Characteristics of The Drainage Network of the Abu Ghar Basin :A Hydrological Study

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Abstract

The studies dealing with drainage water characteristics of the basins dry studies that gained wide attention from geographers in general and hydrologists in particular , they contain indicators and characteristics reflect the reality of geological and climate , as well as the human factor , and the basin area of research is the Wadi Abu Gar , which is located between the brackets length-¯48) (˚ 45and (˚ 46 -¯ 28) to the east, and latitudes (28 - ¯ 54) and (˚ 30-¯37) north , and bordered on the north low Alsalibat , hand south drilling sub From the east, the Wadi al -Athir basin ,and from the west, Wadi Khanka and the Sudair basin.

Introduction

The geological structure of the surface, climate and vegetation cover an important role in drawing a picture of the hydrological activity , as well as the river tributaries and their various ranks within the basin. Accurate analysis of spatial data and then linking it to metadata, which provides limitless possibilities in studying the characteristics of the water drainage network of the Wadi Abu Ghar basin using advanced automated methods, and building a geographical database based on advanced data sources.

the study Problem Problem of Study : What medical nature of influencing processes in the formation of the characteristics of the network of river basin and its manifestations ground?

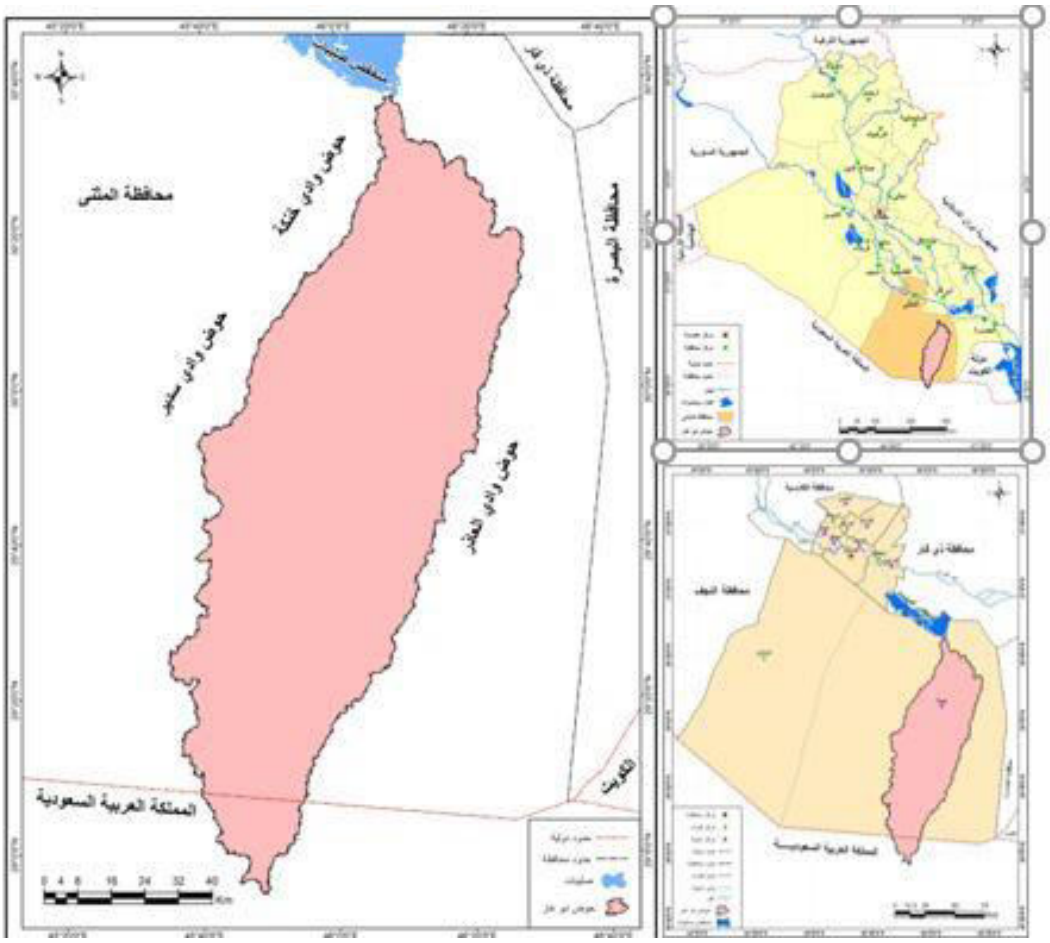
Study hypothesis Hypothesis of Study: There is a major role for the ancient climate in the Quaternary time, represented by the Pleistocene and Holocene eras, one of the sections of the Quaternary era, in the formation of basins in the study area, in addition to the contribution of some current geological and climatic factors in changing some of its features.

Purpose of the study: Aims of Study: Shedding light on the stages of geomorphological development of the Wadi Abu Ghar basin , by conducting an analysis of the characteristics of the river network and knowing its geomorphological importance.

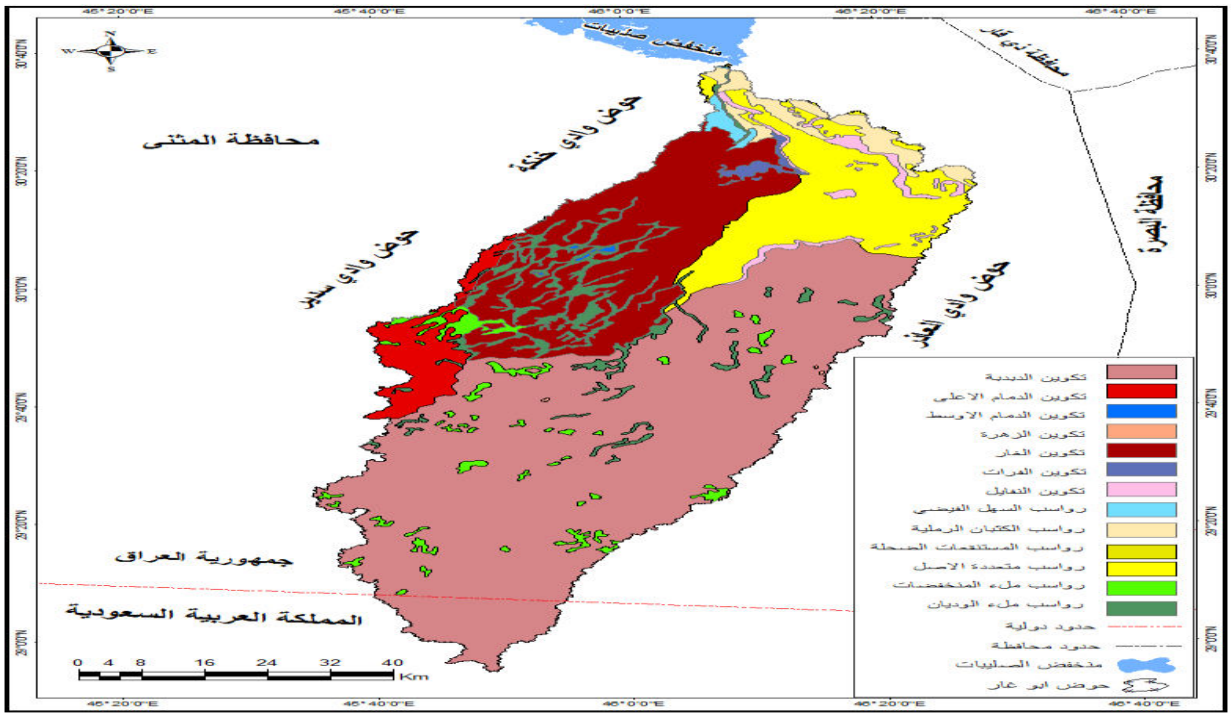
Boundaries of Wadi Abu Ghar Basin

Located between the brackets of the length (˚ 45-¯48) and (˚ 46 -¯ 28) to the east, and latitudes (28 - ¯ 54) and (˚ 30-¯37) north , and bordered on the north low Alsalibat , hand south drilling subcontractors and from the east basin valley Adhir hand the West Valley Khankh basin Alasdair, notes (Map 1).

Map (1) the location of the study area from Iraq and Al-Muthanna Governorate



Map (2) Geology of the study area



Source: From the work of the researcher with credit-:

1- Ministry of Water Resources, General Authority for Survey, Map Production Department ,Administrative Map of Iraq at a scale of 1:1000000, Baghdad, 2016.

2- Ministry of Industry and Minerals, General Organization for Geological Survey and Mining ,Iraq's structural map at a scale of 1:1000000, Baghdad, 2013.US satellitelandat 8 (Visuals (167/39), (167/40), 2019.

Surface Almkashif relay medicine a valuable) stratigraphicsequence- :(

1. **Tertiary time deposits : Tertiary Sediments It includes the following-:**

1.1. Dammam Formation : Dammam Formation

Outs Section East and the highest in the center and west of the study area , notes the map ,(2) as revealed Dammam East with an estimated area of 1.07 km , ^{2} either Dammam Top occupies an area of 1 km . ^{2}

Source: The researcher based on the Ministry of Industry and Minerals ,the General Organization for Geological Survey and Mining, geological maps (Suq Al-Shuyoukh, Al-Rakhima, Al-Salman) at a scale of 1:250,000, Baghdad, various years.

1.2. **Composition Laurel :Ghar Formation**

This configuration is revealed in the center of the basin and extends to the far west and north - west, and running this configuration an area of 19.65 km , ^{2} of the basin area.

1.3. **The composition of the Euphrates: Euphrates Formation**

Outs in the northern part of the basin , depositional environment for this configuration shallow marine environment ,and consists of limestone sand with the thickness of 5 m trees , color gray bleached to greenish gray.

1.4. **Composition of the nafail : Formation Alinvaal**

This formation is revealed in the form of patches in the far north of the basin and in the east, north-east and middle of the basin with an area of up to 5 . 4 km. ^{2}

1.5. **Composition of the flower : Zahra Formation**

This configuration is revealed in the form of small patches in the eastern parts and in central and south - west of the basin, an area estimated at 3.6 km. ^{2}

1.6. **Composition of the bear : Dibdibba Formation**

It spreads in the middle, east and south of the basin, with an area estimated at 18 1 . km , ^{2} and is composed according to the relay class from the bottom to the top of the sandstone and gravel.

2.2. **Quaternary time deposits : Quaternary Sediments**

Quaternary age sediments inconsistently cover most of the exposed formations in the region, and they appear clearly in the following units:

2.1.1. **Sediments of river terraces :River Terrace Deposit**

These deposits are spread along Wadi Abu Ghar, and they are a mixture of gravel, sand, silt and gypsum crust.

2.2.2. Deposits filling depressions :Depression Deposit

These sediments cover scattered areas in the center and south of the basin and consist of detritus such as clay, silt and sand of different characteristics.

2.2.3.Sediments filling the valleys :Vally Fill Deposits

These sediments cover the bottoms of some secondary valleys in the basin. They are the product of rock weathering and erosion processes by torrents and winds. These sediments are classified as a mixture of silt, clay, sand and gravel.

2.2.4. Flood Plain Sediments : Flood Plain Deposit

It consists of clay and alluvial deposits, some of which are pebbly, which are deposited during the flood season. They are deposited in the far north of the basin outlet. These sediments date back to the Holocene era.

2.2.5. sediment sand :Sandy Deposits

These deposits arise due to wind erosion and vary from place to place Â another by the fish and the type of rock Almh t Ge including those deposits, and consists of sand containing gypsum and little silt , and is the sand dunes that spread in the form of casual bar in the north of the basin as well as the spread of the collected sediment Around the vegetation, in most parts of the aquarium

2.2.6.Shallow swamp sediments :Marsh deposits

These sediments are no touching a small plates near the low in the downstream area of the Crusaders north of the basin, and consists of clay, silt and sand.

3.1. Analysis of drainage water:

The water network is the net result of the structural, climatic and rocky conditions of any drainage basin .As determined by the number of waterways, lengths and patterns discharged by rocks and their characteristics in terms of porosity and permeability type, as well as the rock structure and exposed him breaks and sprains and fractures lifting tectonic movements, as well as affected by climatic conditions include rain in terms of quantity of the effectiveness of , and the temperature as a factor in operations of the T air and the creation of the Earth 's surface materials for settlement processes, and the Hittite stage reached to the basin is one of the factors affecting the drainage networks, the impact on the regression factor which is one of the most important factors controlling the dynamics of rivers and the speed of the water flow in their courses .Study of water drainage systems also contribute according to Mratbha and the numbers of their courses and they relate to each other within the basin to know the size of the water discharge and flow velocity and hanger of that increase operations pressed and sedimentation in the basin .It will be addressed those characteristics as the come- :

3.1.1. river mattress:

Know mattress river of being the numerical order of the group reaches , which form the drainage network, and the study of mattresses river contributes to the knowledge of the amount of water discharge and predictive A in any part of the parts of the basin, estimating the flow velocity and forecasting A risk of flooding and this from a link in increasing operations Erosion and sedimentation within the aquifer (Strahlar , 1958: 48).

The researcher adopted the methodStrahlarIn calculating the ranks of the drainage network , as it is characterized by its simplicity and effectiveness in calculating the ranks ,through which the river bifurcation ratio is determined, which we will review later .Under this method , called sewage , which is not related any previous course ranked first , and when it connects Mejraan of ranked first consists of the course of the second place, and when Hungarian contact yen from the second course consists of so -called third place , and so down to the Hungarian president, into which all ranks, and The rank of the river increases when it meets a tributary that carries a lower rank than it) Streller. (233 :1946 ,

The total number of river levels in the Abu Ghar basin reached seven . These ranks consist of 3,917 streams .The number of streams varied at the level of the ranks , it is noted in Table. (1)

Table (1) The ranks of the drainage networks and the number of their sewers for the basins of the study area.

Total number of sewers	**7th place**	**6th place**	**5th place**	**fourth place**	**3rd place**	**second place**	**first place**	**Variables pelvis**
3917	**1**	**3**	**9**	**39**	**160**	**801**	**2904**	**Abu Gar Basin**

Source : The researcher based on the digital elevation model) DEMEThe measurements were extracted using a program . Arc.Gis . (10.2

Reached the number of sewage in the first place 2 904 and by 7 % 13 , 4 of the sewage college basin, and reached the number of sewage in the second 801 and by % 45 , 20 while the number of third place 160 ie by 4 , % 08 ,while the number of streams of the rest of the mattress , were 39, 9, 3.1 for the fourth, fifth, sixth and seventh ranks, respectively, and 1.34% of the total number of waterways in the basin .From the map ,(3) we notice that the number of water courses decreases with the increase in their ranks.

3.1.2. The lengths of the waterways:

The total reached lengths of waterways for all streams of the basin President 924.063 , 7 km and vary these lengths between the rank and the other , as the total reached lengths of streams ranked first 4090.654 km and by 5 ,% 62 , 1 while the second place was the total length of their courses 1826.128 km and increased by % 23.05 and ranked third 917.464 km by % 58. 11 were the lengths of streams ranked fourth 501.792 km by % 3 3 .6 fifth place 384.668 km by % 4.85 and the total length of mg Larry ranked sixth 154.57 km and is a ratio of , %95 .1 while the length of the course ranked seventh was 48.787 km, or 0.62% of the total lengths of the waterways of the basin .Table (2) is noted.

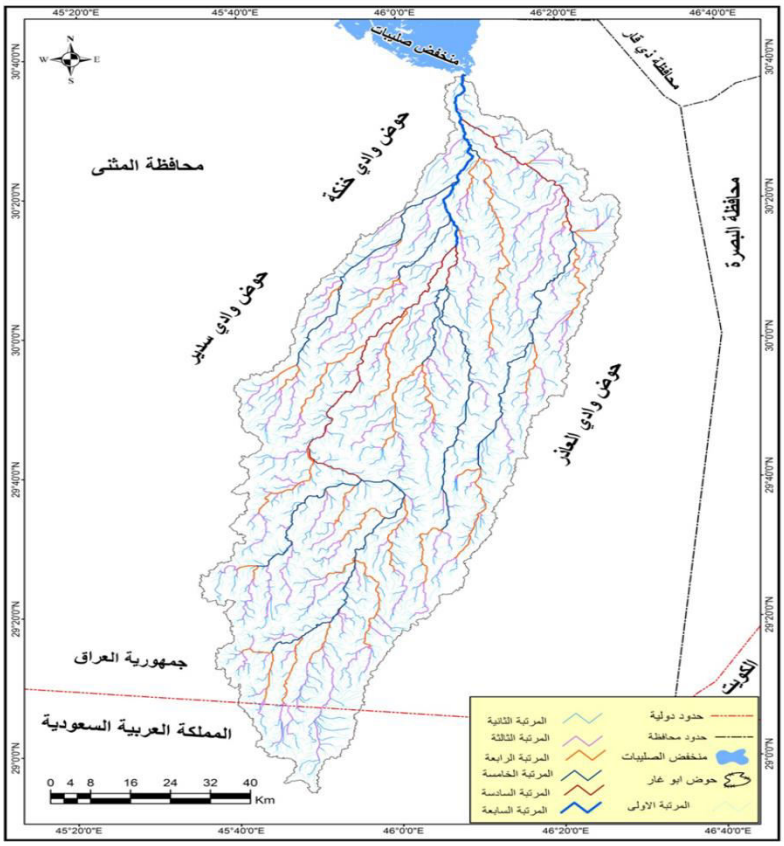
Table (2) The total lengths of the waterways, in km, by rank

Total	Seven	Sixth	Fifth	the fourth	the third	the second	first	rank
7924.063	48.787	154.57	384.668	501.792	917.464	1826.128	4090,654	The lengths of the waterways in km
100	0.62	1.62	4.85	6.33	11.58	23.05	51.62	The ratio %

Source : The researcher based on the digital elevation model) DEMEThe measurements were extracted using a program . Arc.Gis . (10.2

Map (3) of the river beds in the Abu Ghar Valley basin

Source: The researcher based on the data of the digital elevation modelDEME.



3.1.3. lenghts waterways rate:

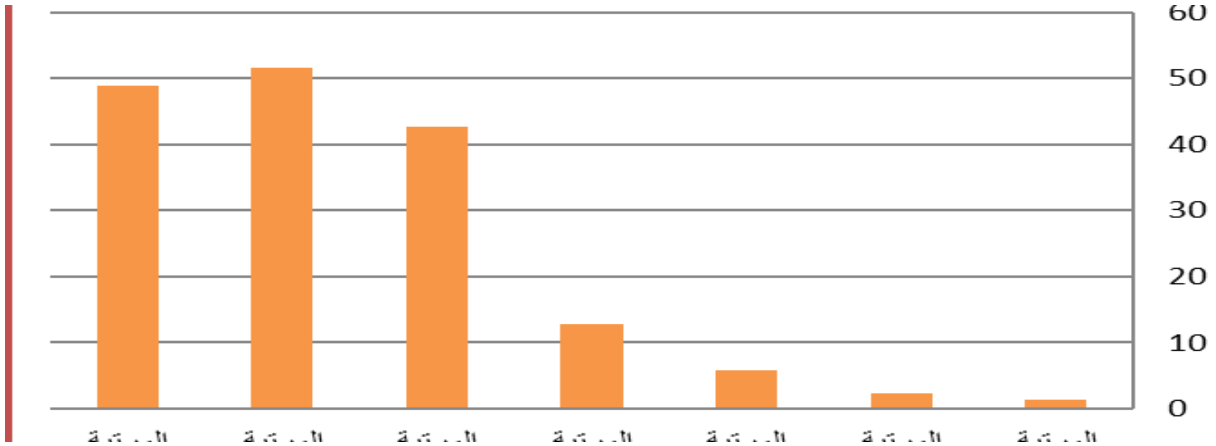
The average total lengths of all grades for the Abu Ghar Basin amounted to 2.022 km , it is noted in Table (3) and Figure. (1)

Table (3) average lengths of watercourses according to their ranks for Wadi Abu Ghar Basin

7th place	6th place	Fifth place	fourth place	3rd place	second place	first place	rank pain pelvis
48.787	51.523	42,740	12,866	5.734	2.279	1.408	**Abu Gar Basin**

Source :From the researcher's work based on the digital elevation model) DEMEThe measurements were extracted using a program. Arc.Gis . (10.2

The contrast is due to the increase in the lengths of the lower ranks, conducted within the steppe lands, which are characterized by increasing lengths of basins, lengths of linear faults and control structures as well as increasing lengths of sewage water.
Source :Table(4)



4.1.4. Density of drainage:

4.1.4.1. intensity longitudinal exchange:

It means the lengths of the sewers in the basin in full to the area of the feeding basin **) Patrick McCulla ,1986 , p** , **(23 .**and it is expressed according to the following equation **) Dawood , ,2002p**: **(200 .**

$$Longitudinal\ drainage\ density = \frac{The\ sum\ of\ the\ lengths\ of\ the\ waterways\ in\ the\ basin\ /\ km}{Basin}$$

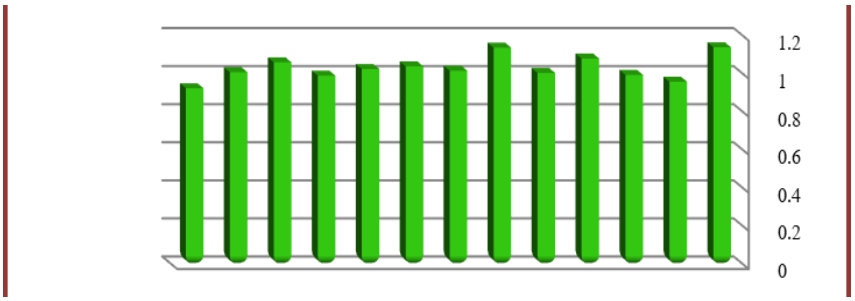
It reached the density of drainage basin in Wadi Abu Gar 048 .1 km / km^2 a low density of , ([*]) notes Table.4

Table :(4) Density of longitudinal and numerical drainage, stream survival rate, and deflection coefficient

inflection coefficient	ideal length/km	real length/km	Stream survival rate	scalar density	Drainage density	rank pain pelvis
1.17	41.434	48.787	0.95	0.52	1,048	**Abu Gar Basin**

Source : The researcher based on the digital elevation model) DEMEThe measurements were extracted using a program . Arc.Gis . (10.2

The geological conditions of the climate was the cause of the decline in the lengths and the number of waterways, on pelvic areas account, assisted by the high permeability of the sandy soil that covers most of the surface of the basin, as well as is a gradient little one the most important factors that contributed not to the emergence of the lower ranks and increase the density of the disposal, so All basins of the study area are classified as having low drainage density.



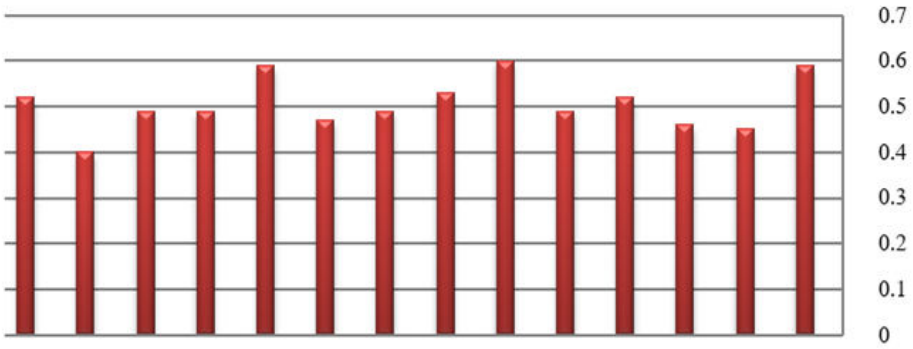
Source :Table4

2.4.5. Density of sewage numerical:

It can be extracted in the following way :Numerical drainage density**) Al-Abdan, 2004, p. 183(**

$$Numerical\ drainage\ density\ = \frac{The\ sum\ of\ the\ numbers\ of\ sewers\ of\ all\ ranks}{Basin\ area\ /\ km^2}$$

The values of the river frequency in the main Abu Ghar valley basin were reached 0.52Stream/km ,^{2} note table , 4 note figure. 3



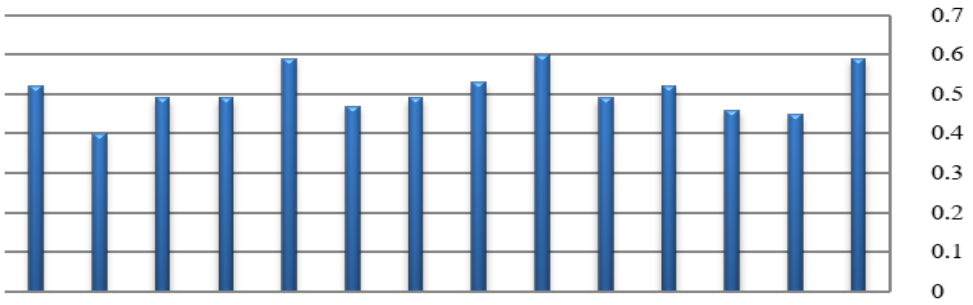
Source :Table5

5.5.3. survival rate reaches:

It refers to the average of the spatial unit needed to feed one longitudinal rank of the drainage network of any basin, and the larger the basin area at the expense of the short-length water channels, the greater the value of the output, and thus the result is the distance of the waterways from each other, and it is measured according to the following equation**) Al-Khafaji, 2015, p. 639** : basin area / km^2

$$Stream\ survival\ rate\ = \frac{Total\ lengths\ of\ sewers/km}{}$$

The survival rate reaches in the basin and the Valley of Abu Gar 95 .0 km /^{2} km , notes table ,4 notes the figure. (4)



Source :Table. 4

6.5.3. inflection coefficient:

The true length of the stream is the distance that the river travels on dry land. As for the ideal length, it is the shortest path that the stream takes between the source and the estuary. Usually, the real length is greater than the ideal length. The deflection coefficient can be extracted according to the following equation **:) Al-Naqash, 1985, p. 518(**

$$\text{inflection coefficient} = \frac{\textit{The real length of the river is km}}{\text{The ideal length of the river (straight) km}}$$

Through this parameter, it is possible to identify the extent of the river's torsion and meandering ,and its impact on the speed of the flow and the flow of the stream, which decreases with increasing torsion and the resulting increase in the amount of evaporation and water leakage from the river) Al-Babwani, 2005: 149 , (and the speed of water flow varies in The cross section of the river according to its straightness .In the straight section, the maximum velocity of the water current in the middle of the stream is near the surface and above the deepest point, and it decreases as we head towards the banks under the influence of the friction factor .The situation is different in the areas of river bends and twists, as the velocity of the water current reaches its maximum on the concave side of the bend and decreases on the convex side. Therefore, erosion is active on the concave side and sedimentation increases on the opposite convex side.

The formation of river torsions is related to a number of factors, including the nature of the surface slope, the speed of flow, and the amount of water in the river. The formation of torsions is also affected by the amount of sediment carried by the river, as well as the geological conditions of the area through which the river passes.

According to the above relationship, the main stream of Wadi Abu Ghar is twisted [*] ,As it reached coefficient reversal ,1:17 notes table , (4) and note the approach of the course of the river from the Alastqam of in most areas where the river passes, except for the last part near the mouth areas of low Crusaders

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7.5.3. Bifurcation Ratio:

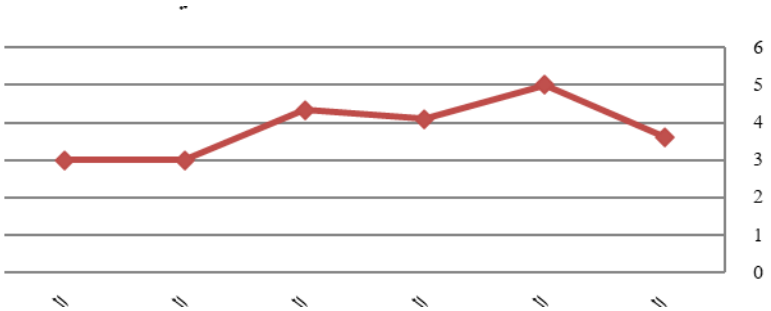
It is the value that, when multiplied with the number of tributaries of a particular rank, gives the number of tributaries of the lower rank**) Al-Jubouri, 1999, p. 29** . **(**The bifurcation ratio affects the length of the run-off and raises the quantity of the higher ranks, which increases the possibility of river erosion, transport and sedimentation in estuaries**) Al-Abdan, 2008, p. 26** , **(**and it is expressed mathematically as follows :Branching ratio) branching ratio **) ,** (**Salih , ,1992p (79 .**

The bifurcation rate of the Wadi Abu Ghar basin reached 3.84 ,Either bifurcation water mattresses ratios in the basin was the ratio for the first rank Z and the second 3.62, 5 second and third of the two places, and the ratio was the third and fourth two places4.1 ,And the 4.33For the fourth and fifth ranks, while the ratio between the fifth and sixth ranks was 3, and the ratio between the sixth and seventh was also 3, it is noted in Table. (5)

Table (5) the rate and percentage of bifurcation of the basins of the study area.

bifurcation rate	six / seven	five / six	four / five	third / fourth	second / third	first / second	rank pain pelvis
3.84	3	3	4.33	4.1	5	3.62	Abu Gar Basin

Source : The researcher based on the digital elevation model) DEMEThe measurements were extracted using a program . Arc.Gis . (10.2Ratios above refers to the homogeneity of the natural



characteristics , and the conduct of Algimorvologih operations , similar pace in the basin in general . We also note that the bifurcation ratios of the river mattresses are not consistent with the geometric progression proposed before) Horton 1945 , (as we note the anomaly of the riverine ranks from this sequence, as the second to third rank recorded the highest bifurcation ratios, and the fourth to fifth rank recorded the second bifurcation ratio, while the third to fourth rank recorded the third rate, and the first rank came in the fourth rank with the bifurcation rates of the riverine ranks. For each basin, Figure 5 is noted . The reason for the low bifurcation rates for the first rank is due to the nature of the dry climate in the study area, which in turn prevented the emergence and development of streams from the first rank after the rainy periods in which the basins of the study area were formed, as well as the development of some streams of the first ranks to the second rank due to the processes of retrograde and lateral erosion , and the resulting river captivity processes that occur between the streams of the first ranks, which are characterized by their proximity to each other.

Source: the researcher based on Table5

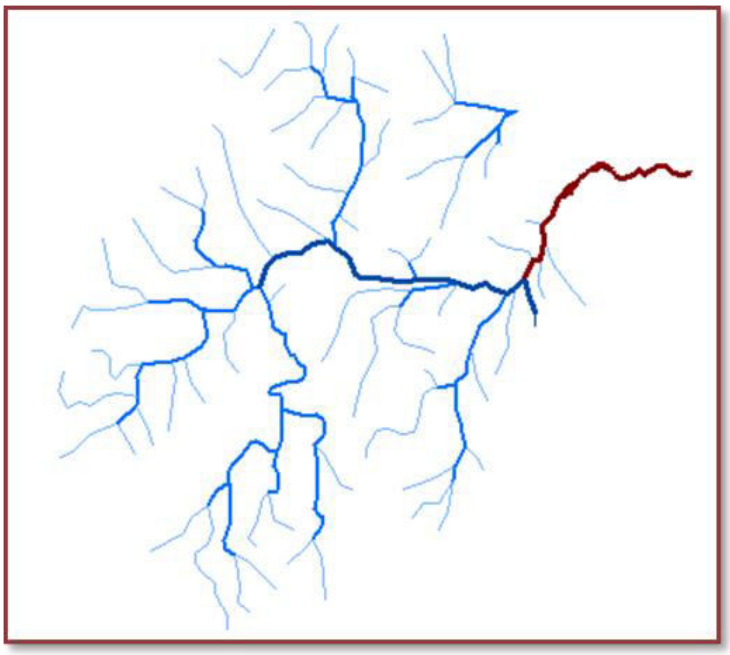
6.3. River Drainage Patterns:

It is the general form in which the group of rivers forming the water network of the main river course appears , and the drainage pattern is a reflection of the nature of the slope of the surface, the type of rock structures, the extent of their homogeneity, the tectonic movements that the region has been exposed to and the type of climate prevailing in it, as well as the geomorphological development of th stream , and it was possible to identify the following drainage patterns .For Wadi Abu Ghar Basin:

6.1.3. Drainage Pattern Tree:

This pattern is one of the prevailing forms of drainage in the basin, and it is formed in areas characterized by the homogeneity of its rocks, and the water network of this type consists of tributaries that meet with each other in the form of sharp angles, it is noted in Figure , (6) and the density of branching of this pattern depends on the extent The hardness and porosity of the rocks and the type of climate ,as the branching density increases when the hardness of the rocks decreases as in sedimentary rocks, while the branching density decreases in the hard, resistant rocks such as igneous rocks, and the degree of branching increases with the increase in the amount of precipitation and decreases in its abundance) Karbel , (125 :1986 , And this pattern prevails in most parts of the basin.

Figure (6) Tree drainage pattern in Wadi Abu Ghar basin

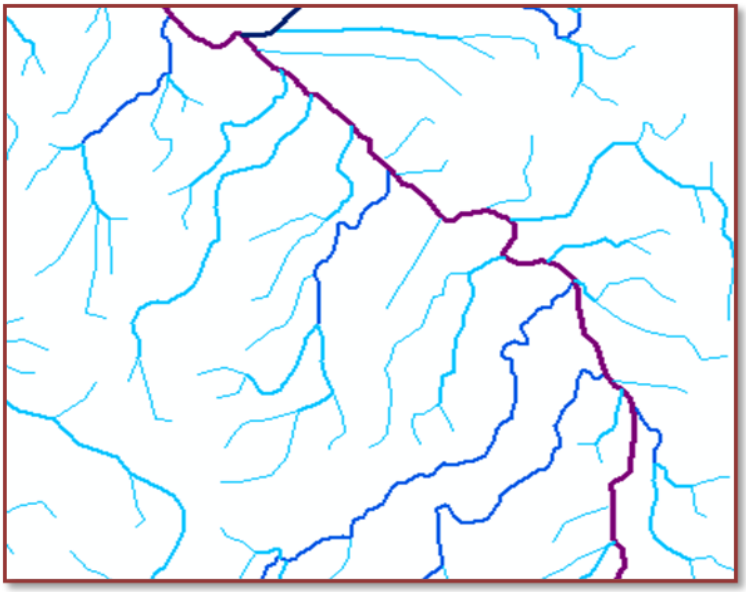


Source : researcher using software) Arc.Gis 10.2

6.3.2. Orthogonal Discharge Pattern:

Where the main valleys and their tributaries meet at almost right angles, it is noted in Figure , (7) and it can be said that the factors that formed this pattern are the fissures and breaks that the waterways use, as this type of drainage is formed in many parts of the basin.

Figure (7) The orthogonal drainage pattern in the Wadi Abu Ghar base

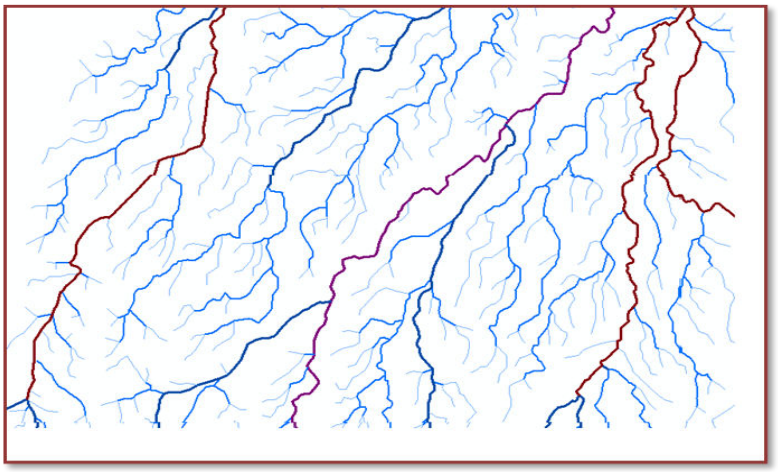


Source : researcher using software) Arc.Gis 10.2.(

6.3.3. Parallel discharge pattern:

This form of river drainage appears in the middle of the study area in the Baswa basin. It is formed at the confluence of the main valleys and the formation of the main course of this secondary basin. Figure (8) is noted.

Figure (8) discharge pain pattern parallel in the basin and Wadi Abu Gar

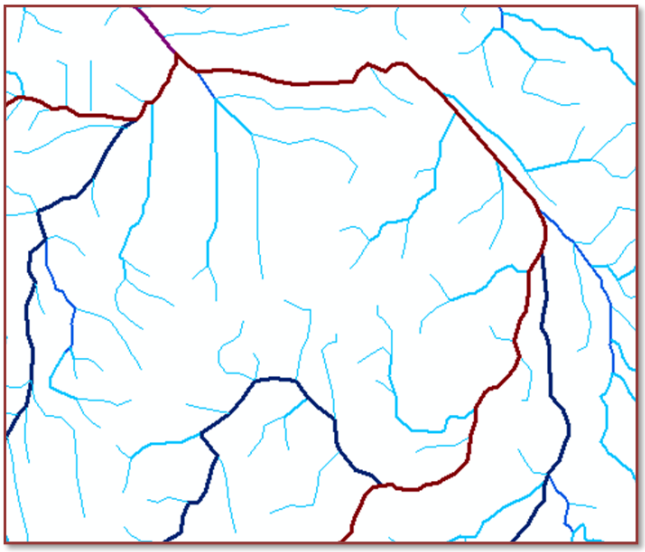


Source : researcher using software) Arc.Gis 10.2(

6.3.4. Type of radial discharge:

Represented the existence of this pattern factors in the study area is not the homogeneity of the rocky nature of the existence of solid rock areas are in contact with the fragile rock, especially in areas that suffer from distortions tectonic of led to the behavior of the Hungarian president in the areas of weakness of rock, especially rock removable for melting rocks limestone ,While the secondary valleys descended from the solid rocky areas towards the larger streams, and as a result of the processes of back retreat, and the resulting river families, in turn, helped in the emergence of this pattern (Al-Abadan, 2004: 198), which is represented by Figure (9) as it forms in the southern part from the study area.

Figure (9) Pattern of radial drainage in Wadi Abu Ghar basin



Source : researcher using software) Arc.Gis 10.2.(

Conclusions

1. The total number of river ranks in the Wadi Abu Ghar basin was (4) ranks, while the number of sewage sewage in the first rank was (106) wadis, at a rate of (53.53)%, while the number of sewage in the second rank reached (48) wadis, at a rate of (24.24)%. In the third rank, it amounted to (43) valleys at a rate of (21.71)%. When calculating the number of sewage sewage in the fourth rank, it was found that it amounted to (1) with a rate of (0.50)%, and the average length of sewage in all its ranks was (187.1) km, and it amounted to (109.7-43.2 (6.7-27.5 -ranked first, second, third and fourth, respectively.

.2The total density of longitudinal in Wadi Abu Gar ,(1:32) while the population density amounted to (1.39) and reached the survival of the Hungarian rate (0.75) which is one of the low rates that confirm the decline in the proportion of precipitation in the study area, which is reflected in the low density Drainage water conservation of the valley And the

inflection coefficient of the Wadi Abu Ghar basin reached (1.72) which is thus closer to straightening, and this leads us to the conclusion that the basin is going through the early maturity stage, and the beginning of the lateral expansion stage, and thus the study basin is at the beginning of its geomorphological development .

Suggestions:

1. Establishing a hydrological station in order to estimate the volume of available water resources.
2. Agricultural investment in areas that witness water gatherings such as) floods, depressions and valleys.
3. Preserving the natural vegetation, preventing early grazing, and adopting media to raise awareness, as well as following legal methods.
4. Establishing a network of land roads to take advantage of the available natural resources.
5. The construction of dams on the streams of the valleys and during the rainy seasons ,from the materials available locally.
6. Providing some services, the most important of which is potable water.
7. Investing the lands of the study area in the field of desert tourism and hunting, similar to the Gulf countries.
8. The researcher finds it necessary to urge researchers to carry out similar and complementary studies to this study and previous studies in order to cover all regions of Iraq in order to establish an integrated geographic information system on the basins.

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