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SPATIAL ANALYSIS OF THE PHYSICAL PROPERTIES OF GROUNDWATER IN ISHAQI DISTRICT

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Abstract

It was found through the research that the results of the turbidity in the wells of the study area recorded a clear discrepancy between them, as it ranged between (11.15) mg / liter in well (2), while the lowest concentration value was recorded in well (4), which amounted to (0.11) mg / liter. Liters. As for the pH values in the water of the wells of the study area, there is a clear discrepancy in the pH values in the wells of the study area, where all the values of this element indicate that the water is basic in order to increase its value from (7) and when comparing the pH results with the permissible determinants and standards. In it, we find that all sites did not exceed the permissible limits, and the reason for this is the lack of industrial activity in the region.

Also, the total hardness values reached in well (7) the highest concentration value of (1850) mg / liter, then in well (8) it ranked second, reaching (1640) mg / liter, and the lowest value was recorded in well (9), where it reached (310) mg / liter, the electrical conductivity recorded a clear spatial variation between the wells of the study area, as the highest conductivity values were recorded in well (6), which reached (9.92) mg / liter, then came well (20, 15) in the second place, with conductivity values that reached (4.56 and 4.39) mg/L for the two wells, respectively, while well (9) recorded the lowest conductivity values among the (20) studied wells, as the electrical conductivity value in it was (0.98) mg/L, as evidenced by the analysis of the map (13). The clear spatial discrepancy in the

distribution of electrical conductivity values between the parts of the study area.

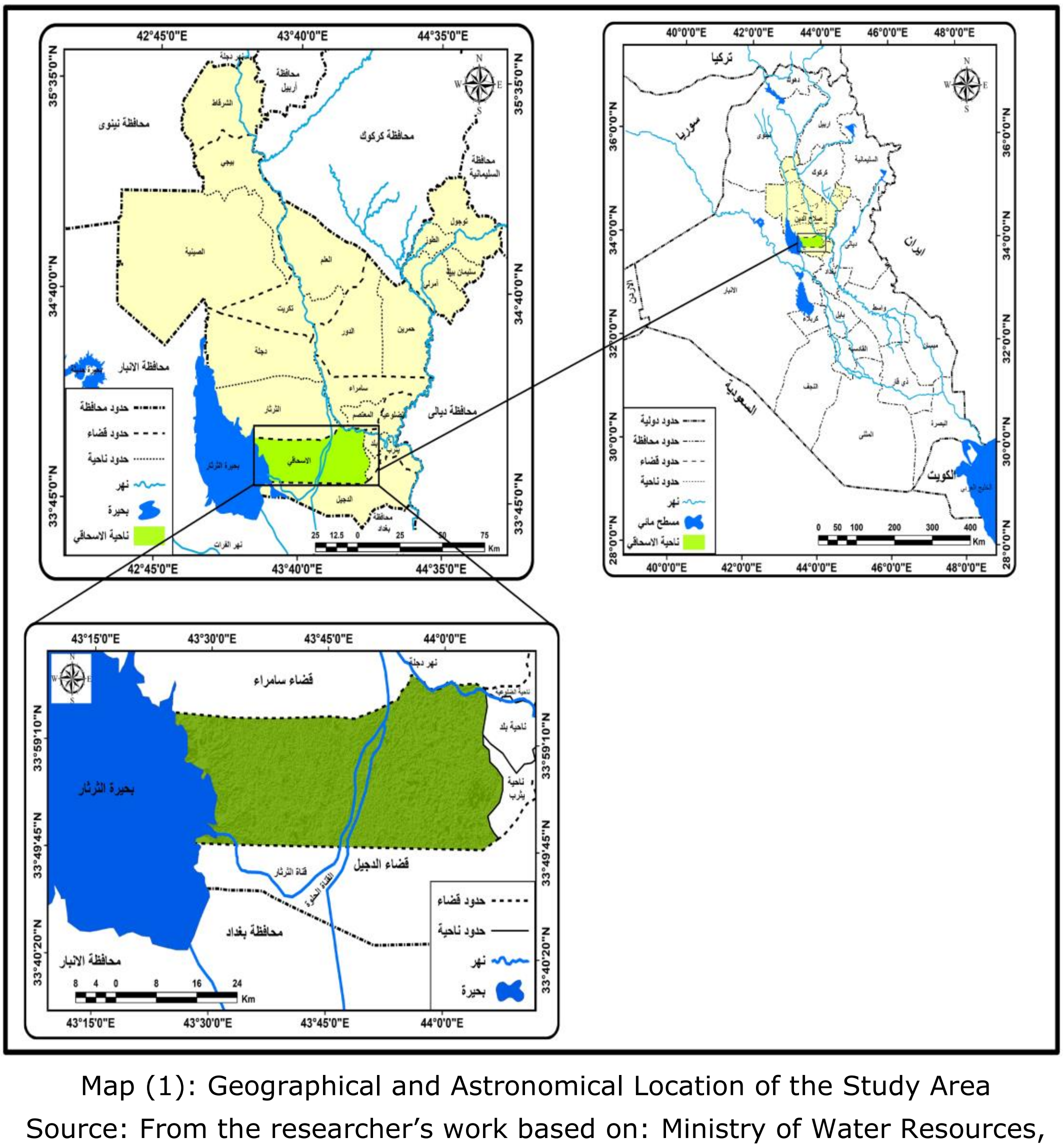
Stages of the Study

In order to achieve the goal of the study in the study area, sequential stages were adopted, which can be clarified as follows:

1. Office Work

This stage of the study aims to collect complete information about the study area by obtaining various sources of (books, letters, theses, magazines, periodicals), whether published or unpublished, in addition to collecting information about the study area with regard to the natural aspect, especially the geological structure. Climate and its elements and soil from official departments, bodies and research centers directly related to them, especially (Ministry of Agriculture, Ministry of Water Resources, Ministry of Transport, Ministry of Industry and Minerals).

2. Field Work



Map (1): Geographical and Astronomical Location of the Study Area

Source: From the researcher's work based on: Ministry of Water Resources,

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General Authority for Survey, Topographic Map, 2021 and Arc GIS 10.8.

This stage of the study is summarized by work and multiple field visits to the study area, revealing the nature of the area and determining the groundwater wells that will be studied. In addition, this stage includes withdrawing groundwater samples and then sending them to laboratories for the purpose of analyzing their physical and chemical properties. The number of samples withdrawn reached (20). A sample of selected sites from the study area.

Analysis of the physical properties of the study area

1. Temperature

The temperature of the groundwater depends on factors including the depth of the water-bearing layers, the interactions that take place in the rocks, and the geographical and astronomical location of the region. An increase in the temperature of the groundwater may affect the water quality, as it causes an increase in the content of sodium chloride and calcium carbonate and a decrease in the solubility of calcium sulfate.

The more groundwater layers are far from the surface of the earth, the more stable they are because they are not affected by atmospheric fluctuations. As for the layers near the surface of the earth, they are more affected by the temperature of the gas envelope, where the temperature is more than the gas envelope due to the slow loss of water temperature.

2. Turbidity NTU

Table (1): Physical properties of well water samples in the study area

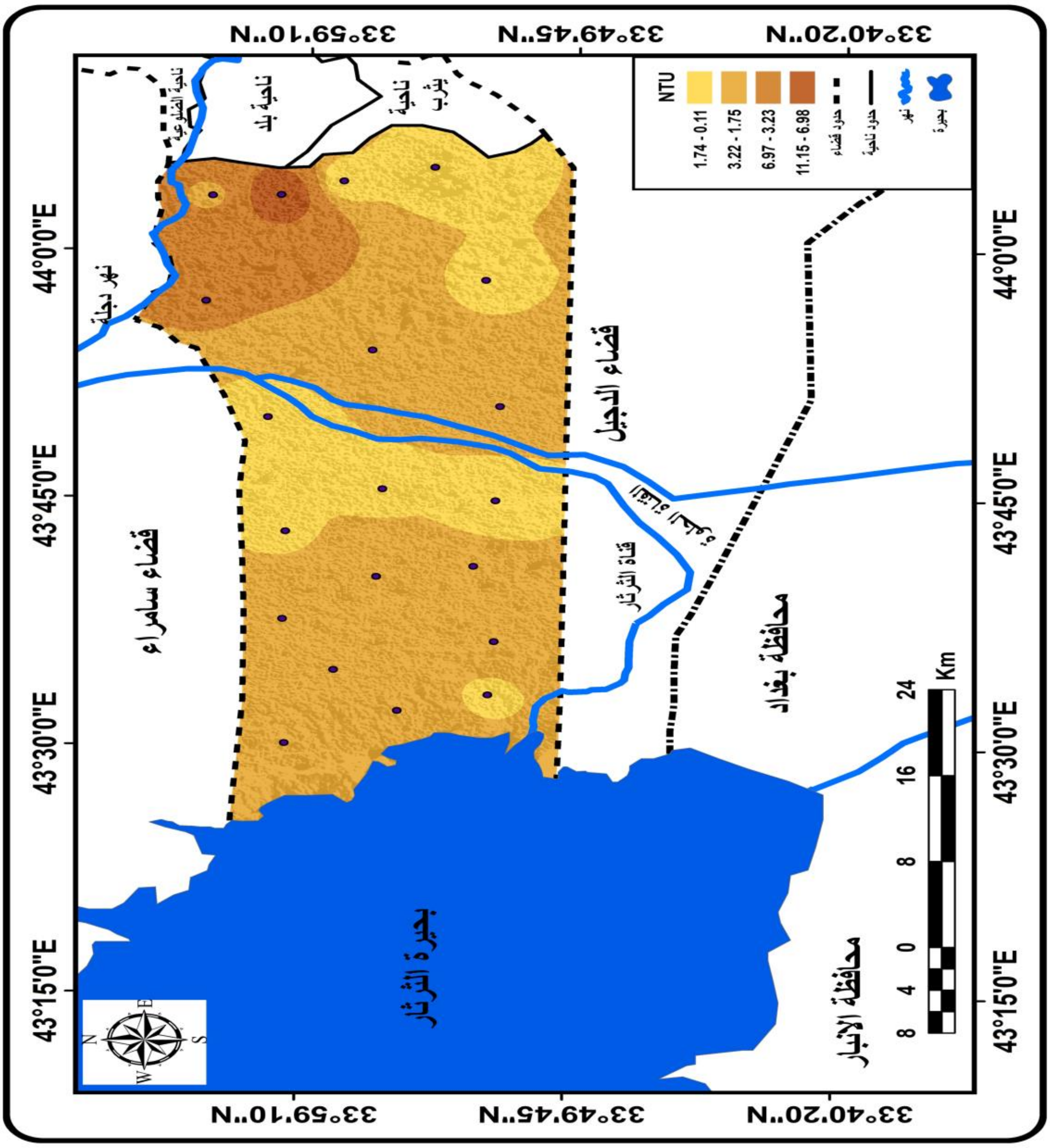
Sample	X	Y	Ph	TDS ppm	EC MS	NTU	TH PPM
Well 1	**44.05**	**34.04**	**7.8**	**2060**	**2.73**	**2.76**	**750**
Well 2	**44.06**	**34.00**	**7.9**	**1550**	**2.03**	**11.15**	**720**
Well 3	**44.07**	**33.97**	**7.8**	**1640**	**2.11**	**0.16**	**710**
Well 4	**44.08**	**33.91**	**8.1**	**1170**	**1.9**	**0.11**	**650**
Well 5	**43.97**	**33.88**	**7.6**	**1430**	**1.92**	**1.3**	**640**
Well 6	**43.95**	**34.05**	**7.8**	**5220**	**9.92**	**3.4**	**330**
Well 7	**43.90**	**33.95**	**7.5**	**3720**	**4.93**	**3.1**	**1850**
Well 8	**43.84**	**33.87**	**7.8**	**3530**	**4.54**	**2.5**	**1640**
Well 9	**43.83**	**34.01**	**7.8**	**520**	**0.98**	**0.6**	**310**
Well 10	**43.75**	**33.88**	**7.6**	**863**	**1.45**	**0.9**	**450**
Well 11	**43.76**	**33.94**	**7.3**	**1442**	**1.98**	**1.4**	**750**
Well 12	**43.67**	**33.94**	**7.6**	**1582**	**2.27**	**3.3**	**870**
Well 13	**43.72**	**34.00**	**7.2**	**1624**	**2.26**	**1.5**	**880**
Well 14	**43.63**	**34.00**	**7.9**	**3245**	**3.6**	**2.3**	**1270**
Well 15	**43.61**	**33.87**	**7.4**	**3173**	**4.39**	**2.7**	**1470**
Well 16	**43.50**	**34.00**	**7.3**	**3366**	**3.12**	**1.9**	**1120**
Well 17	**43.55**	**33.88**	**7.4**	**1672**	**2.4**	**1.4**	**790**
Well 18	**43.58**	**33.97**	**7.8**	**2073**	**2.38**	**1.6**	**930**
Well 19	**43.68**	**33.89**	**7.3**	**2781**	**3.25**	**2.1**	**1280**
Well 20	**43.54**	**33.93**	**8.1**	**2576**	**4.56**	**3.2**	**1270**

Source: From the researcher's work based on the results of the analysis of the

Ministry of Science and Technology, Department of Laboratories, 2022.

It is the ability of water to scatter the light falling on it, and this is caused by the presence of solid materials suspended in it, such as soil particles, sand, clay, organic and inorganic materials, as well as it can occur due to the presence of bacteria, microorganisms, or plants floating on bacteria or metal elements between suspended particles, as well as It consumes an additional amount of chlorine in disinfecting highly turbid water.

The turbidity is low in stagnant water, as is the case in groundwater, and increases in running water as a result of the movement of sediments with the water current. It is clear from Table (1) and Map (2) that the results of turbidity in the wells of the study area recorded a clear discrepancy between the wells of the study area, as it ranged between (11.15) mg/L in well (2), while the lowest concentration value was recorded in well (4), where it reached (0.11) mg/L.



Map (2). Spatial variation of turbidity (NTU) in the wells of the study area

Source: From the researcher's work based on Table (1) and Arc GIS Software v10.8

3. Potential of Hydrogen "PH"

The pH is a measure of the hydrogen ion activity in water, and its value ranges between (0-14), as numbers more than (7) indicate alkaline water, while a value less than (7) indicates that water is acidic, and the number (7) It refers to neutral water, which is the optimum degree of fresh water. However, the water remains suitable for drinking or use. Generally, the PH value falls between (6-9) for most natural waters.

There are factors that affect the hydrogen element or the degree of interaction (PH), including rain and torrential rain that dissolve natural pollutants, including the substances dissolved in the soil, and the use of pesticides and various fertilizers all affect the value of (PH) as well as temperature, calcium carbonate and bicarbonate dissolved in the water, as well. Most natural waters tend to be slightly alkaline due to the presence of these two ions, and the increase or decrease in the pH value has a direct impact on the biochemical activities in the water, including problems related to corrosion and taste.

It is clear from the analysis of Table (1) that the value of the pH in the water of the wells of the study area, that there is a clear discrepancy in the values of the pH in the wells of the study area, where all the values of this element indicate that the water is basic in order to increase its value from (7) when the highest value was recorded It has in well (4) and well (20) with similar values, reaching (8.1), while the lowest pH values were recorded in well (13) where it reached (7.2), then came wells (11, 16, 19), after which similar values reached (7.3), and when comparing these values with the permissible parameters and standards, we find that all sites did not exceed the permissible limits, and the reason for this is the lack of industrial activity in the region.

4. Total Hardship TH

The total hardness of water means the making and formation of soap foam during the use of water. It produces water hardness due to magnesium and calcium ions, and it is measured in milli-equivalents / liter or in milligrams of the equivalent of magnesium and calcium ions per liter of hard water in which the soap is not foamed by dissolving the soap in a known concentration. Hardness is also the characteristics of water that contains the full concentration of divalent positive calcium and magnesium ions with negative particles such as nitrate, sulfate and bicarbonate.

The total hardship is divided into two parts:
Temporary Hardship

Temporary hardness is formed as a result of the presence of calcium and magnesium bicarbonate, and it can be removed by heating, as it turns into a carbonate precipitate.

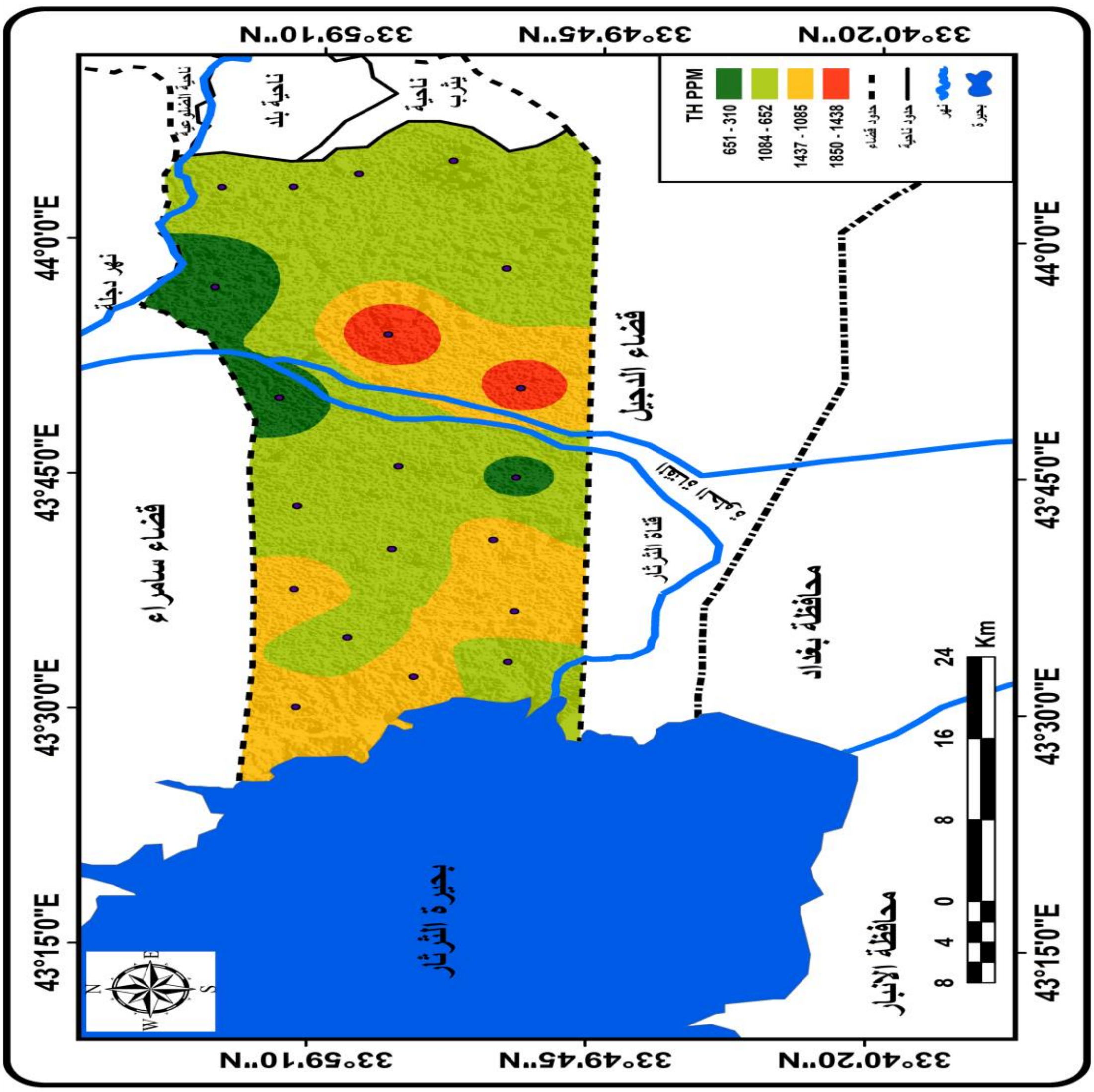
Permanent Hardship

This type of hardness is formed due to the presence of calcium and magnesium sulfate or chloride. It cannot be removed by heating because chemical methods are required to remove it by adding sodium carbonate. The calcium carbonate and sodium sulfate formed in this reaction are dissolved in water without causing hardness.

It is clear from the analysis of Table (1) that the total hardness values have varied in their concentrations from one well to another, where the highest concentration value was reached in well (7), which amounted to (1850) mg/L, then in well (8) it ranked second, reaching (1640) mg/L. liter, and the lowest value was recorded in well (9), reaching (310) mg / liter, while the rest of the values were recorded gradually, as they ranged between the highest and lowest values.

It is noted from Table (1) and Map (4) that the total hardness values of all wells in the study area increased. This rise is due to the presence of gypsum, anhydrite and dolomite in these areas.

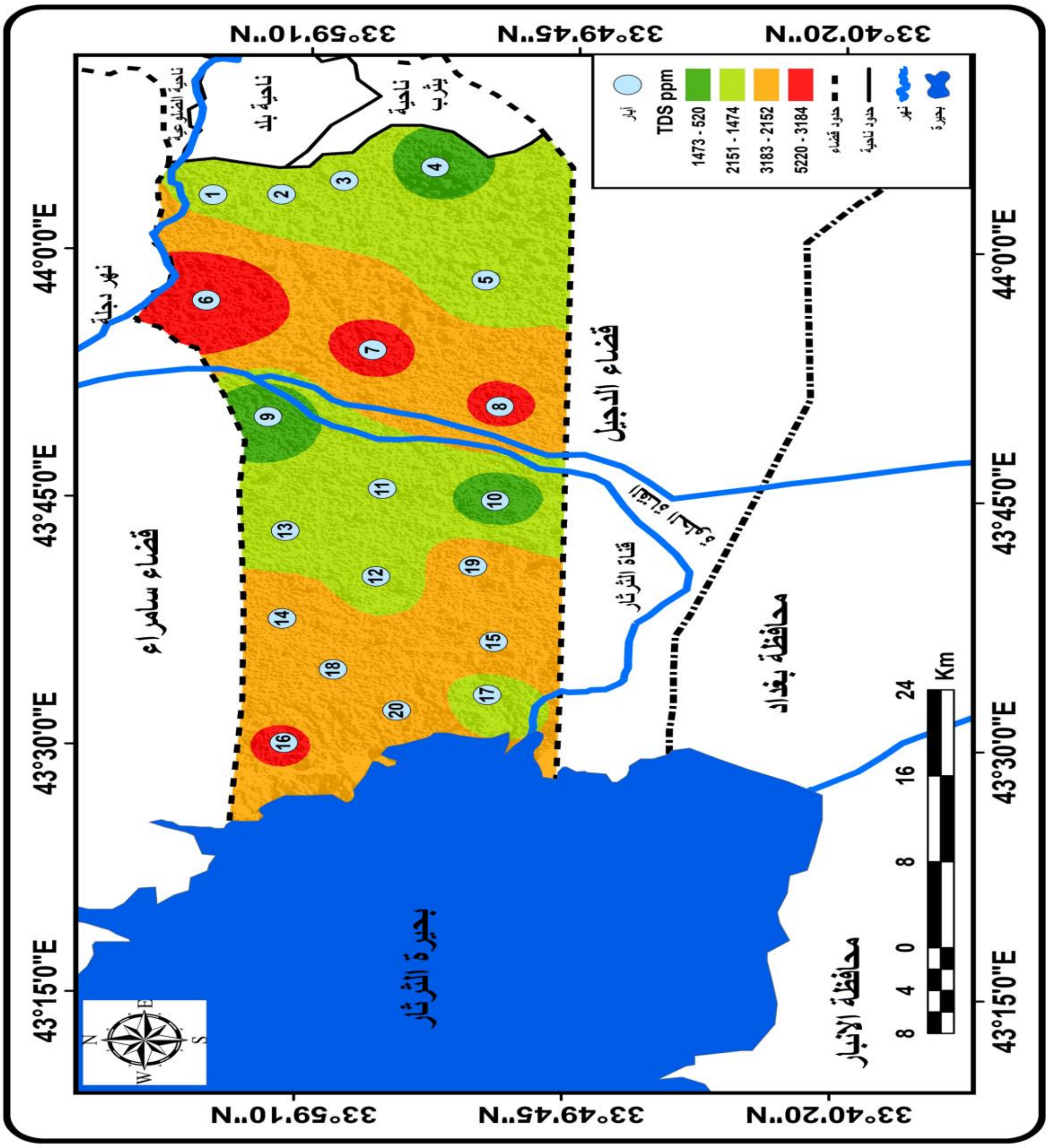
1. Dissolved Solids (T.D.S)



Map (4). Spatial Variation of Total Hardness (TH) in the wells of the Study Area

Source: From the researcher's work based on Table (1) and Arc GIS 10.8.

It is a group of dissolved solids in water, a real melt, where the water remains in the filtration process, does not include suspended substances and dissolved gases and is called salinity. Household and industrial. It is considered the second source of water pollution, as well as the total concentration of dissolved substances in water, an important factor in describing the properties of water, and the negative effects of increasing its concentration in water make water unsuitable for domestic, agricultural and industrial uses.



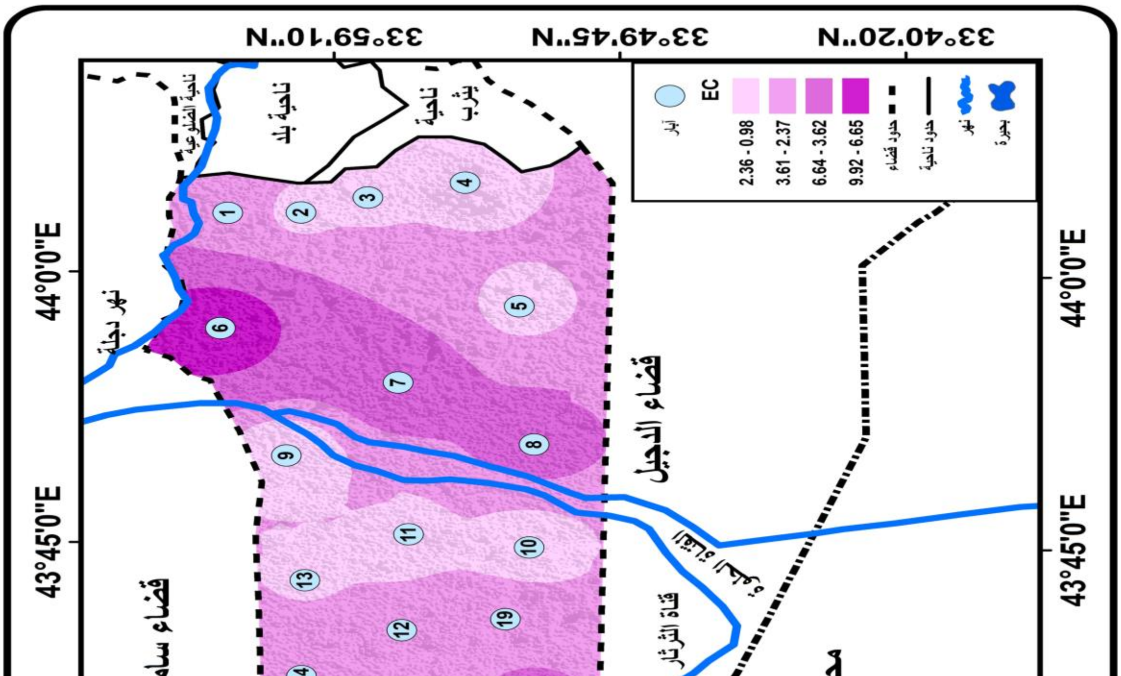
Map (5). Spatial Variation of Total Dissolved Salts (T.D.S) in the Wells of the Study Area
Source: From the researcher's work based on a table () and Arc GIS 10.8.

It is clear from the analysis of Table (1) that the values of dissolved solids in the water of the wells of the study area varied spatially between the wells of the study area, where the highest values of dissolved salts were recorded in well (6), which amounted to (5220) mg / liter, then the rest of the wells graded recorded the lowest value of dissolved salt in well (9), where its value was (520) mg/L.

It is also noted from map (5) that there is a clear spatial discrepancy in the values of wells salts in the study area, as it rises in the western parts.

2. Electrical Conductivity (EC)

The electrical conductivity of water is the ability to carry electric current, which has a direct relationship with the temperature of water and dissolved solids, as its value is higher than the presence of a large proportion of salts, bases and acids, and the reason is either natural or less in various human activities, as the value of conduction reaches Electrolysis in rain water is between (2-100) micromhos, and in sea water it reaches more than (50,000) micromhos.



Map (6). Spatial Variation of Electrical Conductivity (EC) in the Wells of the Study Area

Source: From the researcher's work based on a table () and Arc GIS 10.8.

It appears from the analysis of Table (10) of the electrical conductivity values that it recorded a clear spatial discrepancy between the wells of the study area, as the highest conductivity values were recorded in well (6), which amounted to (9.92) mg / liter, then well (20, 15) ranked second. With conductivity values of (4.56 and 4.39) mg/L for the two wells, respectively, while well (9) recorded the lowest conductivity values among the (20) studied wells, as the electrical conductivity value in it was (0.98) mg/L, as shown by Map (6) analysis of the clear spatial discrepancy in the distribution of electrical conductivity values between the parts of the study area.

It is noted from the map that there is a clear discrepancy in the value of electrical conductivity between the wells of the study area.

Conclusion

1. The research found that the turbidity results in the wells of the study area recorded a clear discrepancy between the wells of the study area, as it ranged between (11.15) mg / liter in well (2), while the lowest concentration value was recorded in well (4), which amounted to (0.11) mg /Liter.
2. As for the concentrations of pH in the water of the wells of the study area, it was found that there is a clear discrepancy in the values of pH in the wells of the study area, where all the values of this element indicate that the water is basic in order to increase its value from (7) as the highest value was recorded in a well (4) and wells (20) with similar values, reaching (8.1), while the lowest pH values were recorded in wells (13) where they reached (7.2), then came wells (11, 16, 19), after which they had similar values of (7.3). When comparing these values with the permissible parameters and standards, we find that all sites did not exceed the permissible limits, and the reason for this is the lack of industrial activity in the region.
3. It was also found that the total hardness varied in its concentrations from one well to another, where it reached in well (7) the highest concentration value of (1850) mg / liter, then in well (8) it ranked second, reaching (1640) mg / liter. The lowest value was in well (9), which amounted to (310) mg / liter, while the rest of the values recorded a gradation, as they ranged between the highest and lowest values.
4. With regard to the dissolved solids in the water of the wells of the study area, it varied spatially between the wells of the study area, where the highest values of dissolved salts were recorded in well (6), which amounted to (5220) mg / liter, then the rest of the wells were graded to record the lowest value of dissolved salts in a well (9), where its value reached (520) mg / liter.
5. The research also found that the conductivity values recorded a clear spatial discrepancy between the wells in the study area, as the highest conductivity

values were recorded in well (6), reaching (9.92) mg / liter, then well (20, 15) ranked second with conductivity values. It reached (4.56 and 4.39) mg/L for the two wells, respectively, while well (9) recorded the lowest conductivity values among the (20) studied wells, as the electrical conductivity value in it was (0.98) mg/L, as shown by the analysis of the map (13) The clear spatial discrepancy in the distribution of electrical conductivity values between the parts of the study area.

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