carbonate, sulfate, chloride for priority in digging new wells in future plan in the areas of northeast, southeast and the distance between them as follows:

We never recommend these areas: 1-Northeast areas 2- Southeast areas 3- Central, West and Northwest areas.

**KEY WORDS:** Quality of water, Drinking water wells, Modeling, Malard County, and Geographical Information System.

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### • INTRODUCTION AND GOAL

Growing of industry and population, increased consumption and real need to the water for using in societies' infrastructure and limited water resources is one of the main challenges in developing countries especially in arid and semi-arid areas as our country. Hence research on water resources and its pollutions and also modeling in software environment such as GIS make a suitable condition for supplying healthy and sanitary water.

- Malard county subdivisions according to population and housing census as follows:

Today's city of Malard is an integration of three population point of Malard (old Malard), SarAsiyab and Marlik town. Malard County with an area of 1000 Km<sup>2</sup> and a population of 373994 in solar 2011 has two central part and Safadasht. Center of this County is Malard.

Malard County is situated in west of Tehran province, neighbor of Alborz and Markazi provinces.

**2.1 Climate:** It has cold and arid winter, rather warm and arid summer. Best period or season in this area is among early Farvardin up to middle of Tir. Average precipitation (rainfall) is about 30mm. This city is situated in the path of high speed Shahriyar monsoon north to west.

### 2.2 General geology of the studied area

Generally, the geology of the area divided in two separated part included: Heights and around mountains dominant to the plain which has a significant impact on quality and quantity of underground water. The plain's sediments as a

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best reservoir of introduced underground waters has been created by erosion of around and dominant to the plain mountains which transferred by rivers and freshets to the plain and sediment.

### 2.3 Qualitative study of water resources

Water resources status of the villages is divided to three parts: A- chemical contaminant in situ such as hardness and high electrical conductivity B- Exotic contaminant: Due to environmental pollutions caused by industrial and housing swage like the one in Dahak village. The thing which we can achieve of the two contaminations is that totally in the areas in which the thickness of alluvial sediments has been decreased and stone surface has a lower depth and is not a good condition for monitoring underground waters, the possibility of chemical pollution in situ considering the quality of the ground and exotic pollution because of lack of monitoring by earth's layers are provided. C-pollution due to increasing turbidity: it could be related to the existence of deposits of fine-grained sediment and low permeability of the ground and finally to the entrance of fine or small sands and silt to well at the time of utilization in which have destructive effects and it causes earth erosion, damaging water pumps and destructing clogged pipes and transferred pipelines.

results achieved by maps of interpolated model of the rate of each parameter shows that the physicochemical quality of underground water in this area from north to south and also from east to west decreases because we are facing to increasing contaminants due to rising surface stone and stream of underground water and contiguity to the Shour River and reducing sedimentary texture and fine-grained sediments accompanying with intrusive pollutions of sewage absorption and lack of self-purification (Due to reducing sedimentary deposit).

## 2-3- RESULTS AND DISCUSSION

While reviewing the analysis' results of the quality of Malard region's wells' water, it is seen that it is better to divide the whole Malard county to some definite sections and then come to a result because there are possibility of mistakes in taking samples and related analysis or sectional pollutions in a well that divert us in a way to choosing a suitable place for new wells. The chosen wells in Malard region are divided to four following sections:

- North east section: including KHoshnam and Kosar 1, 2, 3, 3 wells.
- South east section: including Lam Abad, GHalefamarz, yeladasht, Mehrazin and Mehrchin wells
- North west section: including Arghashabad, Mehrdasht, Selmiyan and Amirabad wells
- West section: including six wells.
- Central section: including Dehak, Ghabchagh, Koshkak and Yousefabad

It is needed to mention no wells have been reviewed for review and analysis in south section in SHahrestanChahi.

### The Analysis of the Research Results

**Turbidity:** the Selmiyan and Arghashabad wells show the high level of turbidity and it is because of the region's fine tissue the land low permeability and finally the entrance of sand and fine soil from the mosaics wells' walls during the usage (that can lead to destructive effects and the land drop, pumps burning and degradation and shocking of transferring of water lines and increasing the sand forming) this can lead to increasing of wells' turbidity. Finally the matter can be suggested from the analysis of qualitative and quantitative of preparing water in Malard region is that in the in Selmiyan and Amirabad areas existence of fine and sand forming and in other areas like Dehak, SHosh and Arghashabad the existence of evaporative salty-plaster layers and pollutant home wastewater cause that the quality of water sources does not enjoy favorable situations, but in other areas like GHapchagh village, Faramarz castle and KHoshnam named the suitable areas as they have the big fine tissue of sediments from one side, and the possibility of ground self-purification because of suitable deepness of alluvial layer and existence of bed sands in high deepness (under 150m) in addition to shortage of evaporate layer from the other side, has caused these areas in terms of qualitative and quantity have great ability for preparing deepness. In this regard, we see that Kosar water supply complex has covered 15 villages in Malard County and even in nearby counties like SHahyar and Robatkarim too.

**EC:** Researches show that the reason for the great swing in EC level can be depended to three factors that is related to 1- the situation of geology and sedimentary tissue 2- the situation of claimant rain 3- changes in water level. Regarding this, in a main principle, in Faramarz castle and Kosar region wells, EC is in standard level and low as it has sedimentary big grading, the location of bed sand in high deepness and non interfering with evaporated layers, while in villages like SHosh and Amiabad and even Arghash as regions' geological tissue and existence of salty inter layer and shortage of aquifer and decreasing the static level and increasing density of solute, the level of EC

and TDS has increased increasingly. Of course changes that happen regionally in some areas of Arghashabad wells are a function of hydrologic situations. As they are near to Shore River and leakage of salt water from this river to underground aquifer, qualitative changes especially increase in EC have occurred.

**Hardness:** Due to reduction of atmospheric precipitation into aquifer and overusing of it, it causes that despite the proper condition of geology and sedimentary texture, with water level drawdown and decrease in water column, the rate of solute density increases in aquifer. Of course regarding Aghash Abad wells, in the place of well, it seems that due to permanent using of aqueduct crossing around the well causes that the well gets the suitable Debbi and deeper and also have a good condition in case of chemical and physical processes.

**ALKALINE:** As Dehak village is located in the end of sedimentary area and the raise of bed sand and entrance of aquifer from north regions have led in increasing TDS following the increasing in PH which lead to increasing the Alkaline.

**CHLORIDE:** the changes in static level, has led to increase of level of connection between static level with evaporate salty layer in 2010 and the level of saluted Chloride in water is increased.

**SOLFATE:** because of Shore River function and entrance of water with salty evaporated solutes and its entrance to the aquifer and the connection between aquifer and evaporated layers lead to increasing the Sulfate level.

**NITRATE:** in YosefabadGHavam and Dehak and Amirabad have shown the level of higher nitrate in 2010 and this level have decreased in 2011 and 2012 and its reason is doing some development and preventing the entrance of contaminates to surface waters and aquifers, therefore the nitrate level is decreased in the wells.

**SODIUM:** injection of chloride sodium from Shore River to surface and under surface streams and into the region sedimentary tissue, have led to increase of sodium.

**POTASSIUM:** entrance of chloride sodium from Shore River to surface and under surface streams and into the region sedimentary tissue, have led to increase of potassium in the region's wells.

**PH:** regarding the done tests and reviews about PH and adopting it with national standards and world health standards, the PH level in all region drinking water wells is about standard and favorable level and is between 7 till 8.5.

Region's wells with a PH average about 8/1 is neutral. So there is no problem in this case.

**Color:** There is no color in any sample.

**Fluorine:** The result of sampling every three years shows a fixed or stable rate and it has a sign of lack of fluorine in the drinking region's water.

**Magnesium:** Considering the tests and studies regarding magnesium ion and adopting to national standard and global health shows that in most of the studied villages is less than 50mg/lit. According to the national standard of Iran when the rate of magnesium is more than 30mg/lit, the rate of sulfate should not be more than 250mg/lit because there will some changes in taste and digestive. According to the tests in which the rate of magnesium was more than 30mg/lit, the rate of sulfate has not been more than 250mg/lit. According to enclosed maps in villages of central section to the North West, rate of magnesium has been more than permitted.

**Calcium:** Considering the tests and studies regarding calcium ion and adopting to national standard and global health shows non of studied samples with a rate of calcium more than permitted but the maximum concentration of the determined amount in central parts up to northwest is more in a way that as we move from center of county to the east, the rate of calcium decreases. According to enclosed map, moving to west and northwest strip of Malard County, the rate of calcium becomes more in this region and in other parts, the rate of calcium ion is on average. This is confirmed through maps of slope of earth of the areas in the same latitude and slope of north surface of underground waters.

According to the results and studying maps of qualitative model of underground water of the area and also compared to national and international standards, we can categorize parameters such as hardness, TDS, nitrate, carbonate, sulfate, chloride for priority in digging new wells in future plan in the areas of northeast, southeast and the distance between them as follows:

- Northeast zones.
- Southeast zones.
- West zones.

Considering findings of analysis of maps definitely we can ensure that northwest and zones are not suitable for digging new well at all and are not recommended.

Hence, generally we can say that EC and TDS factors concentrate in west and northwest of the area and in central section, factors such as Nitrate, Hardness and Bicarbonate has been more observed. From center to northwest, Sulfate and chloride has been more observed.

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