The wells of the underground water in Al-Aatha area south of Al-Miqdadiya District and its Agricultural uses

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Abstract:

Al-Aatha area is located in the south of AL Muqdadia district in Diyala province. Its unreclaimed lands. It was natural pastures distributed among peasants and farmers on contracts after the imposition of the Economic Blockade on Iraq in 1990. This area contains alot of hills, sand-dunes and arable lands. It covers two agricultural territories with an area of (55034) Dunams. These are rain irrigated lands and the underground water provides their needs for water in Agriculture. The Wells water is affected by many natural factors which led to agglomeration under this area such as geological structure, sandy texture, soil and natural vegetation. The wells of this area are characterized by huge amounts of water through the permanent supply of water which goes on for about 14 hours aday. This means that the level of water does not fall much and this proves that it contains ahuge under ground water reservoir. This case encouraged use the extensive agriculture with winter crops such as wheat depending on these Wells. So the farming of this crop is about (9173) Dunams acope with agricultural plan for the present season (2019-2020) The irrgation of two methods. The first one by surface irrigation with an area about (8531) Dunams and the other is the modern system is called sprangler irrigation. The region contains five advance methods with an area about (642) Dunams.

Introduction

Water under the surface of the earth to be stored in the soil and permeable rocks that contains spaces is known underground water. They have a great importance in plants irrigation, the level of such water is not fixed and differ from one place to another\(^{(1)}\). go it is considered the water that drops on the surface of the earth in the form of rain and snow one of the most vital sources to provide the underground. It penetrates in to the interior through the crackes and joints in the soil and rocks\(^{(2)}\). There are many factors controlled in their existance such us the nature of precipitation,structure, Geological composition of rock, Topographical surfaces and natural vegetation. There
are several ways for determining the positions and collected water including: physical methods with their different ways; specially the seismic method, airgoing and Geomorphology signs including the existence of superficial surface deposits in specific places and distinct from their surroundings resulted from the evaporate of ground water ascending to the surface of the earth by many means of the property of noodles in arid areas besides the appearance of humidity in a place with out another in which indicates the existence of water in the formations below it, and the growth of plants in places with out anothers through which it can be determined water pools sites in its configurations. The study area is with in the plain extended from Tikreet and Samara toward Mandili and Badra. The groundwater in this plain recognized by heavy in production, so the production of one well in diameter (6-10) cups between 20 and 1515 liters in minute, and the total number of nutrients in it about (1000 parts) in amillions, and there are some areas more than that, as for the ground water level. It ranges between (5-55) meters from the surface.

The research problem: The research problem centered on two questions:

1- Is there a wells in Al-Aath area?
2- Is the ground water wells be used for cultivation in Al-Aath area?

The Research Hypothesis: The hypothesis is focuses on the answer of the research question:

There are a large number of ground water wells in Al-Aatha area, whose water used to cultivate large areas of water crops especially, the wheat.

The aims of research

1- Recognizing the importance of ground water wells and their agricultural uses in Al-Aatha area.
2- Know the size of agricultural areas and the kind of crops adopted on ground water in the process of land irrigation.

The boarders or (location) of research area.

The area is located astronomically between two latitudes (33-36) North and longlatitudes (44 56 – 45 40) east and its geographical location in Baquba province, south-east of Al-Muqdadiya district, and administratively belong, to the district; it seems to be two Agricultural territories its boarders from the East and south and north Al-Haronia, so from the North and West-north the two territories Al-Jazeera and Tuqatili, and from the west Al-Kaf, Al-Shaka, Al-Aswaed and
Abu-Alward where as from south Al-Eizia territory, all the territories belong to Al-Muqdadia district except Mubarak territory it belongs to Baladruz district, (map1).

Map (1) of the location and borders of the study area

Source: From the researcher's work based on the map of the agricultural districts of Diyala Governorate / General Commission for Survey / Baghdad, 1986 / Scale 1: 1,000,000 using Arc.Gis 10.7.1

Natural aspects or (features) of the study area.

1- Geological structure:

The majority of the study area covers the by sediments, which consist of the fourth area than contains as follow:
A. Floodplain sediments: it includes the Diyala River deposits and pediments of Himreen foot hills. The sediment formed by the movement of clay, silt and sand along the study area from east and southern.

B. Wind sand sediments: It includes dune deposits of sand and sand bags spread almost west of the study area.

C. Falling deployment: it include deposits of the low-region in south of the study area it composes from sand, silt and clay basically.

D. Piles: These deposits delineated with asallation rises after the evaporation of rains water and after the evaporation of under ground by poetic property.

E. Internal sews: it is a huge sedimentary deposits stretched in abar toward, northeast area until the southeast(5). map(2).

Map (2) geological structure

Source: From the researcher's work depending on the information of the General Authority for Ground Water (Department of Drilling Geology) Diyala Branch, using Arc.Gis10.7.1
2-Topography of the study area:

The region is limited between (34-67 meters above sea level) and descended (steeped) from the north towards south and southeast, then towards the southwest direction, the pain seems to be a prominent feature in this region except that the sands appear over the plain regions it spreads in different regions also there are some of deprecies that are unquested by rainwater in separation and dismissal in summer map (3).

Map (3) Topographic study area

Source: From the researcher's work based on Landsat 8 satellite visuals, 2017 using Arc.Gis 10.7.1
3-Climate of the study area:

Groundwater is affected by the daily and annual climatic fluctuations of heat and precipitation, as it causes a difference in the levels of this water, as temperatures cause evaporation of groundwater near the surface of the earth when it rises to the highest layers that contain it. The water is underground and thus the groundwater level rises. As for the low water level, it means the low level (6).

The region is located within the arid and semi-arid regions of Iraq, and is characterized by a hot, dry climate in summer and cold with fluctuating rains in the winter (7), And the data of the Khanaqin and Al-Khalis stations were relied upon, as there is no climate station in the region, and the climate elements represented by heat, winds and rain that have a direct impact on the groundwater in the region were addressed.

Temperature:

The study area is characterized by high temperatures in the summer and low in the winter, and a large temperature range up to (19,2) degrees in Khalis station and (17,91) degrees in Khanaqin station.

The minimum temperatures for the summer months (June-July-August) were recorded (43-45,6 -45,7) respectively at Khanaqin Station, while the pure temperature was recorded (41,2-43,9-43,8) for the same months, While Al-Soghra (26-28,3-27,8) was registered for the same months in Khanaqin Station, and Al-Soghra was registered in Al-Khalis Station for the same consecutive months (22,7-25-24,6), as for the same three-month range in Khanaqin Station It was (17,3 -17,9) 17-17, while in Khalis station it was (18,5-18,9-19,2) for the same months in a row.

As for the winter months (December - January - February), the maximum temperature for these months was recorded at Khanaqin Station (17,5-16,2-19), respectively, while it was recorded (17,6 -15,8-19) for the same The months in Al-Khalis station, while the range for the same months was (11-10,7-12,1) in Khanaqin station, and (12,8-12,2-13,2) for the same months in al-Khalis station, and these data show higher degrees The temperature is significantly reduced in the summer and its decrease in the winter season (Table 1)
Table (1) Maximum, minimum and range temperatures for Khanaqin and Al-Khalis stations for the period 2000-2018

| Stations     | Khanaqin Station | Khalis station |
|--------------|------------------|----------------|
|              | max | min |      | max | min |      |
| September    | 41.3 | 23.4 | 17.9 | 39.8 | 20.9 | 18.9 |
| October      | 34.5 | 18.9 | 15.6 | 33.2 | 16.3 | 16.9 |
| November     | 25.1 | 11.0 | 14.1 | 23.4 | 8.8  | 14.6 |
| December     | 17.5 | 6.5  | 11.0 | 17.6 | 4.8  | 12.8 |
| January      | 16.2 | 5.5  | 10.7 | 15.8 | 3.6  | 12.2 |
| February     | 19.0 | 6.9  | 12.1 | 19.0 | 5.8  | 13.2 |
| March        | 24.3 | 10.8 | 13.5 | 24.5 | 9.7  | 14.8 |
| April        | 30.4 | 1.2  | 14.2 | 30.1 | 14.4 | 15.7 |
| May          | 32.4 | 21.9 | 10.5 | 36.1 | 19.3 | 16.8 |
| June         | 43.0 | 26.0 | 17.0 | 41.2 | 22.7 | 18.5 |
| July         | 45.6 | 28.3 | 17.3 | 43.9 | 25.0 | 18.9 |
| August       | 45.0 | 27.8 | 17.9 | 43.8 | 24.6 | 19.2 |

Source: From the researcher's work based on the data of the General Meteorological Authority / Climate Department (unpublished data) 2018

Rain:

The rains in Iraq are generally characterized by their fluctuation from year to year, as they fall profusely in some years and decrease in others, leading to a drought, and as such they are fluctuating from one year to another and the fluctuation rate increases as we advance from the north towards the south (8). and the study area is located 200 mm south of the rain line, As its rains begin to fall in the month of October and stop in the month of June, and it is fluctuating during this period from one month to the next, as it increases in some months and decreases in others according to climatic conditions, but in the summer it ends completely from June until September, as for the total Annual rains for the rainy months (October-November-December-January-February-March-April-May) were recorded (28.77 -33.27-27.11-28.55-19.30-22.41--08-21.08), respectively, in Khalis station, while in Khanaqin station, it was lost Recorded respectively for the same months (24.85-55.28-40.13-45.33-29.26031,22-26.50-5.22), Table (2).

As for the winds, their speed and direction vary from one month to the next, as their speed increases in the months (January-February-March-April-May-June-July-August), 27-1.41-1,1-1,18-1,10-1,29 (m/s), while it decreased in the months (September-October-November-December) at the same station, when it was recorded) 0.98-0.96-0.75-0.71 m / s.
As for the Khalis station, it was different in speed and direction for most of the months of the year, Table (2), and this has a direct effect, especially in the summer, as the high wind speed helps in increasing the amounts of evaporation and evaporation / transpiration, which affects the soil and plant moisture, which in turn affects the groundwater. In the region.

Table (2) Total rain rate mm / year and wind speed m / s and direction for Khanaqin and Khalis stations for the period from 2000-2018

| Months       | Khanaqin Station | Khalis Station |
|--------------|------------------|----------------|
|              | Total precipitation mm / year | wind speed m / s | direction | Total precipitation mm / year | wind speed m / s | direction |
| September    | 0                 | 0.98           | West      | 0              | 2.2               | North West   |
| October      | 24.85             | 0.96           | West      | 28.77          | 2                 | North West   |
| November     | 55.28             | 0.75           | West      | 33.27          | 1.7               | North West   |
| December     | 40.13             | 0.71           | North West| 27.11          | 2.1               | Southeast    |
| January      | 45.33             | 1.03           | West      | 28.55          | 2.5               | Southeast    |
| February     | 29.26             | 1.18           | West      | 19.30          | 3.1               | North West   |
| March        | 31.22             | 1.27           | West      | 22.32          | 3.3               | North West   |
| April        | 26.50             | 1.41           | North West| 21.08          | 3.2               | North West   |
| May          | 5.22              | 1.1            | West      | 7.41           | 2.8               | North West   |
| June         | 0                 | 1.18           | West      | 0              | 3.7               | North West   |
| July         | 0                 | 1.10           | West      | 0              | 3.1               | North West   |
| August       | 0                 | 1.29           | West      | 0              | 2.6               | North West   |

Source: From the researcher's work based on the data of the General Meteorological Authority / Climate Department (unpublished data) 2018

soil

The importance of soil in the study of groundwater is evident, as the types, types and texture of the soil are factors that control its permeability. Therefore, it affects the amount of what seeps through it from the water into the ground. It contains a high percentage of sand, which increases the speed of rainwater penetration into the soil, which increases the quantities of groundwater. However, sandy soils have a negative effect on plants, as they need to increase irrigation operations to compensate for the decrease in soil moisture that The plant needs it because of the speed of water penetration into the ground, the most important types are sand dune soil, flood plains soil, and swamp soil, which are spread differently in the region.
Natural plant:

Natural plants play a fundamental role in the availability and quality of groundwater, as the density of vegetation cover impedes surface runoff and increases the quantities of water infiltrated into the soil, as it prevents freezing inside the soil pores, preserves its moisture and reduces evaporation processes (11).

In the study area there are different types of natural annual and perennial plants as annual plants grow and abound in the rainy season and die and end at the end of their fall season. Among these plants are legumes, trabies, wild barley, roe and baker, etc., while the other type are perennial plants that have adapted themselves to resist drought. They are plants with needle leaves covered with a wax material, Its roots are long and extend into the soil down to the places where there is moisture, and these plants include prickly alhagi, propis, boxthorn, halfa, turf and others, in addition to the presence of marsh plants, reeds and sedge.

Picture (1) Natural plants in the study area

Source: researcher's field study
Production capacity of wells:

As a result of the failure to study the area by the General Authority for Ground Water, and no well has been drilled in the area before it. Therefore, no information is available on the drainage of wells, as all the wells dug in the area have been dug by farmers in different ways, including those dug by the manual method and those dug by the mechanical method. Many of them were not registered with the water resources and agriculture departments in the district except for some of them that were registered with these departments in order to obtain an official agricultural plan by the aforementioned departments, but through the field study it was found that the depths of wells in the region are limited between (10-30 m). And a tube diameter confined between (8-12Ang) Water pumps have a size (4-5-6 inches) and sprinkler irrigation systems and regulation volumes (6 inches) on these wells, and in order to enjoy these wells with their abundance of water, through the continuous pumping of these wells and for continuous hours of up to more than 20 per day, the level of quantities is found. Large amounts of agricultural crops (wheat), which is why large quantities of agricultural crops (wheat), It is also possible to take advantage of these water sources in providing alternative water to the districts of Muqdadiya and Baladruz, similar to the alternative water project in the Karbala governorate in the event of a water crisis in the future, as the area is far from the Rose Creek that feeds the Baladruz district with water (2000 meters) only, and less than This is about the city of Muqdadiya (12), and thus it is considered a strategic storage of water.

Geographical distribution of groundwater wells and their agricultural uses, and the prevailing irrigation methods

The wells are distributed in the Al-Aitha area in the two provinces 18 called Al-Aithah Al-Janoubi and 24, which is called Al-Aaitha Al-Shamali. Each farmer owns one or a number of wells according to the cultivated area. Some of these wells are registered with the Agriculture Division of the district, and the other part is not registered. Wells are used to irrigate wheat farms in the two provinces, as areas of the region’s lands are cultivated with wheat crops, with an area of 9173 dunums, according to the winter plan for the agricultural season (2019-2020). The irrigation process is carried out in two ways, the first is tourist irrigation after raising water from the wells using pumps. Picture (2) As in this way, an area of 8531 dunams is irrigated, As for the second method, it is sprinkler irrigation through the use of modern (pivot and fixed) irrigation systems, as these systems are erected directly over the well, and in this way agricultural areas up to (642) dunums are irrigated, so each system irrigates (120) dunums except for the fixed system that irrigates (42) dunums,
and the systems are divided into (3) systems in each province (13). Table (3) map (2), picture (3). As for summer crops, they are almost limited to very small areas of vegetable crops.

**Picture (2) Flood irrigation method**

![Flood irrigation method](image1)

Source: researcher's field study

**Picture (3) The irrigation method with pivot systems**

![Irrigation method with pivot systems](image2)

Source: researcher's field study

**Table (3) the geographical distribution of the groundwater wells according to the agricultural districts in Aatha**

| T | Name of farmer(well)       | Territorie | Total area / dunam | Irrigated area / dunam | Perfusion type |
|---|---------------------------|------------|--------------------|------------------------|---------------|
| 1 | Ahmed Mohamed Abd         | 18         | 372                | 125                    | Melt          |
| 2 | Arkan Aziz Mutashhar      | 18         | 250                | 95                     | Melt          |
|   | Name                          | Year | First | Last | Melt |
|---|-------------------------------|------|-------|------|------|
| 3 | Iyad Ghazal Hussein           | 18   | 12    | 12   | Melt |
| 4 | Badiaa Kazem Abd             | 18   | 372   | 125  | Melt |
| 5 | Bushra Ibrahim Khalil        | 18   | 100   | 30   | Melt |
| 6 | Bushra Mohsen Dawood        | 18   | 30    | 10   | Melt |
| 7 | Bada mal Allah Hussein       | 18   | 100   | 80   | Melt |
| 8 | Thamer Atta Hussein          | 18   | 12    | 12   | Melt |
| 9 | Thamer Nehme Atta            | 18   | 100   | 50   | Melt |
|10 | Thaer Musleh Hussein         | 18   | 113   | 35   | Melt |
|11 | Thaban mal Allah Hussein     | 18   | 57    | 30   | Melt |
|12 | Jmhorea Hadi Ali             | 18   | 100   | 80   | Melt |
|13 | Jury Alwan Mansour           | 18   | 100   | 50   | Melt |
|14 | Hafez Zaid Ali               | 18   | 50    | 25   | Melt |
|15 | Hamed Attia Hussein          | 18   | 12    | 12   | Melt |
|16 | Habib Hussain Ali            | 18   | 50    | 30   | Melt |
|17 | Hussein Thamer Nehme         | 18   | 100   | 45   | Melt |
|18 | Hussein Jawad Kazem Swari    | 18   | 250   | 100  | Melt |
|19 | Hussein Abdullah Hussein     | 18   | 100   | 80   | Melt |
|20 | Hussein Abdullah Hamid       | 18   | 182   | 90   | Melt |
|21 | Hussein Mal Allah Hussein    | 18   | 132   | 60   | Melt |
|22 | Hussein Mohsen Ghadeeb       | 18   | 400   | 200  | Melt |
|23 | Hamid Attia Hussein          | 18   | 21    | 20   | Melt |
|24 | Khaled Karim Abbas           | 18   | 100   | 30   | Melt |
|25 | Khalis Abdullah Hussein      | 18   | 309   | 180  | Melt |
|26 | Rasool Sakban mal allah      | 18   | 100   | 50   | Melt |
|27 | Raad Sami Muhammad           | 18   | 182   | 90   | Melt |
|28 | Sami Kazem Abd              | 18   | 200   | 90   | Melt |
|29 | Saadia Jassim Mohammed       | 18   | 100   | 80   | Melt |
|30 | Sania Attia Hussein          | 18   | 100   | 45   | Melt |
|31 | Sakban Kazem Abd            | 18   | 250   | 100  | Melt |
|32 | Sakban money Allah Hussein   | 18   | 150   | 50   | Melt |
|33 | Amer Attia Hussein           | 18   | 12    | 12   | Melt |
|34 | Abbas Ibrahim Saud           | 18   | 730   | 600  | Melt |
|35 | Abbas Kazem Abd             | 18   | 200   | 90   | Melt |
|36 | Abd Kazem Abd               | 18   | 250   | 100  | Melt |
|37 | Abboud Faleh Abd            | 18   | 240   | 150  | Melt |
|38 | Adnan Mal Allah Hussein      | 18   | 25    | 15   | Melt |
|39 | Aqeel Nizhan Abdullah        | 18   | 500   | 250  | Melt |
|40 | Alwan Mal Allah Hussein      | 18   | 125   | 80   | Melt |
|41 | Ali Ahmed Khalaf            | 18   | 168   | 90   | Melt |
|42 | Ali Ahmed Khalaf Jawad      | 18   | 57    | 40   | Melt |
|43 | Ali Hussein Abdul Rahman    | 18   | 50    | 40   | Melt |
|44 | Ali Abd Muhammad            | 18   | 100   | 50   | Melt |
|45 | Ali Mal Allah Hussein       | 18   | 39    | 25   | Melt |
|46 | Ammar Muhammad Najm          | 18   | 83    | 50   | Melt |
|47 | Ghassan Adnan Mahdi          | 18   | 50    | 30   | Melt |
|48 | Fatima Hadi Mahdi           | 18   | 92    | 50   | Melt |
|49 | Qasim Mazal Saeed           | 18   | 45    | 25   | Melt |
| No. | Name                        | Year | Hours | Melt       |
|-----|-----------------------------|------|-------|------------|
| 50  | Kamel Attia Hussein         | 18   | 28    | 25         | Melt       |
| 51  | Muhammad Jawad Kazem Sawari | 18   | 125   | 80         | Melt       |
| 52  | Muhammad Ali Musa           | 18   | 205   | 100        | Melt       |
| 53  | Muhammad Muthanna Ali       | 18   | 1000  | 500        | Melt       |
| 54  | Mahmoud Abbas Saleh         | 18   | 25    | 15         | Melt       |
| 55  | Mahmoud Attia Hussein       | 18   | 21    | 20         | Melt       |
| 56  | Mustafa Mahmoud Attia       | 18   | 100   | 80         | Melt       |
| 57  | Malka Saleh Hussein         | 18   | 113   | 35         | Melt       |
| 58  | Muhammad Mahdi Rashid       | 18   | 100   | 30         | Melt       |
| 59  | Neda Ali Ahmed              | 18   | 100   | 70         | Melt       |
| 60  | Naima Abdul Mahdi Rashid    | 18   | 168   | 90         | Melt       |
| 61  | Noria Hamad Khudair         | 18   | 113   | 35         | Melt       |
| 62  | Yassin Ahmed Mohammed       | 18   | 72    | 50         | Melt       |
| 63  | Khudair Abbas Hussein       | 24   | 219   | 150        | Melt       |
| 64  | Tariq Saleh Ali             | 24   | 50    | 35         | Melt       |
| 65  | Mujahid Taher Ahmed         | 24   | 168   | 120        | Melt       |
| 66  | Raad Hadi Hussein           | 24   | 82    | 65         | Melt       |
| 67  | Alia Salman Safar           | 24   | 90    | 60         | Melt       |
| 68  | Ahmed Raad Ali              | 24   | 70    | 66         | Melt       |
| 69  | Ismail Khalifa Majeed       | 24   | 84    | 55         | Melt       |
| 70  | Umm Kulthum, leisurely, Sakr| 24   | 19    | 18         | Melt       |
| 71  | Iman Ali Khalil             | 24   | 150   | 145        | Melt       |
| 72  | Jawhar Abdul Redha Mohsen   | 24   | 54    | 50         | Melt       |
| 73  | Jabiya Abbas Muhammad       | 24   | 50    | 45         | Melt       |
| 74  | Hassan Abbas Jaber          | 24   | 50    | 35         | Melt       |
| 75  | Hassan Ali Saleh            | 24   | 22    | 21         | Melt       |
| 76  | Hamza Abdul Redha Muheisen  | 24   | 430   | 170        | Melt       |
| 77  | Hanona Mohammed Abdullah    | 24   | 150   | 100        | Melt       |
| 78  | Raad Ali Najm               | 24   | 168   | 150        | Melt       |
| 79  | Zahra Razzaq Zaidan         | 24   | 200   | 175        | Melt       |
| 80  | Salem Abdul Redha Muheisen  | 24   | 150   | 100        | Melt       |
| 81  | Saier Dowlab Hammadi        | 24   | 15    | 14         | Melt       |
| 82  | Salman Muhammad Hamid       | 24   | 90    | 65         | Melt       |
| 83  | Shorouk Muhammad Mahdi      | 24   | 84    | 50         | Melt       |
| 84  | Aziza Hamad Press           | 24   | 200   | 175        | Melt       |
| 85  | Ali Ahmed Khalaf            | 24   | 125   | 110        | Melt       |
| 86  | Ali Abbas Jader            | 24   | 40    | 35         | Melt       |
| 87  | Ammar Laith Hamad          | 24   | 200   | 175        | Melt       |
| 88  | Anbara Mraished Khudair    | 24   | 200   | 175        | Melt       |
| 89  | Faris Layadh Muhammad      | 24   | 400   | 375        | Melt       |
| 90  | Faliha Naeem Marishid       | 24   | 200   | 175        | Melt       |
| 91  | Karim Abbas Jader          | 24   | 24    | 21         | Melt       |
| 92  | Muhammad Layd Muhammad      | 24   | 400   | 375        | Melt       |
| 93  | Muslim Majeed Hassan        | 24   | 400   | 200        | Melt       |
| 94  | Mokbl dolab Hammadi        | 24   | 15    | 14         | Melt       |
| 95  | Ahmed Mohamed Abd           | 18   | 372   | 120        | Pivot spray system |
| No | Name                          | Irrigation System | Quantity | Area (ha) |
|----|-------------------------------|-------------------|----------|-----------|
| 98 | Badiaa Kazem Abd              | Pivot spray system| 18       | 372       |
| 99 | Iman Naji Hamid               | Pivot spray system| 24       | 153       |
| 100| Hanona Mohammed Abdullah      | Pivot spray system| 24       | 430       |
| 101| Hanona Mohammed Abdullah      | Pivot spray system| 24       | 120       |
| 102| Sakban Mal allah Hussein      | Fixed sprinkler system| 18 | 150       |
|    | Total                         |                   |          | 9173      |

Source: From the researcher's work, depending on the data of the two divisions of cultivation of Muqdadiya, the center, and the division of Wajih sub-district

Map (4) Geographical distribution of groundwater wells according to the agricultural Territories of Al-Aatha

Source: From the work of the researcher based on the map of the agricultural districts of Diyala Governorate / General Commission for Survey / Baghdad, 1986 / Scale 1: 1,000,000, and data of the Muqdadiyah Agriculture divisions Center and the Wajiha sub-district, using Arc.Gis 10.7.1
Conclusions

1- The region’s almost complete dependence on rainwater and underground wells in providing water to farms due to the absence of surface water sources in it.
2- There are no test pumping wells in the area established by the General Authority for Ground Water, and thus it is not possible to know the layers and geological deposits and the size of the underground storage of water in the area.
3- It was found through the field study that the wells are characterized by the abundance of water, through continuous pumping using pumps of capacity (4-5-6 Ang) for hours reaching more than 20 hours, the water supplied by these pumps does not decrease.
4- An area of (9173) dunums was cultivated with wheat harvest for the season (2019-2020) depending on the water of the ground wells, and the irrigation process is carried out in two ways, the first is flood irrigation (flooding) after raising water from these wells using pumps, and the second method is sprinkler irrigation by installing irrigation systems on Wells.
5- Wells are distributed over the region according to the areas cultivated with the wheat crop, as each farmer owns one well or a number of wells that were dug by them.

Recommendations:

1- Drilling a group of wells for test pumping in the region at different depths confined between (30-100m) by the General Authority for Ground Water in order to know the stratigraphic sequence of wells, geological deposits, the volume of underground storage, the movement of groundwater and the amount of drainage.
2- Establishing an alternative water project similar to the Karbala project to supply the Baladruz and Muqdadiyah judiciary with water in the event of a water crisis.
3- Reclaiming large areas of land in the region in order to exploit them for agriculture, especially since the region is considered water-guaranteed through its dependence on groundwater.
Margins:

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