Groundwater Assessment of Spring Water Using (GIS) Arc map 10.8 in Al-Shanafiyah District, AL-Qadisiyah Governorate, Southern Iraq

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Abstract: Groundwater takes center stage in areas where other sources of water are unavailable. The surface of rivers and irrigation schemes and applies to the study region represented by the district of Shanafiyah in southern Iraq. In the Al-Shanafiyah district, Production An aquifer probability map Geographical information number (GIS) Arc map 10.8 in the Shanafiyah watershed, Al Qadisiyah Governorate, Iraq. First, surveys were conducted to locate the springs Digital DEM mapping A total of 24 springs and 6 wells were identified and assigned to geographic information systems; 30 of these were chosen for chemical and physical examination, and a spatial study was conducted to determine the suitability of groundwater for drinking, irrigation, and animal watering. Since groundwater is the primary source upon which people depend, the judiciary is primarily used for drinking and second-class irrigation, and its function and significance have grown. Groundwater in the area has been depleted as a result of population growth and years of drought in recent years. Particularly since the area relies heavily on rainwater for agricultural investment. As a result, the judiciary will have to decide if groundwater is suitable for human consumption. In research and distribution systems, (GIS) Arc map 10.8 and agriculture, and by the implementation of modern techniques, exemplified by the use of The spatial characteristics of the groundwater in the area are important.

Keywords: springs water, wells, groundwater, Al-Shanafiyah, (GIS) Arc map 10.8

Introduction

Water is one of the most important natural resources to mankind, and vast amounts of this natural resource are laid under the surface[1]. enormous advances in agriculture, industry, and domestic economic activities in the last few years has brought with it an increased need for [decreased] or higher-quality water Due to its low emissions and wider availability, groundwater is considered to be a better option than potable water in most scenarios[2]. If the presence of groundwater anywhere on the planet is not an accident, it is because it is a result of any of the above factors (climatic, hydrological, physiographical, and ecologically related). This groundwater movement is mostly dominated by the porosity on the surface and ground and subsurface layers' lithology[3]. There are 24 springs distributed in Al Shanafiyah that have been environmentally studied[4]. Maps of groundwater potential are beneficial for planners and engineers looking for appropriate places to conduct resource explorations[5]. Land surveys are the most popular tool for preparing groundwater potential zones[6]. The advancement of geographical information systems and remote sensing technologies has made mapping of groundwater potential zones within each geological unit a useful procedure[7]. Much research on groundwater assessment has been conducted using geographical information systems and remote sensing[8]. [9] used demonstrate a spatial data
application technique for modeling the distribution of possible groundwater springs. The primary goals of this paper were to create a groundwater spring potential map for the Al-Shanafiyah Watershed in southern Iraq using Arc map 10.8 (GIS), as well as to test the forecasting capabilities for potential groundwater spring mapping. Water pollution in general and its non-compliance with international standards lead to many cancerous diseases and their danger to children as well[10]. The research problem is summarized in how to find the appropriate method in the analysis The spatial distribution of the values of the concentration of the qualitative characteristics of groundwater, and the estimation of its suitability for Drinking, watering, and watering animals. And from (GIS) Arc map 10.8 therefore, the employment of modern technologies represented in geographic information systems programs Through the use of the specialized tools represented mainly by the Appendix of Ground Statistics Analysis It is of the utmost importance . (Geostatistical Analyst). The research aims to represent a group of the specific characteristics of the groundwater in the AIShanafiyah district And the analysis of their spatial distribution (GIS) Arc map 10.8 as it is done using geographic information systems (GIS) Arc map 10.8 programs. Each of the studied characteristics is represented by an independent map, and its categories are classified according to a group Among the criteria for assessing the suitability of these specific properties for drinking, irrigation and animal watering purposes. On these maps (Overlay) on the area of the search area, and then perform the spatial match Properties to reach the final determination of the areas in which groundwater is suitable for purposes Drinking, watering, and watering animals, over the area of the study area

Materials and methods

Study area

Where geographic information maps were created in the Shanafiyah district of Qadisiyah Governorate, southern Iraq. The study relied on a multiple set of data, mainly represented by the following data: There is (24) data on spring water and (6) wells distributed over the research area Goofy, and for each of these springs a set of spatial data obtained is available. From the source it is. XLS data, which was obtained in GPS format from the readings As for the other part of the data, it was represented by (X, Y) ready and represented by the coordinates of the geographical location. These springs are characterized by qualitative analysis of the water (Attributes Data) of three randomly selected springs out of 24 springs, and 6 of these wells for these metadata such as EC, TH, TDS, Ca, Mg, SO4, CL,) were also extracted The basis for the Attributes Data that has been appended to the metadata table And mineral investigation to identify the nature of the geological formations in the area, as was adopted To know the character of the terrain surface of the area using digital altitude maps (altitude and slope (DEM) radar data The use of the( Geostatistical analyst) tool, Set weights for the variable layers entered via the (Weighted overlay) tool.
Map No. (1) shows the district of Shanafiyah and the distribution of the locations of springs and wells.
Methodology

Software used:

(ESRI), which is one of the products of GIS Arc Map 10.8. The programs used are represented by a program. This program includes a group of basic programs, as well as the American (GIS) specialized in programming. The use of the (Geostatistical analyst) tool, which was adopted in the building. The study maps of the qualitative characteristics of groundwater. Set weights for the variable layers entered via the (Weighted overlay) tool.

The work steps in the study consisted of preparing the basic data approved in the study. Which were represented by data of underground springs in the district of Shanafiyah, and for each of these springs a set of spatial data obtained from GPS readings were represented by geographic location coordinates (X, Y), which were obtained in (XLS) format from the source, which is ready data. And the Arc Arc map 10.8 (GIS) program (10.8) was used in the process of entering the basic data represented by (GPS) data, which was projected to its real locations in the form of raster data (Figure 1), either the metadata for these springs was linked with the basic springs layer (Join Data).

The studied qualitative variables: the quality of the groundwater is important, not less than its quantities, and the quality depends on the envisaged existing groundwater from the use of that water and the qualitative variables of the water is intended. Groundwater is the sum of the salts it contains dissolved in it, and it is expressed by the weight of the parts per million (4). A set of basic determinants have been adopted in assessing the viability of groundwater for purposes of Drinking and irrigation, and in the light of it the decision was taken to define the areas in which spring water is aquifer is suitable for drinking and irrigation purposes.

Results and discussion:

determinants included the following variables: The electrical conductivity (EC)

water is its ability to carry an electric current, and its high value reflects the presence of a large proportion of salts, bases, and acids. The reason is either natural or human[11]. The value of the electrical conductivity ranged between 4.23 And 5.98, as shown in Map (2), its categories have been classified into two groups, according to For Iraqi standards specifications where the first groups fall within Medium salinity for drinking and irrigation it acquired (55.85%) of an area. The search area, while the two groups were classified within the limits not allowed for Irrigation and drinking took place (44.14%) of the area.

Total dissolved solids (TDS)

This variable reflects some physical and chemical characteristics: Of water, such as salinity and water quality, and groundwater movement affects the effectiveness of water in dissolving Limestone rocks and evaporates and then raising the concentration of dissolved salts[12]. This is gained The variable is of great importance in the process of classifying the quality of groundwater in terms of its suitability. For drinking and irrigation purposes as well as water animals, which is the primary criterion in determining Or an assessment of the suitability of water for mainly watering animals, and the concentration values varied. The dissolved salts are between 2346 and 3986 mg/liter as shown in Map (3). (Classifying the map categories according To three groups, as the first and second groups fall within It may cause many harmful effects to crops and its use requires experience., and it acquired (65.64)% of the area of the research area at a time. The last group was classified within the impermissible limits for irrigation and drinking purposes. It acquired 34.35% of the area's area as for its validity to water animals, it is evident
that the focus of this element is distributed over the research area. Within the permissible limits for this purpose, which constitutes a positive element in water investment Subterranean field in this area.

**Total hardness**

Total hardness concentration varied between 1809 to 2265 mg/liter in a map (4), and the map categories have been classified according to the standards specifications. (divided into two groups, the first group was within the limits The allowed and acquired 79.24%, while the second group acquired The percentage of 20.76% was within the permissible limits for drinking purposes.

**Calcium**

The high percentage of calcium ions is due to the prevalence of gypsum rocks. And calcareous, whether they are passable rocks or a container for it, where calcium reacts quickly and combines with Bicarbonate formed with calcium bicarbonate[13]. The proportion of the calcium in the calcium varied between (302) and (495) mg/liter, Map (5), and in accordance to can be Classifying the map categories into three groups belonging to the first two groups within the boundaries, It is unpermitted for drinking purposes and occupies 11% of the area while it belongs The third group is within the impermissible limits for drinking purposes and acquired 89% the area's area.

**Magnesium**

Dolomitic rocks, limestone’s, and clay minerals are from The main sources are magnesium ion, which is formed as a result of the process of decomposition and dissolution in water [14]. From the map note (6), it becomes clear that This item on the search area is within the permissible limits for drinking purposes.

**Bicarbonate (HCO3)**

The source of this ion is water reacted with carbon dioxide Forming carbonic acid, as these waters, in turn, interact with the exploding carbonate rocks. In the study area, especially limestone to form a solution of calcium bicarbonate [15]. And from Map note (9), and according to it is clear that the distribution of The focus of this element on the research area is within the permissible limits for drinking purposes.

**Chlorides (CL)**

The reason for its presence in the study area is due to the laminar mud that predominates In rock formations as a link and aperture formation [16]. The concentration of this ingredient varied (Between 802 and 1100 mg/liter, Map (9) Map categories can be classified into two groups, the first group falling within the acquired 100% of the area, which is outside The permissible limits for drinking purposes.

**Sulfates**

The reason for its presence is due to the prevalence of gypsum formations (gypsum The anhydrite (returning to forming the aperture) has high solubility and dissolution in water[16].

From the note in the map (8), it is clear that the distribution of this element's concentration varied between Spatial analysis to assess the suitability of groundwater for drinking, irrigation, and animal watering purposes in the Shanafiyah district. 1760 and 2987 mg/liter were classified into three groups, according to the standard specifications., where the first two groups belong within the permissible limits for Drinking and it acquired of the area, while it acquired The third group of the area, and this group is located within Limits that are not permitted for drinking purposes.
Map No. (2) shows the distribution of Electrical Connectivity values (EC)
Map No. (3) showing the distribution of TDS values

- **2,346 - 2,738**
- **2,738 - 3,028**
- **3,028 - 3,221**
- **3,221 - 3,330**
- **3,330 - 3,427**
- **3,427 - 3,562**
- **3,562 - 3,703**
- **3,703 - 3,986**

It may cause many harmful effects to crops and its use requires experience.

They can be used to irrigate plants that are highly tolerant to salt, and their use requires experience.

1 cm = 4 km
Map No. (4) showing the distribution of hardness values (TH)

Relatively hardness

Very hard

TH classification

1,809 - 2,757
2,757 - 4,232
4,232 - 6,128
6,128 - 8,867
8,867 - 12,659
12,659 - 17,188
17,188 - 22,560
22,560 - 28,669

1 cm = 4 km
Map No. (5) shows the distribution of calcium values:

- 302 - 347
- 347 - 366
- 366 - 378
- 378 - 390
- 390 - 403
- 403 - 419
- 419 - 445
- 445 - 495

1 cm = 4 km
Map No. (6) shows the distribution of magnesium values.
Map No. (7) shows the distribution of bicarbonate values

| HCO₃ classification | 105 - 123 | 124 - 129 | 130 - 138 | 139 - 147 | 148 - 152 | 153 - 158 | 159 - 172 | 173 - 198 |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|

1 cm = 4 km
Map No. (8) shows the distribution of sulfate values.
Map No. (9) shows the distribution of chloride values

Satellite (ASTER GDEM) the US Geological Survey (USGS) DEM = Digital elevation map

UTM metric system

The map is the work of the researcher based on the outputs of Arc Map (GIS) 10.8

Conclusion

During the assessment of the consistency of the spring water in Shanafiyah, it was discovered that it is unfit for drinking and unfit for human consumption due to exceeding the allowable values during the analysis of the findings. This water is suitable for animal consumption.

Regarding the suitability of water for irrigation, this water must be irrigated to plants that tolerate salinity because it contains high salinity and requires experience in its use. The study reached a set of conclusions The spatial analysis of the data of the qualitative characteristics of groundwater using modern technologies The researcher (Geostatistical Analyst) represented by the extension has enabled statistical
analysis of the ground Moving from the descriptive analysis stage to the decision-making stage. The presence of a strong spatial relationship between the environmental conditions, which were mainly represented by the formations The geological characteristics of the area, which were reflected in the specific characteristics of the groundwater. The values of the qualitative characteristics of the groundwater varied in terms of its suitability for drinking purposes, as it was noted that all measurements were not allowed, and also for irrigation, the salinity was high.

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