# Applying GeoPlanner for ArcGIS in Urban planning

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**Abstract**

The science of urban planning emerged clearly after World War II, in the wake of the massive destruction of European cities. Because Iraq suffered from the results of more than three decades of wars and wrong policies, the urgent need for urban planning has emerged to address the consequences of war as well as large population growth with the lack of services and infrastructure. In addition, the use of traditional and old methods in planning has increased the problems of cities, it is therefore necessary to find modern scientific methods to discover the causes of problems and to develop appropriate solutions. These methods should use modern techniques such as GIS techniques and remote sensing, to enable the study of the present state of cities and the problems they suffer.

At present, GIS has evolved tremendously and has been used in many fields, including field of urban planning, where GIS is the cornerstone of urban planners because it simulates reality, explores points of vulnerability and gives timely solutions at low cost. There are different GIS applications according to the stages and levels of sectors and functions of the various urban planning. With increased ease of use and reduced GIS prices, GIS has become the practical and reasonable system for planners and an important component in supporting planning systems.

Recent developments in the integration of geographic information systems with planning models, visualization, and the internet, make GIS more useful in urban planning. It is known that data collection is difficult and costly task in the planning process. Today it is possible to obtain a lot of data required at no cost through the websites specialized in GIS.

This research highlights the process of collecting and filtering processes, analysis and presentation of geographical data as well as a data collection method of specialized websites, easily and free of charge, using GeoPlanner for ArcGIS Application which is one of GIS applications online. I found GeoPlanner for ArcGIS application has been the appropriate tools and assistance in the urban planning process, because its tools can explore, collect, analyze, process, and provide information in a variety of easy to understand formats capable of performing complex and difficult tasks such as Nassiriyah city problems.

I think that this research is the first paper which highlights GeoPlanner for ArcGIS application in Iraq and Arab countries, therefore I wrote the details of how we can use it.

**Keywords**: GeoPlanner for ArcGIS is the best application for urban planning

## 1. Introduction

The phenomenon of population growth of Nasiriyah city has directly affected the spatial expansion of the city. The city has expanded at the expense of the surrounding agricultural lands to accommodate the rising population growth, reflecting the negative effect of the devastating wars that Iraq went through during more than three decades. These wars, in addition to the neglect of master planning of the city has resulted in poor urban planning process and in losing the balance between the elements of land use. The lack of funds denied the city from many essential public services and utilities resulting in the creation of many problems such as:

1. There was a rapid increase in the population due to natural population growth plus the migration of people from other unsafe places to Nasiriyah city;

2. Random distribution of services;

3. Significant shortage of services compared to the population needs;

4. The concentration of population masses on specific areas of the city;

5. Shrinking of green areas;

6. Increase of pollution sources;

7. Neglecting the standards of urban planning of the city which are necessary to create a balance between population and services;

8. The use of poor urban planning that was done with old, slow and costly traditional methods has led to problems in the preparation of data and maps.

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All these and other causes inflicted on Nasiriyah city made the problems chronic and complex. In order to find urgent and future solutions to these problems and making the right decisions, there must be a systematic and real evaluation of the current situation, and the changes that took place in land use and what factors dictated such changes and the extent of deviation in land use compared to the national standard of urban planning. The lack of essential services such as education, health and provision of green areas should also be evaluated

## 2. Problem Statement

Nasiriyah city suffered greatly because of wars from the 1980s to 2003. These wars, in addition to the neglect of master planning of the city has resulted in poor urban planning process and in losing the balance between the elements of land use. As well as using poor urban planning that depends on old, slow and costly traditional methods. Therefore, the results were clear with the emergence of major problems such as:

- The rapid change in population growth;
- Random distribution of services;
- Significant shortage of services compared to the population needs;
- A significant deviation between the current situation and the standards of Urban planning;
- The lack of balance in the elements of land use;
- Facilities (Education, Health, etc.) do not accommodate the population density of the city

## 3. Study Objectives

The objectives of the study are:
- Studying the spatial distribution of the population;
- Studying the spatial distribution of educational, health services and open space;
- Comparison of the distribution of facilities with the national standards of urban planning;
- Know the extent of services in each zone of the city;
- Find the relationship between population size and services size;
- Explore underserved population;
- Highlight the modern applications of geographic information systems specialized in urban planning;
- Highlight spatial data sources;
- Highlight the modern GIS methods for the integration of spatial and non-spatial data;
- Prove that GeoPlanner for ArcGIS application is the appropriate tool in the process of studying cities and urban planning.

## 4. The limits of study

The study area is Nasiriyah city, it is one of south Iraq cities. It is located along the banks of the Euphrates river, the geographic coordinates of its location WGS 84 (31° 10′-30° 19′ NØ, 46° 24′- 46°20′ E ℓ). The Projected coordinate system is UTM zone 38 N. It is at about (370 km) southeast of Baghdad that is the capital of Iraq, It is close to the archeological site of Ur (4000 BC), about 10 KM, figur no 1. It is the capital of Dhi -Qar Governorate. Its population in 2018, is about 647,000 [1]
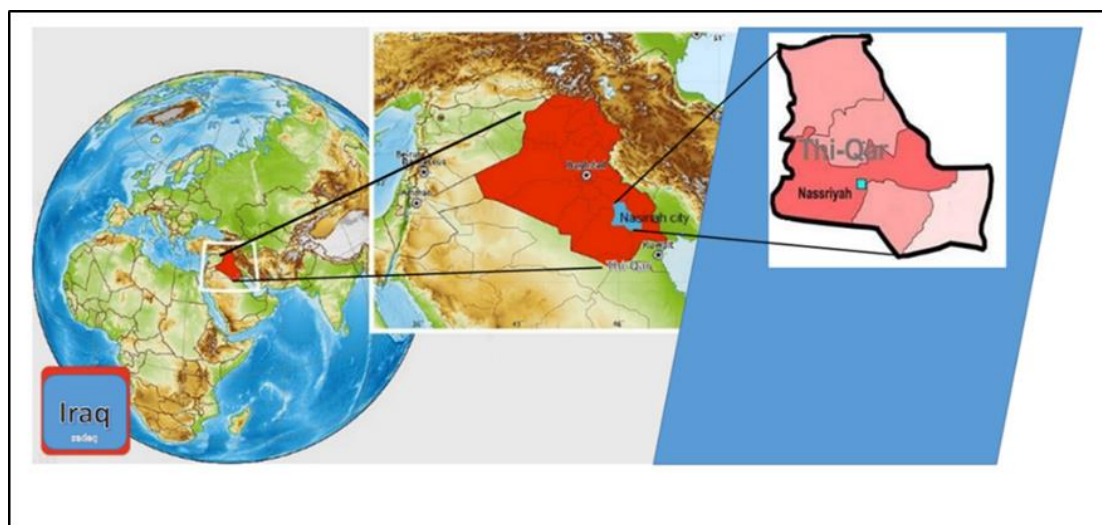


**Fig.1** The location of Nasiriyah city     [Prepared by the author from Web mapping sites and ArcGIS app.]

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*4.1 The Neighborhoods of Nasiriyah city*

Nasiriyah city consists of 38 neighborhoods with a total area of about 5293 hectares figure no 2 and an estimated population of 647, 000. [2]
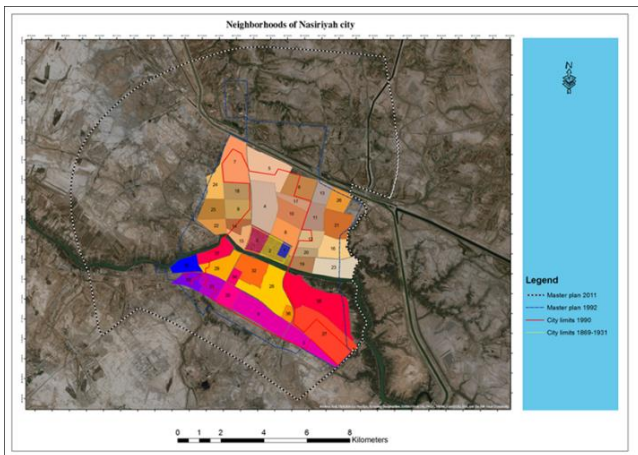


**Fig.2** Neighborhoods Nasiriyah city

*4.2 Reasons for Choosing the Study Area*

*4.2.1 Strategic Position and Corridors*

Nasiriyah city is the capital of The Governorate of Thi-Qar. It is located in the heart of southern Iraq, which has the second largest oil reserves in the world. Nasiriyah has a strategic location in the center of five governorates. Nasiriyah has strategic location close to the main expressway linking the port of Basrah in the south with Baghdad and most of the governorates. The main railway line between Basrah and Baghdad runs through Nasiriyah. The city is well placed to accommodate much of the opportunities for development, figure no 3 below shows the transport network.[3]
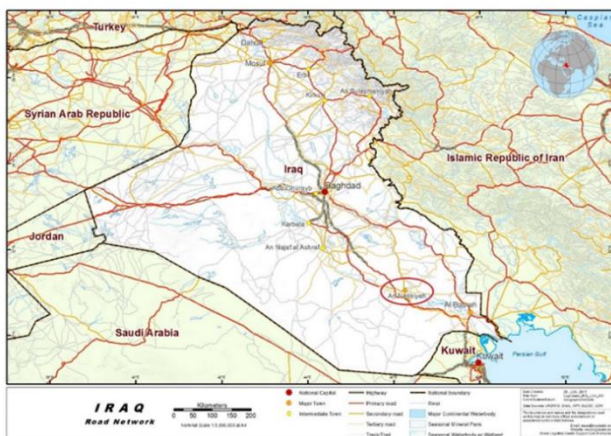


**Fig.3** Iraq road network and location of Nasiriyah city

*4.2.2 Historical Depths and Culture*

In Istanbul on 17 July—2016 "The World Heritage Committee "inscribed seven new sites in Iraq on UNESCO's World Heritage List, six of them are in Thi Qar province. Three archaeological sites and four wetland marsh areas in southern Iraq. The archaeological cities of Uruk and Ur and the Tell Eridu archaeological site form part of the remains of the Sumerian cities and settlements that developed in southern Mesopotamia between the 4th and the 3rd millennium BCE in the marshy delta of the Tigris and Euphrates rivers. The Ahwar of Southern Iraq – also known as the Iraqi Marshlands – are unique, as one of the world's largest inland delta systems, in an extremely hot and arid environment.[4],[5]

**5. Methodology**

1. Applied approach: which depends on GeoPlanner for GIS application: GeoPlanner for ArcGIS, it is one of GIS online applications, very modern application and Specialist in urban planning.

2. Descriptive approach: This approach that I used to identify the characteristics of Nasiriyah city; with a view to establishing the relationship between them and the human and natural factors that led to the spatial distribution for facilities.

3. 3.Analytical Approach: Through this approach, I explored problems by analyzing the factors that influence the spatial distribution of populations and facilities and the relationship between them

**6. GIS applications used**

*6.1- GeoPlanner for ArcGIS Application*

GeoPlanner for ArcGIS is a web-based geodesign app that helps to create, analyze and report on planning alternatives. The app supports common planning and design options like project definition, suitability assessment, scenario creation, design comparison, evaluation and reporting. It integrates online data, analysis tools, weighted raster overlay, landscape content, sketching tools, and Geo Enrichment services to help visualize and understand a plan or a design, in the figure no 4. I have shown the interface of GeoPlanner for ArcGIS application. [6]

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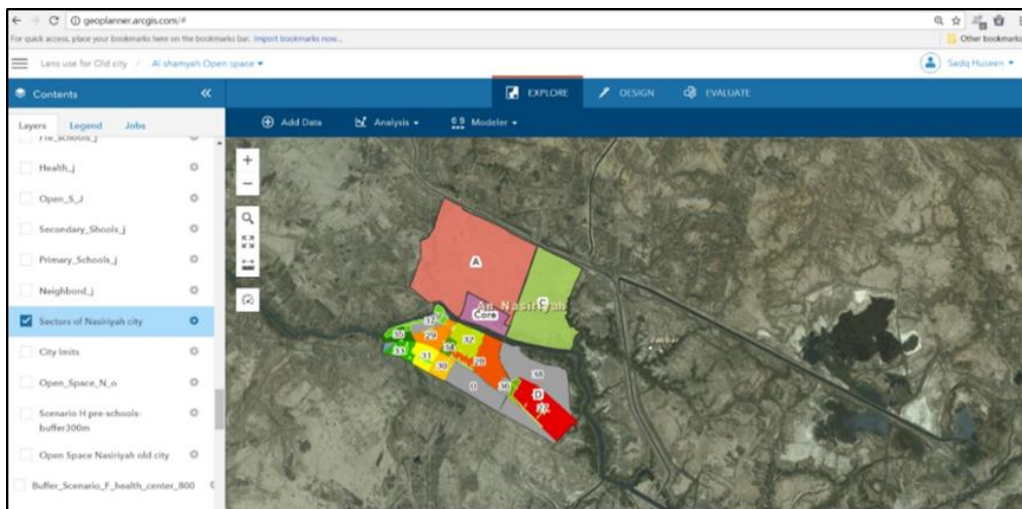
**Fig. 4** The interface of GeoPlanner for ArcGIS application
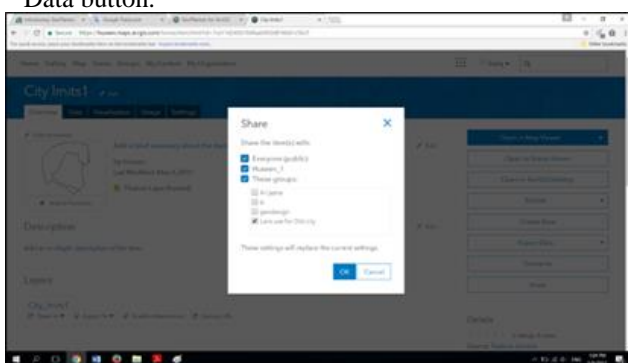
*6.1.1 The Application Tools*

**A-** **Add data tool***:* When pressing Add data as shown in the figure no 4 above, the system will go to the page of the data import as shown in the figure no 5 below, which contains many options for adding and sharing data.In this research, I adopted a very easy way to add data:

o Converting feature class to shapefile;

o Converting shapefile to zip;

o From ArcGIS online page and then My Content (add item button), as shown in figure 5;
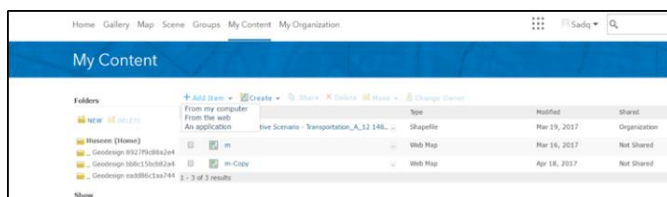


**Fig.5** Adding data in ArcGIS online

o Sharing of the item (shape file format zip) as shown in figure 6; From GeoPlanner for ArcGIS and then Add Data button.



**Fig.6** Sharing data in ArcGIS online

**B-** **Analysis tools GeoPlanner***:* The application has spatial analysis tools within the Explore list. These tools are: Summarize data, Find locations, Data enrichment, Analyze patterns, Use proximity and Manage Data, as shown in figure no 7. In this research, I used some of the important tools in Group (Use Proximity) such as the tool "Create Buffers" as shown in figure no 8.
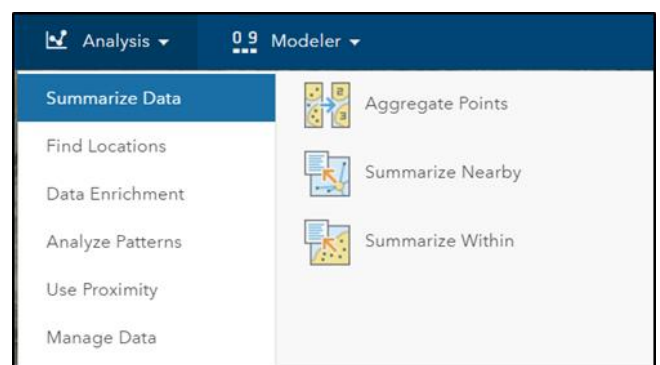


**Fig.7** Spatial analysis tools in GeoPlanner for ArcGIS
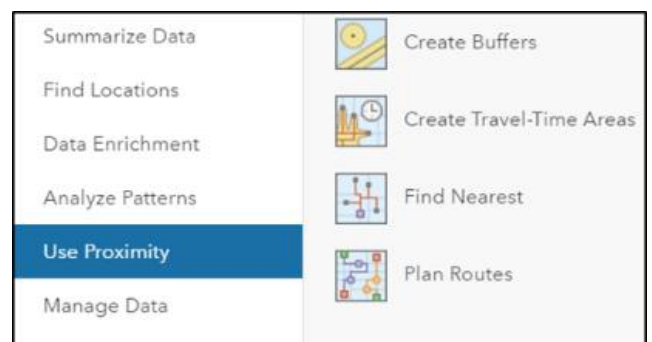


**Fig. 8** "Use Proximity" tools in GeoPlanner for ArcGIS

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**C- Design tool**: Design tool allows sketching, painting, importing, modifying, and deleting design features. These tools help to create plans and designs within multiple scenarios, as shown in figure no 9.
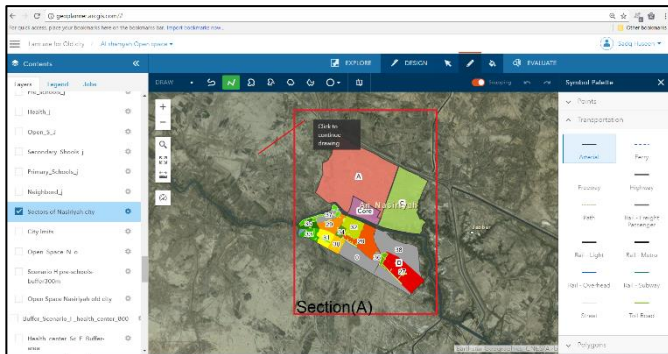


**Fig. 10** Evaluation tools
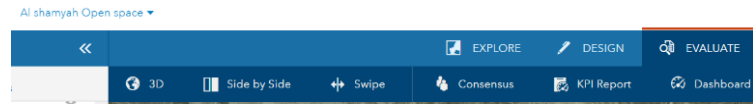


**Fig. 11** Dashboard tool
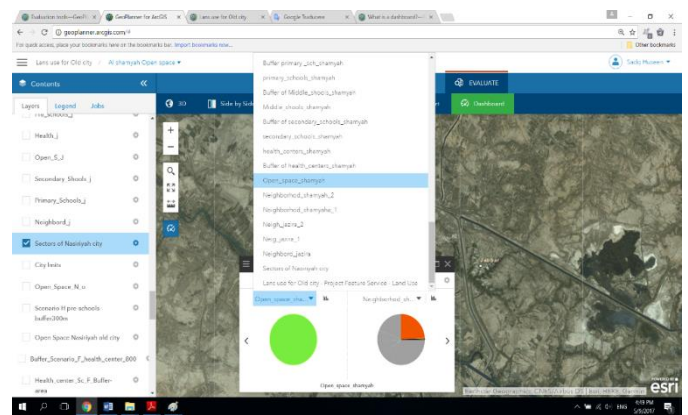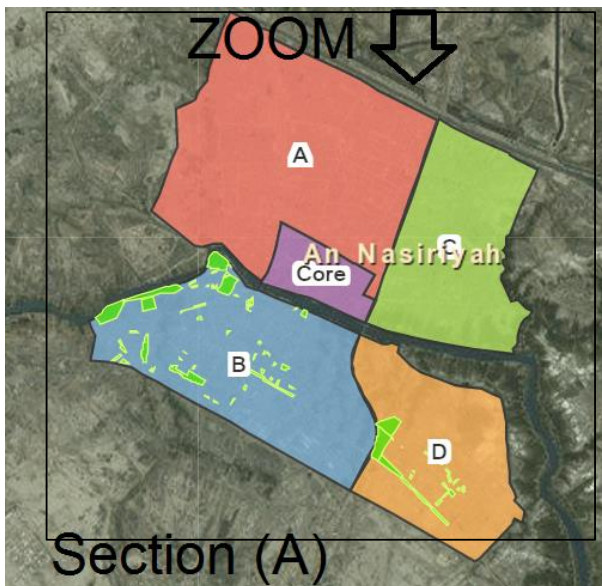




**Fig. 12** Side by Side tool

**D- Evaluation tools**: There are four evaluation tools: 3D, Side by side, Swipe, Consensus, KPI Report and Dashboard tool. These tools are available from the Evaluate segment of the application toolbar, as shown in figure no 10. The most important of the tools above is the Dashboard tool, it displays key performance indicator (KPI) information in easy-to-read gauges and charts. The dashboard displays qualitative and quantitative information about the Active Scenario point, line, and polygon features, as shown in figure no 11. Also Side by Side tool is a tool for comparison and evaluation between two scenarios, as shown in figure no 12. [2.8]

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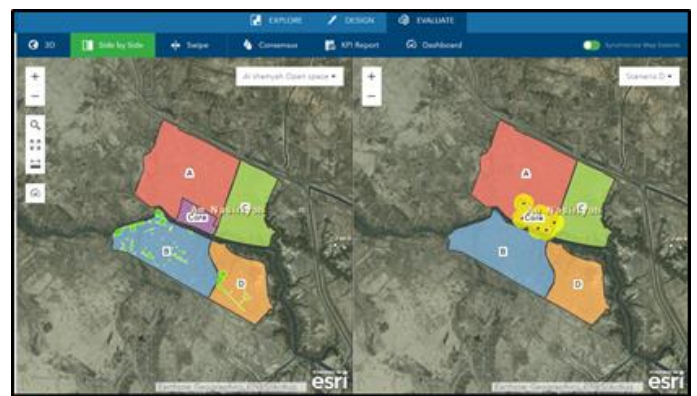
*6.1.2 Working Method with GeoPlanner for ArcGIS Application:*

- I created a Scenario;
- I added layers, such as primary schools;
- I created a buffer to layer the primary schools with equal access distance in the National Standard Urban Planning which is 500 m;
- I add layer of neighborhoods, such as Aljazeera part for city of Nasiriyah, where there are a total of 23 neighborhoods;
- I used Classify tool for each layer above (GeoPlanner helps to display these impacts by assigning or classifying attribute values within a dataset to a suitability scale)
  - For the layer of (Buffer 500 m) primary schools as shown in figure no 13; and its index no 1.
  - For the layer of neighborhoods, classification of colors in this case by codes (Numbers) of neighborhoods, as shown in figure no14 and its index no.2



**Fig.14** Classification of colors by codes of neighborhoods in classify tool
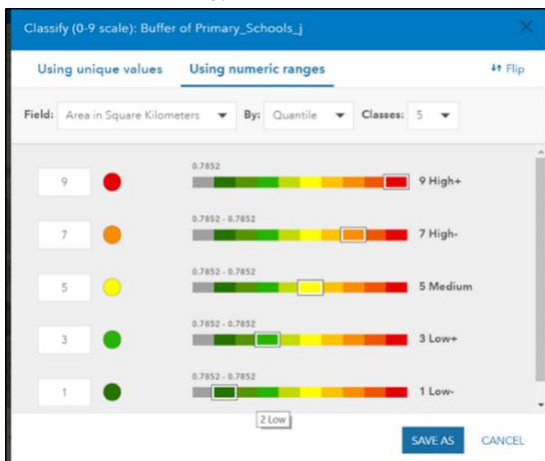


**Fig. 13** Classification of colors by impact degree of primary schools in classify tool

**Index:1** classification of colors by impact degree of primary schools in classify tool

| No | colure | Impact degree | Effect Power | Interpretation |
|----|--------|---------------|--------------|----------------|
| 1 | Red | 9 High | First | The service is excellent |
| 2 | Brown | 7 High | Second | The service is good |
| 3 | Yellow | 5 Medium | Third | The service is medium |
| 4 | Green | 3 Low | Forth | The service is poor |
| 5 | Green Forest | 1 Low | Fifth | The service is bad |

**Index:2** classification of colors by codes of neighborhoods in classify tool

| No | Number of neighborhoods | Codes of neighborhood in Classify tool |
|----|-------------------------|----------------------------------------|
| 1 | 5 | 8 High |
| 2 | 15 | 0 Exclusion |
| 3 | 6 | 7 High |
| 4 | 7 | 6 Medium |
| 5 | 8 | 5 Medium |

• Using Dashboard tool, I selected the two layers in the previous step by this tool, the dashboard allows to track the impact of primary schools on neighborhoods across indicated areas, which lead me to easily evaluate advantages and disadvantages. The effect of the total area of "Buffer of the school hectares" was calculated for each neighborhood of the city as shown in figure no 15.
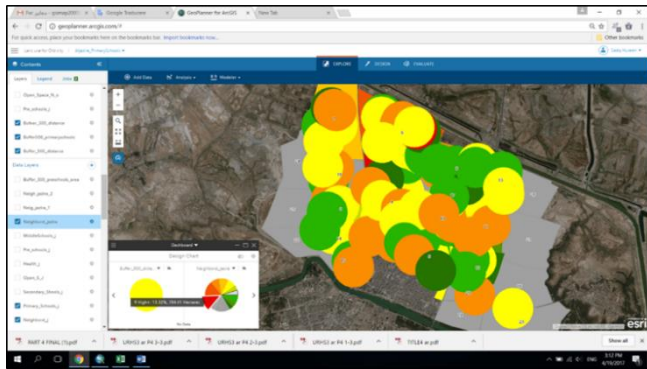


**Fig.15** Dashboard tool results

### 6.2- ArcGIS online application

It is a GIS online system, based on collaboration that allows the users to use, create and share maps, scenes, applications, theme layers, analysis and data.**[7]**

#### 6.2.1- Analysis Tools
Analysis tools in ArcGIS online are similar to the analysis tools in GeoPlanner for ArcGIS, as shown in figure no 16.



**Fig.16** Analysis tools in GIS online

In this research, I used ArcGIS online to import and export spatial data, to export certain maps and as a database for my project as shown in figure 17.



**Fig. 17** Database in ArcGIS online

### 6.3 - QGIS software

QGIS (previously known as Quantum GIS) is a free and open-source cross-platform desktop geographic information system (GIS) application that supports viewing, editing, and analysis of geospatial data. In Iraq QGIS is as not famous as ArcGIS Desktop application, but it is a very important application and widely used in Europe, America, Australia and other countries because it has more advantages than ArcGIS Desktop, both of them are free and the installation process is very easy.[8]

## 7. Data sources

GIS data collection is one of the most important, since the cost of this part of the project may become a great burden for the rest of the future analysis that is going to be performed with this data and its incorporation into the system. This is the process called "data capture". The fact is that data capture is one of the most time consuming processes in GIS. In this research,[9]

I collected necessary data for my work from many sources such as Government institutions:

- Department Urban Planning in Dhi Qar;
- Municipality of Nasiriyah Also from some web mapping sites such as:

- Open street map; figure no 18
- ArcGIS online; figure no 19
- Earth Explorer USGS web, figure no 20
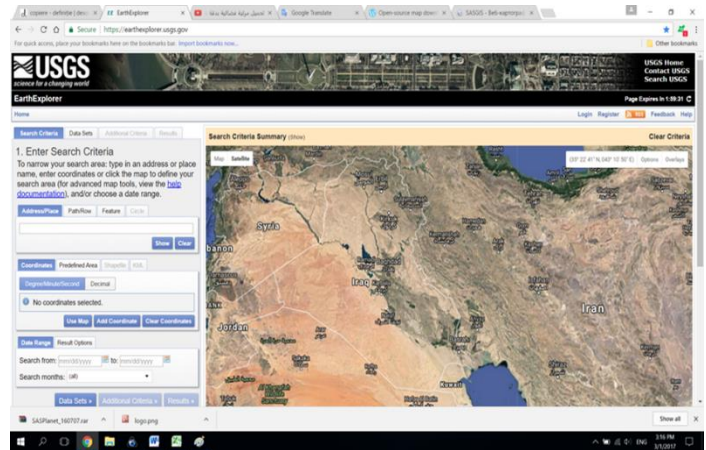


**Fig. 20** Download interface of USGS

*7-1. Data types*

Data types were:
- Vector GIS layers map;

- Tabular data;
- Cad files;
- Orto-imagery;
- Graphic data (Maps);
- GPS data from site, as illustrated in figure no 21.
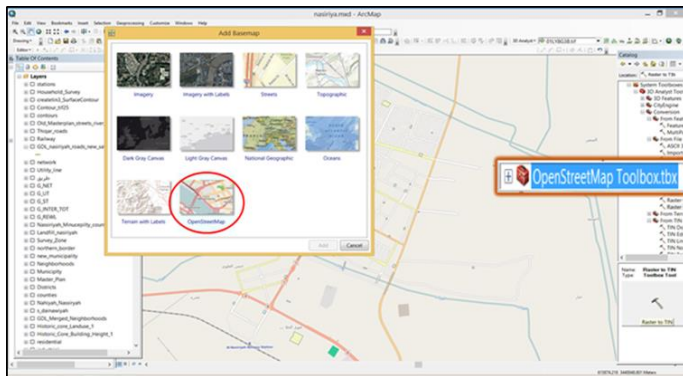


**Fig.18** Data collection online by Open Street Map



**Fig.19** Data collection online by ArcGIS online
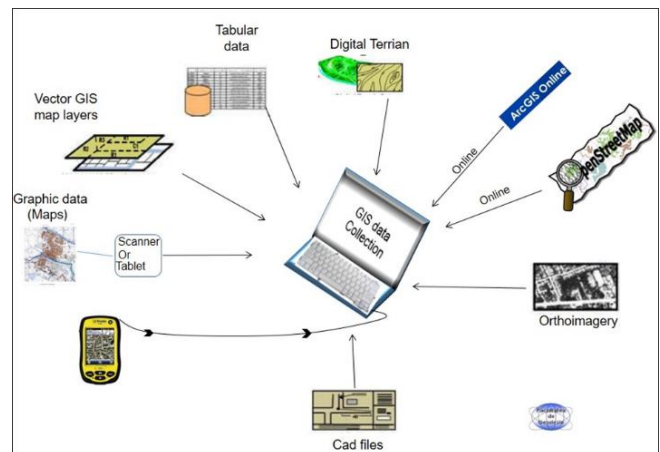


**Fig. 21**- Data types and source

## 8- Flowchart of work

In order for the GIS application to be most effective, it must be planned and implemented according to a structured process which ensures that all of the activities are under check. The planning and implementation process of the project can be described in six basic phases[10]:

1. Identify the project objectives;

2. GIS data collection;

3. Geodatabase design;

4. The Implementation of geodatabase;

5. Data management and analysis;

6. Result collection and solution proposal.

Figure no 22 displays a flowchart which includes six basic phases that contain activities and processes from the phase of identify the project objectives to the phase of the suggestion of optimal solutions. This chart was obtained with the help of the tools available in GIS applications.
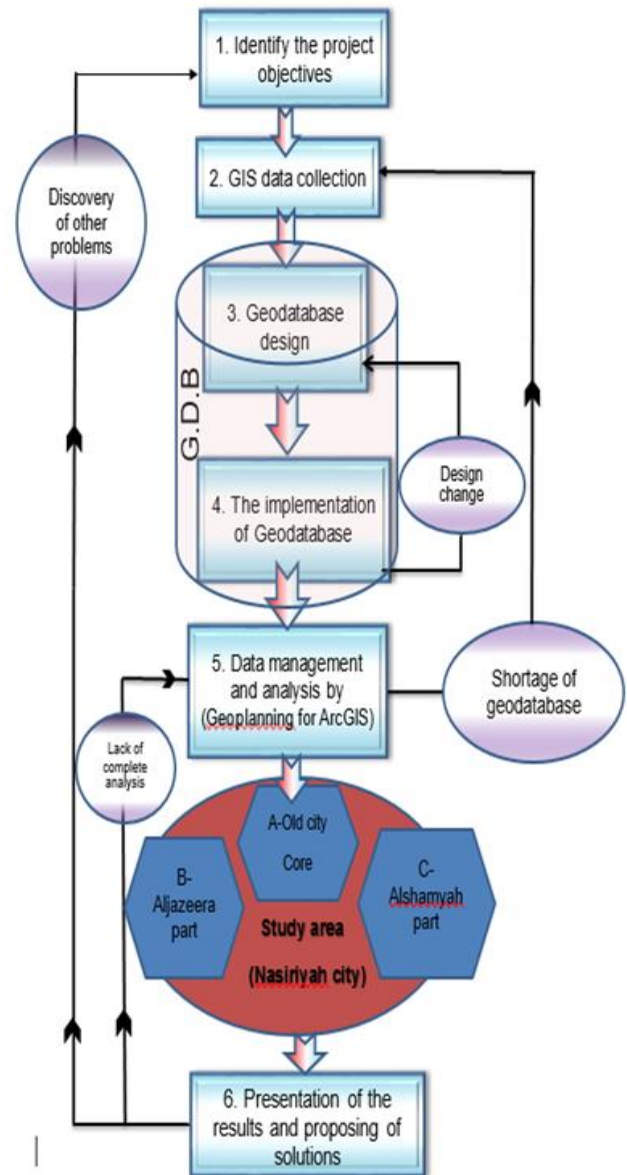


**Fig. 22** Diagram of implementation of the project phases

*8-1 Presentation of results*

The results which I obtained from application of the flowchart of work were very interesting, where I have got values that are amount of the coverage area of service (measurement in hectares) for the facilities (education, health and green area) for each neighborhood of Nasiriyah city which contains 38 neighborhoods, I collected results in tables 1, 2 and 3) which are summary results of analysis for the facilities in the neighborhoods of the city.

**Table 1** Quantity of facilities (**primary schools** and **kindergartens)** impact on neighborhoods (measurement in hectares) [*prepared by the author using GeoPlanner for ArcGIS*]

| Neighborhood code | Neighborhood name | primary schools | Kinder-garten |
|---|---|---|---|
| 1 | Shaqia | 130.665 | 0.000 |
| 2 | Almajad | 458.227 | 16.885 |
| 3 | Tamoz | 293.966 | 11.341 |
| 4 | Sommer | 784.405 | 53.000 |
| 5 | Aredo | 860.373 | 75.078 |
| 6 | Alshuhdae | 501.148 | 40.773 |
| 7 | AlSadr | 546.493 | 3.976 |
| 8 | Salhia | 493.492 | 125.169 |
| 9 | Ur | 298.569 | 44.275 |
| 10 | Alaskari | 476.414 | 85.761 |
| 11 | Alshurta'a | 273.246 | 29.556 |
| 12 | Altdhia | 223.190 | 53.000 |
| 13 | Fida | 232.613 | 21.544 |
| 14 | Alepeshair | 141.923 | 7.181 |
| 15 | Aladara-Almh | 129.556 | 0.000 |
| 16 | Bekaa | 34.156 | 0.000 |
| 17 | Alravdin | 136.623 | 8.131 |
| 18 | AlHussein | 206.113 | 25.580 |
| 19 | Alkadhraa | 18.845 | 0.000 |
| 20 | Al-Zahra | 48.289 | 0.000 |
| 21 | Alyarmook | 11.778 | 0.000 |
| 22 | Alsumood | 22.967 | 1.009 |
| 23 | Aletihad | 49.467 | 0.000 |
| 24 | Aljamaheer | 46.523 | 0.000 |
| 25 | Alakhlas | 30.034 | 2.849 |
| 26 | Anahdah | 41.223 | 0.000 |
| 27 | Askan_alsan | 279.324 | 0.000 |
| 28 | Shoumoukh | 113.146 | 21.027 |
| 29 | Alaguetsadin | 225.428 | 24.786 |
| 30 | Alskak-Amart | 159.959 | 35.031 |
| 31 | Ithora | 194.853 | 10.513 |
| 32 | Alasekan | 195.198 | 30.975 |
| 33 | Mansuri | 102.263 | 0.000 |
| 34 | Alshala | 98.808 | 0.000 |
| 35 | Mansuri-Eneg | 41.285 | 0.000 |
| 36 | Alamel | 0.000 | 0.000 |
| 37 | Almtenzha | 110.900 | 3.278 |
| 38 | Aliboviahd | 31.266 | 0.000 |
| Total | | 8042.728 | 730.719 |

**Table 2** Quantity of facilities (**Middle** and **Secondary** **schools**) impact on neighborhoods (measurement in hectares) [*prepared by the author using GeoPlanner for ArcGIS*]

| Neighborhood code | Neighborhood name | **Middle** Schools | **Secondary** schools |
|---|---|---|---|
| 1 | Shaqia | 42.331 | 75.184 |
| 2 | Almajad | 233.901 | 266.764 |
| 3 | Tamoz | 156.321 | 235.906 |
| 4 | Sommer | 200.757 | 688.722 |
| 5 | Aredo | 262.064 | 252.893 |
| 6 | Alshuhdae | 161.058 | 301.542 |
| 7 | AlSadr | 156.284 | 421.757 |
| 8 | Salhia | 60.177 | 337.325 |
| 9 | Ur | 4.020 | 141.926 |
| 10 | Alaskari | 4.397 | 432.613 |
| 11 | Alshurta'a | 15.829 | 71.566 |
| 12 | Altdhia | 122.866 | 166.451 |
| 13 | Fida | 59.926 | 75.185 |
| 14 | Alepeshair | 49.875 | 110.565 |
| 15 | Aladara-Almh | 76.132 | 125.844 |
| 16 | Bekaa | 0.000 | 13.670 |
| 17 | Alravdin | 12.689 | 188.966 |
| 18 | AlHussein | 0.879 | 184.544 |
| 19 | Alkadhraa | 0.000 | 3.619 |
| 20 | Al-Zahra | 11.307 | 71.164 |
| 21 | Alyarmook | 0.000 | 0.000 |
| 22 | Alsumood | 0.000 | 28.546 |
| 23 | Aletihad | 0.000 | 0.000 |
| 24 | Aljamaheer | 0.000 | 47.443 |
| 25 | Alakhlas | 0.000 | 4.825 |
| 26 | Anahdah | 7.161 | 36.185 |
| 27 | Askan_alsan | 0.000 | 307.573 |
| 28 | Shoumoukh | 4.947 | 156.078 |
| 29 | Alaguetsadin | 126.022 | 344.723 |
| 30 | Alskak-Amart | 33.967 | 135.091 |
| 31 | Ithora | 91.113 | 120.376 |
| 32 | Alasekan | 96.059 | 378.737 |
| 33 | Mansuri | 0.000 | 114.104 |
| 34 | Alshala | 76.226 | 115.792 |
| 35 | Mansuri-Eneg | 0.000 | 109.038 |
| 36 | Alamel | 0.000 | 180.926 |
| 37 | Almtenzha | 30.905 | 158.250 |
| 38 | Aliboviahd | 0.000 | 35.703 |
| Total | | 2097.212 | 6439.597 |

**Table 3** Quantity of facilities (Health center) impact on neighborhoods and  area of open space for each neighborhood (measurement in hectares) [*prepared by the author using GeoPlanner  for ArcGIS*]

| Neighborhood code | Neighborhood name | Health center | Open space |
|---|---|---|---|
| 1 | Shaqia | 50.598 | 0.385 |
| 2 | Almajad | 218.918 | 0.959 |
| 3 | Tamoz | 110.364 | 2.024 |
| 4 | Sommer | 533.127 | 17.344 |
| 5 | Aredo | 396.589] | 9.951 |
| 6 | Alshuhdae | 210.597 | 21.680 |
| 7 | AlSadr | 214.457 | 21.077 |
| 8 | Salhia | 171.035 | 11.170 |
| 9 | Ur | 0.000 | 3.204 |
| 10 | Alaskari | 287.551 | 16.403 |
| 11 | Alshurta'a | 50.900 | 12.802 |
| 12 | Altdhia | 64.409 | 12.008 |
| 13 | Fida | 0.000 | 8.451 |
| 14 | Alepeshair | 0.000 | 0.470 |
| 15 | Aladara-Almh | 0.000 | 1.146 |
| 16 | Bekaa | 84.432 | 0.000 |
| 17 | Alravdin | 64.651 | 2.704 |
| 18 | AlHussein | 52.348 | 4.527 |
| 19 | Alkadhraa | 0.000 | 0.000 |
| 20 | Al-Zahra | 0.000 | 3.234 |
| 21 | Alyarmook | 0.000 | 0.000 |
| 22 | Alsumood | 0.000 | 0.000 |
| 23 | Aletihad | 107.349 | 0.000 |
| 24 | Aljamaheer | 18.575 | 0.000 |
| 25 | Alakhlas | 0.000 | 0.000 |
| 26 | Anahdah | 0.000 | 0.000 |
| 27 | Askan_alsan | 173.205 | 39.178 |
| 28 | Shoumoukh | 51.946 | 6.160 |
| 29 | Alaguetsadin | 342.712 | 2.772 |
| 30 | Alskak-Amart | 167.416 | 1.823 |
| 31 | Ithora | 216.145] | 8.242 |
| 32 | Alasekan | 212.446 | 2.513 |
| 33 | Mansuri | 36.828 | 8.291 |
| 34 | Alshala | 133.000 | 0.136 |
| 35 | Mansuri-Eneg | 9.328 | 22.964 |
| 36 | Alamel | 0.000 | 0.000 |
| 37 | Almtenzha | 100.835 | 29.888 |
| 38 | Aliboviahd | 3.699 | 0.628 |
| Total | | 4083.459 | 272.136 |

## 8.1.1 Arrange of Neighborhoods

Depending on tables 1, 2 and 3, the neighborhoods can be arranged by volume of service in tables 5, 6 and 7. For results to be clear, I made table number 4 below, which it's showing neighborhood code and its name.

**Table 4** neighborhood name and its code

| Neighborhood name | Neighborhood code |
|---|---|
| Shaqia | 1 |
| Almajad | 2 |
| Tamoz | 3 |
| Sommer | 4 |
| Aredo | 5 |
| Alshuhdae | 6 |
| AlSadr | 7 |
| Salhia | 8 |
| Ur | 9 |
| Alaskari | 10 |
| Alshurta'a | 11 |
| Altdhia | 12 |
| Fida | 13 |
| Alepeshair | 14 |
| Aladara-Almh | 15 |
| Bekaa | 16 |
| Alravdin | 17 |
| AlHussein | 18 |
| Alkadhraa | 19 |
| Al-Zahra | 20 |
| Alyarmook | 21 |
| Alsumood | 22 |
| Aletihad | 23 |
| Aljamaheer | 24 |
| Alakhlas | 25 |
| Anahdah | 26 |
| Askan_alsan | 27 |
| Shoumoukh | 28 |
| Alaguetsadin | 29 |
| Alskak-Amart | 30 |
| Ithora | 31 |
| Alasekan | 32 |
| Mansuri | 33 |
| Alshala | 34 |
| Mansuri-Eneg | 35 |
| Alamel | 36 |
| Almtenzha | 37 |
| Aliboviahd | 38 |

**Table 5** Arrange of neighborhoods by service size of kindergartens and primary schools [*prepared by the author using GeoPlanner for ArcGIS*]

| Arrangement of Neighborhoods | Kindergartens (Neigh. Code) | Primary schools (Neigh. Code) |
|---|---|---|
| First | 8 | 5 |
| Second | 10 | 4 |
| Third | 5 | 7 |
| Fourth | 4 | 6 |
| Fifth | 12 | 8 |
| sixth | 9 | 10 |
| Seventh | 6 | 2 |
| Eighth | 30 | 9 |
| Ninth | 32 | 3 |
| tenth | 11 | 27 |
| 11st | 18 | 11 |
| 12nd | 29 | 13 |
| 13rd | 13 | 29 |
| 14th | 28 | 12 |
| 15th | 2 | 18 |
| 16th | 3 | 32 |
| 17th | 31 | 31 |
| 18th | 17 | 30 |
| 19th | 14 | 14 |
| 20th | 7 | 17 |
| 21st | 37 | 1 |
| 22nd | 25 | 15 |
| 23rd | 22 | 28 |
| 24th | 27 | 37 |
| 25th | 35 | 33 |
| 26th | 33 | 34 |
| 27th | 20 | 23 |
| 28th | 15 | 20 |
| 29th | 38 | 24 |
| 30th | 1 | 35 |
| 31st | 34 | 26 |
| 32nd | 23 | 16 |
| 33rd | 16 | 38 |
| 34th | 24 | 25 |
| 35th | 36 | 22 |
| 36th | 26 | 19 |
| 37th | 19 | 21 |
| The last | 21 | 36 |

**Table 6** Arrange of neighborhoods by service size of middle Schools and secondary school [*prepared by the author using GeoPlanner for ArcGIS*]

| Arrangement of Neighborhoods | Middle Schools (niegh Code) | Secondary school (niegh. Code) |
|---|---|---|
| First | 5 | 4 |
| Second | 2 | 10 |
| Third | 4 | 7 |
| Fourth | 6 | 32 |
| Fifth | 3 | 29 |
| sixth | 7 | 8 |
| Seventh | 29 | 27 |
| Eighth | 12 | 6 |
| Ninth | 32 | 2 |
| tenth | 31 | 5 |
| 11st | 34 | 3 |
| 12nd | 15 | 17 |
| 13rd | 8 | 18 |
| 14th | 13 | 36 |
| 15th | 14 | 12 |
| 16th | 1 | 37 |
| 17th | 30 | 28 |
| 18th | 37 | 9 |
| 19th | 11 | 30 |
| 20th | 17 | 15 |
| 21st | 20 | 31 |
| 22nd | 26 | 34 |
| 23rd | 28 | 33 |
| 24th | 10 | 14 |
| 25th | 9 | 35 |
| 26th | 18 | 13 |
| 27th | 27 | 1 |
| 28th | 33 | 11 |
| 29th | 23 | 20 |
| 30th | 24 | 24 |
| 31st | 35 | 26 |
| 32nd | 16 | 38 |
| 33rd | 38 | 22 |
| 34th | 25 | 16 |
| 35th | 22 | 25 |
| 36th | 19 | 19 |
| 37th | 21 | 23 |
| The last | 36 | 21 |

**Table 7** Arrange of neighborhoods by service size of health center and Open space [*prepared by the author using GeoPlanner for ArcGIS*]

| Arrangement of Neighborhoods | Health center (niegh Code) | Open space (niegh Code) |
|---|---|---|
| First | 4 | 27 |
| Second | 5 | 37 |
| Third | 29 | 35 |
| Fourth | 10 | 6 |
| Fifth | 2 | 7 |
| sixth | 31 | 4 |
| Seventh | 7 | 10 |
| Eighth | 32 | 11 |
| Ninth | 6 | 12 |
| Tenth | 27 | 8 |
| 11st | 8 | 5 |
| 12nd | 30 | 13 |
| 13rd | 34 | 33 |
| 14th | 3 | 31 |
| 15th | 23 | 28 |
| 16th | 37 | 18 |
| 17th | 16 | 20 |
| 18th | 17 | 9 |
| 19th | 12 | 29 |
| 20th | 18 | 17 |
| 21st | 28 | 32 |
| 22nd | 11 | 3 |
| 23rd | 1 | 30 |
| 24th | 33 | 15 |
| 25th | 24 | 2 |
| 26th | 35 | 38 |
| 27th | 38 | 14 |
| 28th | 36 | 1 |
| 29th | 9 | 34 |
| 30th | 15 | 23 |
| 31st | 14 | 16 |
| 32nd | 13 | 24 |
| 33rd | 20 | 36 |
| 34th | 26 | 26 |
| 35th | 22 | 22 |
| 36th | 25 | 25 |
| 37th | 19 | 19 |
| The last | 21 | 21 |

*8.1.2 The Number of Buildings Needed*

By analyzing the results in tables 1,2 and 3, and comparing them with the population per neighborhood, I have obtained the number of buildings needed for each locality according to the national standard of urban planning as shown in tables 8,9 and 10 , in this process I had needed for the population of Nasiriyah city 2018 for each neighborhood, I obtained it by use of population growth formula (formula no. 1 and no 2[11])

$$r = \sqrt[n]{Pn / Po} - 1 \ \text{.............. (1)}$$

$$Pn = Po \ (1 + r)^{\wedge} n \ \text{........... (2)}$$

**Table 8** The buildings need of kind. and primary sch. [*prepared by the author using GeoPlanner for ArcGIS*]

| Code | Neigh. | The need of buildings | |
|---|---|---|---|
| | | kindergarten | primary sch. |
| 1 | Alsherqia | 8 | 6 |
| 2 | Almajad | 4 | 0 |
| 3 | Tamoz | 5 | 2 |
| 4 | Sommer | 13 | 6 |
| 5 | Aredo | 11 | 4 |
| 6 | Alshuhda | 10 | 6 |
| 7 | AlSadr | 11 | 4 |
| 8 | Salhia | 5 | 3 |
| 9 | Ur | 6 | 4 |
| 10 | Alaskari | 4 | 2 |
| 11 | Alshurta' | 5 | 3 |
| 12 | Altdhia | 4 | 3 |
| 13 | Fida | 4 | 2 |
| 14 | Alpeshair | 3 | 1 |
| 15 | Aladara | 2 | 1 |
| 16 | Bekaa | 2 | 2 |
| 17 | Alravdin | 1 | 0 |
| 18 | Hussein | 1 | 0 |
| 19 | Kadhraa | 1 | 1 |
| 20 | Al-Zahra | 1 | 1 |
| 21 | yarmook | 1 | 1 |
| 22 | Sumood | 1 | 1 |
| 23 | Aletihad | 1 | 0 |
| 24 | Aljamaheer | 1 | 0 |
| 25 | Alakhlas | 1 | 1 |
| 26 | Anahdah | 1 | 0 |
| 27 | Alaskan_alsan. | 8 | 5 |
| 28 | Al Shoumoukh | 6 | 6 |
| 29 | Alaguetsaddein | 4 | 3 |
| 30 | Alskak-Amarat | 4 | 3 |
| 31 | Ithora | 4 | 2 |
| 32 | Alasekan | 2 | 1 |
| 33 | Mansuri | 3 | 2 |
| 34 | Alshala | 2 | 1 |
| 35 | Mansuri/energy | 2 | 2 |
| 36 | Alamel | 2 | 2 |
| 37 | Almtenzha | 2 | 1 |
| 38 | Aliboviahd | 1 | 1 |
| Total | | 147 | 83 |

**Table 9** The buildings need of middle schools and Secondary schools [*prepared by the author using GeoPlanner for ArcGIS*]

| Code | Neigh. | The need of buildings | |
|------|--------|-------------|--------------|
| | | middle sch. | secondary sch. |
| 1 | Alsherqia | 1 | 2 |
| 2 | Almajad | 0 | 0 |
| 3 | Tamoz | 0 | 0 |
| 4 | Sommer | 1 | 0 |
| 5 | Aredo | 0 | 2 |
| 6 | Alshuhda | 1 | 1 |
| 7 | AlSadr | 2 | 1 |
| 8 | Salhia | 2 | 1 |
| 9 | Ur | 2 | 1 |
| 10 | Alaskari | 2 | 0 |
| 11 | Alshurta' | 1 | 1 |
| 12 | Altdhia | 0 | 1 |
| 13 | Fida | 0 | 1 |
| 14 | Alpeshair | 0 | 0 |
| 15 | Aladara | 0 | 0 |
| 16 | Bekaa | 1 | 0 |
| 17 | Alravdin | 0 | 0 |
| 18 | Hussein | 0 | 0 |
| 19 | Kadhraa | 0 | 0 |
| 20 | Al-Zahra | 0 | 0 |
| 21 | yarmook | 0 | 0 |
| 22 | Sumood | 0 | 0 |
| 23 | Aletihad | 0 | 0 |
| 24 | Aljamaheer | 0 | 0 |
| 25 | Alakhlas | 0 | 0 |
| 26 | Anahdah | 0 | 0 |
| 27 | Alaskan_alsan. | 2 | 0 |
| 28 | Al Shoumoukh | 2 | 1 |
| 29 | Alaguetsaddein | 0 | 0 |
| 30 | Alskak&Amarat | 1 | 1 |
| 31 | Ithora | 0 | 1 |
| 32 | Alasekan | 0 | 0 |
| 33 | Mansuri | 1 | 0 |
| 34 | Alshala | 0 | 0 |
| 35 | Mansuri/energy | 1 | 0 |
| 36 | Alamel | 1 | 0 |
| 37 | Almtenzha | 0 | 0 |
| 38 | Aliboviahd | 0 | 0 |
| Total | | **21** | **14** |

**Table 10** The buildings need of health centers [*prepared by the author using GeoPlanner for ArcGIS*]

| Code | Neigh | The need of buildings health center |
|------|-------|-------------------------------------|
| 1 | Alsherqia | 2 |
| 2 | Almajad | 0 |
| 3 | Tamoz | 1 |
| 4 | Sommer | 1 |
| 5 | Aredo | 2 |
| 6 | Alshuhda | 2 |
| 7 | AlSadr | 2 |
| 8 | Salhia | 2 |
| 9 | Ur | 2 |
| 10 | Alaskari | 1 |
| 11 | Alshurta' | 1 |
| 12 | Altdhia | 1 |
| 13 | Fida | 1 |
| 14 | Alpeshair | 1 |
| 15 | Aladara | 1 |
| 16 | Bekaa | 0 |
| 17 | Alravdin | 0 |
| 18 | Hussein | 0 |
| 19 | Kadhraa | 0 |
| 20 | Al-Zahra | 0 |
| 21 | yarmook | 0 |
| 22 | Sumood | 0 |
| 23 | Aletihad | 0 |
| 24 | Aljamaheer | 0 |
| 25 | Alakhlas | 0 |
| 26 | Anahdah | 0 |
| 27 | Alaskan_alsan. | 1 |
| 28 | Al Shoumoukh | 2 |
| 29 | Alaguetsaddein | 0 |
| 30 | Alskak&Amarat | 1 |
| 31 | Ithora | 0 |
| 32 | Alasekan | 0 |
| 33 | Mansuri | 0 |
| 34 | Alshala | 0 |
| 35 | Mansuri/energy | 1 |
| 36 | Alamel | 0 |
| 37 | Almtenzha | 0 |
| 38 | Aliboviahd | 0 |
| Total | | **25** |

## 9. Conclusions

1. Random distribution of services;
2. Services are not available in some neighborhoods such as (19, 21, 22, 24, 25), which are the results of GeoPlanner for ArcGIS as shown in table (1);
3. Poor planning and lack of plans to accommodate population growth.
4. In the educational sector, there are 202 schools, "kindergartens, primary, intermediate and secondary schools". For the purpose of filling the shortage of school buildings, the construction of 265 schools is required, table .
5. There are currently only 27 kindergartens, while the urban planning standard requires 174. This indicates neglect of the application of the national standards for urban planning, as well as the lack of interest in the age group before the stage of primary schools, tables (1) and (4).
6. In the health sector there are currently 23 health centers distributed randomly in the city and requires the construction of 25 others to fill the deficit in the health sector as shown in table (1) and (4).
7. The study showed significant deviation between existing open space (5%) and the national standard of urban planning 17.5%.
8. The neighborhoods number 4 (neighborhood of Sommer) and 5 (neighborhood of Aredo) are the best neighborhoods in Nasiriyaha city by the amount of services available
9. The neighborhoods number 21 (neighborhood of Alyarmook) and 19 (neighborhood of Alkadhraa) are the worst neighborhoods in Nasiriyaha city by the amount of services available.
10. The study shows that GIS applications are effective and important tools in urban planning process.
11. The study showed the possibility of using ArcGIS Desktop for the collection, filtering and processing of data, as well as building the database and analyzing the data to obtain important indicators and information for urban planning.
12. The study shows the possibility of collecting or examine spatial and non-spatial data from online sites such as "Open Street map" and "ArcGIS online" etc. In fact, it is a successful and effective process.
13. The Study showed the utilization of ArcGIS online applications and the specialized application of urban planning "GeoPlanner for ArcGIS ". It was very effective in the planning process and gave accurate and detailed results in this study.

## 10. Future Development Proposals

Nasiriyah city suffers from complex problems. For the purpose of finding better solutions, I suggest the following:

- The urban and municipal planning departments in the city must implement the projects according to master plan and the national standards for urban planning.
- Design and implementation of the Green Belt project around the city to mitigate the impact of sand storms in the city.
- Addressing the errors of random distribution of services in the city through the preparation of real studies to convert the current random pattern to a pattern dispersed equally.
- Allocation of land and financial resources for the construction of schools and health centers to meet the shortfall.
- Increase the ratio of open space to 17.5 %.
- Adopt vertical construction to minimize the urbanization of agricultural land.
- Adopt a new policy to reduce high population growth.
- Use GIS applications in all stages of urban planning to make healthy decisions and prepare integrated geographic databases for the city in all its details.

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