MANAGEMENT OF SPATIAL DATA OF RESIDENTIAL AREAS IN KIRKUK VIA GIS TECHNOLOGY

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MANAGEMENT OF SPATIAL DATA OF RESIDENTIAL AREAS IN KIRKUK VIA GIS TECHNOLOGY

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Submitted by **Jamal Ghazi JAMAL**

Approval of the Graduate School of Natural and Applied Sciences, Çankaya University.

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ABSTRACT

MANAGEMENT OF SPATIAL DATA OF RESIDENTIAL AREAS IN KIRKUK VIA GIS TECHNOLOGY

M.Sc., Department of Mathematics and Computer
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Due to the importance of Kirkuk which is located between longitudes (44° 26‘ 27 "E - 44° 17'10 "E), and latitudes (35° 30‘ 34 "N - 35° 20 '5 "N), has reached the researcher to choose representation cartographer for the selection of the best residential areas. This study was characterized by the use of systems software geographic information of the program (Arc GIS .v.10.0) and remote sensing techniques of virtual satellite patched (Quick Bird) and captured by the US satellite, with accuracy discriminatory (0.60 cm) for the year 2008 and the use of a huge database of the city and all uses of the land where the base. This study serve to increase the wheel ideal urban development and urban planning on the grounds of residential areas and the center of gravity is the foundation of a city by creating substantial network infrastructure and distribution services by global and regional standards that are spread around the scale.

The researcher test all areas of the city land in residential areas to reach the best and most suitable areas such as education, health, commercial, recreational and religious spaces. On the other hand, has compared the security reality of Iraq in general and the study area, in particular, by testing the police stations sites that cause a threat to residential areas for its existence within the scope of these areas depending on the

user criterion which in turn results bodily harm as a physical in case of any terrorist act at these centers.

In addition, the researcher to build an internal transportation network is ideal represented by the shortest path base and less time to publish this network to all parties and the revival of the city housing, education, health and industrial areas to the comprehensive coverage of the city and the distribution of bus stations in a perfect way a distance of (500 m) between each bus station.

Keywords: GIS, Residential Areas, Spatial Data, Kirkuk, Transportaion Network.

ÖZ

KERKÜK'DE Kİ YERLEŞİM ALANLARININ CBS TEKNOLOJİSİ YOLUYLA MEKÂNSAL VERİ YÖNETİMİ

Yüksek Lisans, Matematik-Bilgisayar
Anabilim Dalı / Bilgi Teknolojileri Bölümü
Tez Yöneticisi: Prof. Dr. Taner ALTUNOK

Ocak 2015, 90 sayfa

44° 26‘ 27 "E - 44° 17'10 "Doğu Boylam ve 35° 30‘ 34 "N - 35° 20 '5 "Kuzey Enlemleri arasında bulunan Kerkük'ün coğrafi önemi nedeniyle araştırmacılar en iyi yerleşim alanlarını bulabilmek için harita uzmanları seçmektedirler. Bu çalışma Coğrafi Bilgi Programı Yazılımı (Arc GIS .v.10.0), Birleşik Devletler tarafından kullanılan sanal uyduların uzaktan algılama teknikleri ve 2008 yılında büyük bir veritabanının kullanılarak 0.60 cm ye kadar tam olarak ayırt edilebilen tüm arazi alanlarının tespit edilmesi olarak tanımlanabilir. Bu çalışma ideal bir kentsel gelişimin sağlanması, yerleşim alanları için kentsel planlama yapılması, ağ altyapısının oluşturulması ve dağıtım hizmetlerinin dünya çapında ve bölgesel standartlarda uygulanmasının sağlanmasını artırmak için hizmet verecektir.

Araştırmacı şehirdeki tüm yerleşim alanlarını test ederek; eğitim, sağlık, ticaret, eğlence ve din alanlarında hizmet verebilecek en uygun bölgeleri bulacaktır. Bunun yanında, Irak'ın güvenlik durumu göz önünde bulundurulduğunda çalışma alanı genel olarak polis karakollarının bulunduğu alanlarının saldırılara karşı test edilmesidir. Polis merkezlerine karşı düzenlenebilecek terörist saldırıların engellenmesi ve görevlilere karşı tehtit olabilecek fiziksel ve psikolojik zararların engellenmesi amaçlanmaktadır. Buna ek olarak araştırmacı, bir iç otobüs ulaşım ağı inşa edecektir. Bu ulaşım ağı 500 metre aralıklarda kurulan otobüs duraklarıyla, tüm

siyasi parti merkezlerine, evlere ve eğitim-sağlık-endüstri merkezlerine en kısa yoldan ve en kısa sürede hizmet verecektir.

Anahtar Kelimeler: CBS, Yerleşim Alanları, Mekânsal Veri, Kerkük, Ulaşım Ağı.

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LIST OF ABBREVIATIONS

GIS	Geographic Information System
RS	Remote Sensing
LULC	Land Use Land Cover
BC	Befor Christ
IPC	Iraq Petroleum Company
CBD	Central Business District
GUI	Graphic User Interface
SPSS	Statistical Packge for Social Seince
GPS	Geographic Posision System
UTM	Universal Transverse Mercator
JPEG	Joint Photographic Experts Group
SHP	Shap File
IMG	Aerial Photo Extension
AMS	Ambalance Mangment System

CHAPTER 1

INTRODUCTION

1.1 Background

Kirkuk is one of the most important cities in Iraq. The new government considers that making construction and built a modern city in Iraq. It is very important for oil wheals and society activities.

As it is known unplanned urbanization process is now a great problem. Especially in the developing countries, there are lack of consistent and dependable data including spatial data. This situation is highly clear in Iraq. Conflicts, political and factional instability, migration, population growth, and improved economic opportunities are the driving forces behind the high level of urban growth particularly in the big cities that has higher economy.

In view of these facts, there should be a wise and rational use of lands in order to make a balance between the life necessities and use lands as a source. While urban areas are generally dominated by human effects and the related land use patterns, an efficient method should be used to deal with land use change processes.

Geographic information system (GIS) technology makes plan to execute its objective because planning is one of the important scientific principle to study resources and capability in every country. It can specify how to use and perform these resources to aim and improve the situation. this study " Management of Spatial Data of Residential area in Kirkuk Via GIS ".

This study introduces us how to use land in Kirkuk city, so it considers the important necessities of life and the progress of its wheels. Because it's the main pillar and sense the first for a point of views evolution and advancement.

Today we are moving forward to the field of technology and the continuing evolution in automated computer and the contents of scientific programs which

provided the science and knowledge. This causes to choose one of these science to be the basis of our study which name is Geographic İnformation Systems. Researcher focuses here to find the optimum suitable residential area for establishment of the citizen, in terms of the application criteria and get the perfect results during the distribution of these criteria such as; schools, health services, parks, police stations, also transportation planning in transportation planning line.

Due to the important role which playes in the economic and social development of the communities, transportation is very important in infrastructure sectors. Also it has importance in promotion of spatial interaction between the residential area of one city. Developed and developing countries uses this system. Transportation to facilitate ways of communication and interaction between the different cities and neighborhoods updated is an integrated system in terms of quantity and quality, so it became the transport in the city of Kirkuk.

The third highest percentage of the area of urban space after residential use and its impact on the value of the land and urban land uses.

By using the topology system which reduces any procedure to the basic elements isolated intersection points or stations and the lines of communication or transportation routes that ignore the direction and distance. This study consists of five chapters.

First chapter contains brief introduction with study objective and problem faces the researcher also study location.

The second chapter deals the literature review and previous study, beside it includes the geographical properties about Kirkuk province.

Third chapter includes the methodology of this thesis and researcher depended to bring the spatial data and non-spatial data also drawing by using Arc Catalog.

Fourth chapter highlights the results which discuss in terms of choosing the best residential areas through the application of the criteria below:

1- Educational Service.

2- Health Service.

3- Police Stations Service.

4- Recreational Service.

5- Commercial Service.

6- Religious Service.

7- Transportation Planning Service.

Finally Fifth chapter focus on the conclusion and recommendation and future work.

1.2 Study Location

Kirkuk is the fourth largest city in Iraq, The area of the city with its suburbs about 9679 km^2 which the center of the province of Kirkuk located in northern Iraq, 250 km north-east of the province, Baghdad, capital of Iraq, and is bordered by the Zagros Mountains to the north and the River Little Zab from the west and a series Hamrin Mountains from the south and the river Sirwan from the south-west as shown in Figure 1. Kirkuk has an ancient history with an estimated age of more than 5,000 years. Kirkuk city centre coordinates are (44° 26‘ 27 "E - 44° 17'10 "E) Longitude and (35° 30‘ 34 "N - 35° 20 '5 "N) Latitude. The borders of the province of north Shwan and Alton-kopry on the south by district for Laylan and Taza and Toz-khermato district, as well as to Kara-anjeer is on the east district and Yaychy is on the west district.

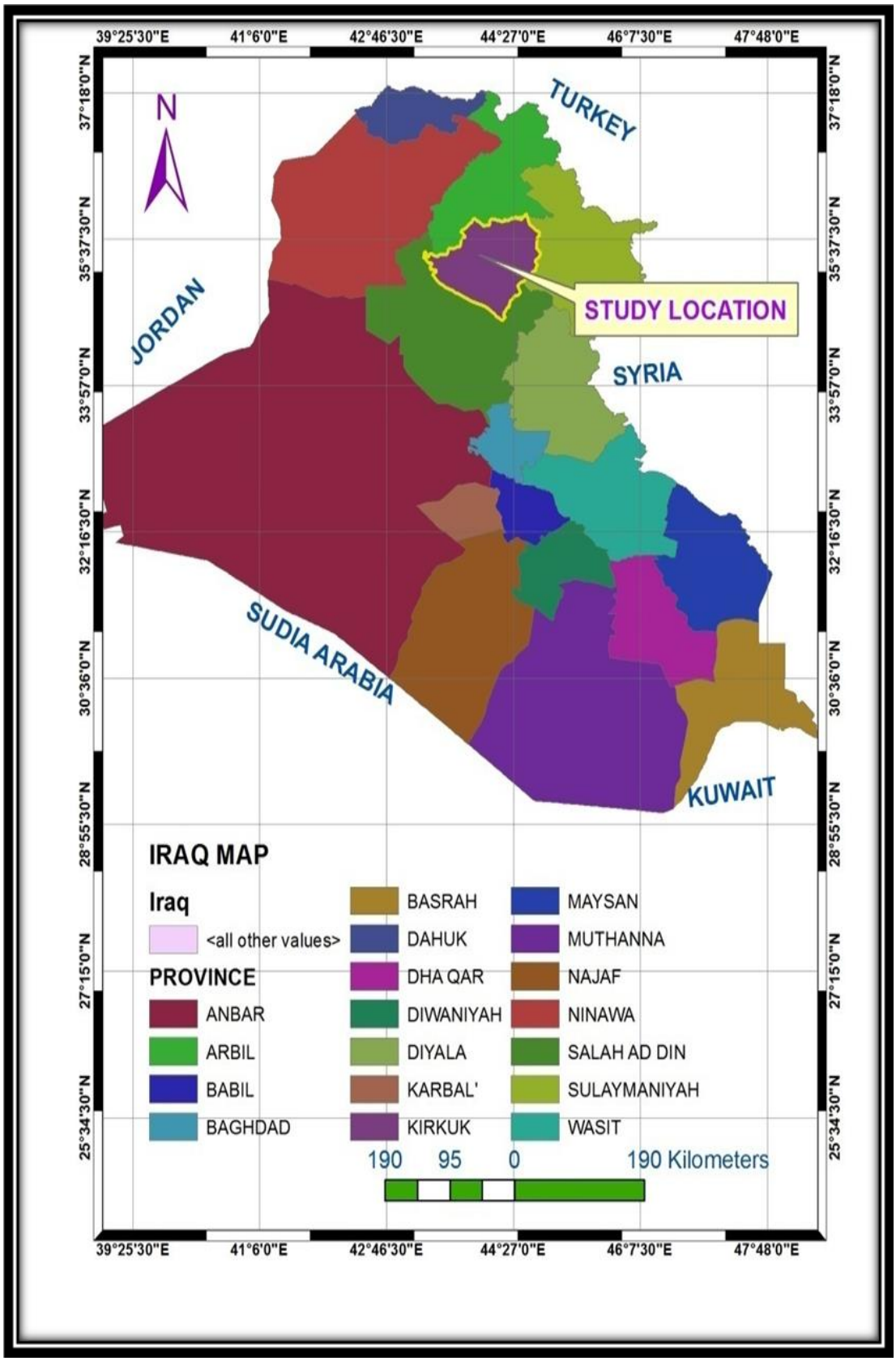


Figure 1: Iraq map

In addition, it consists of 46 residential area as shown in Figure 2. Table 1 shows the number of the residential areas in Kirkuk.

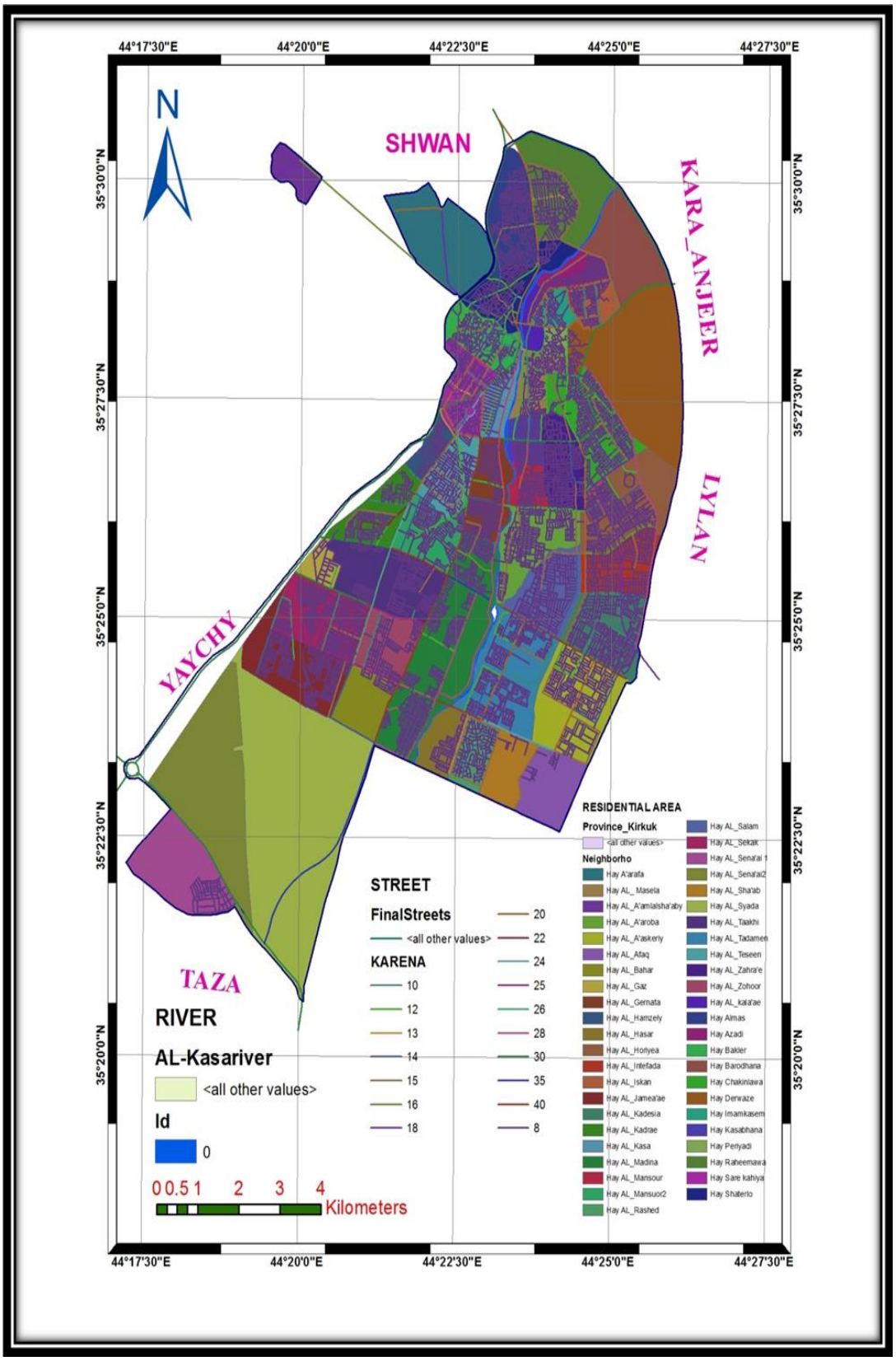


Figure 2: Kirkuk map

ID	Name of Residential	ID	Name Residential
1	Hay AL_Sena'ai	24	Hay Sare kahiya
2	Hay AL_Tadamen	25	Hay Bakler
3	Hay AL_A'askeriy	26	Hay A'arafa
4	Hay AL_Syada	27	Hay AL_A'amlal_sha'aby
5	Hay AL_Kadesia	28	Hay Shaterlo
6	Hay AL_Salam	29	Hay Almas
7	Hay AL_Afaq	30	Hay Raheemawa
8	Hay AL_Sha'ab	31	Hay Barodhana
9	Hay AL_Rashed	32	Hay AL_Intefada
10	Hay AL_Hasar	33	Hay AL_A'aroba
11	Hay AL_Madina	34	Hay AL_Iskan
12	Hay AL_Bahar	35	Hay Azadi
13	Hay AL_Jamea'ae	36	Hay Imamkasem
14	Hay AL_Zohoor	37	Hay AL_kala'ae
15	Hay AL_Sekak	38	Hay AL_Horiyea
16	Hay AL_Taakhi	39	Hay AL_Mansour1
17	Hay AL_Gaz	40	Hay Kasabhana
18	Hay AL_Gernata	41	Hay AL_Zahra'e
19	Hay AL_Mansour2	42	Hay Chakinlawa
20	Hay AL_Kadrae	43	Hay AL_ Masela
21	Hay AL_Teseen	44	Hay Periyadi
22	Hay AL_Hamzely	45	Hay AL_Sena'ai2
23	Hay AL_Kasa	46	Hay Derwaze

Table 1: Kirkuk Residential Area

1.3 Problem Faces The Researcher

The study area suffers from a distinct lack of applied studies in cartographic representation, that rely on modern techniques of remote sensing (RS) data. This is a study that deals with spatial planning for land uses and land cover (LULC) in general. In addition to the residential areas in particular in the province of Kirkuk, by using GIS technology in extracting spatial relationships in terms of accommodation appropriate after the implementation of standards-related services in terms of the distribution of schools, health services and recreational areas, beside commercial and industrial areas. Unfortunately the security situation in the province, there are police stations close to residential areas and this poses a significant risk to the citizens who are living there. They should be far from residential area that is a problem of internal transportation network (Bus). The distribution of bus stations depending on the distribution of each residential area in the province of Kirkuk and find the starting point of beginning and end of the bus is not currently provided in the study area.

1.4 Objective Of Study

This study seeks to achieve a set of goals:

1- Fact the current study of residential areas and the number of population per area.

2- Identify services surrounding each residential area and taken as criteria for the application of this study in terms of insurance the best residence for citizens.

3- Use of modern technology in the process of studying the spatial planning of residential areas in the province, a technique using GIS technology and (RS) that lead to the creation of a new database on these services.

4- Building an integrated transportation system by using an internal network analysis, which is introduction of bus station and find the shortest route (Path) to serve the citizens in this city.

CHAPTER 2

LITERATURE REVIEW

2.1 Historical And Geographical Background of the Study Area

Found current Kirkuk, the center of the province on the ruins of the ancient Assyrian city Arboukha (Arafa), estimated at about 5,000 years old. Because of the fertility of the soil and moderate climate, and the importance of its geographical location between the Babylonians and Assyrians Empires, Kirkuk has seen several battles among those empires that controlled the city in different historical periods [1].

Araboukha became Kirkuk part of the Acadian Empire in the third millennium (B.C.) after that it crashed and political unity of the country, has been capturing the large sections of them before. Alkotien and Alkotyon mountains tribes that were endemic in the middle of the Zagros Mountains zone of Hamedan; were Erbil and Kirkuk from their main bases when they choose the Kirkuk area (Araboukha) which is the center for the governing authority the year "2211 - 2120 (B.C) [2].

The city of Kirkuk which is in the north-east of Baghdad. The capital city of Iraq's central plateau low-rise spread in an easy slope to the south, with an altitude of 1160 feet above sea level, bounded on the north-eastern province of Sulaymaniyah and north-western province of Mosul (Ninawa) and the south-west province of Salah al-Din and the south the eastern province of Diyala. The province of Erbil considered northern of Kirkuk [3], as shown in figure 3.

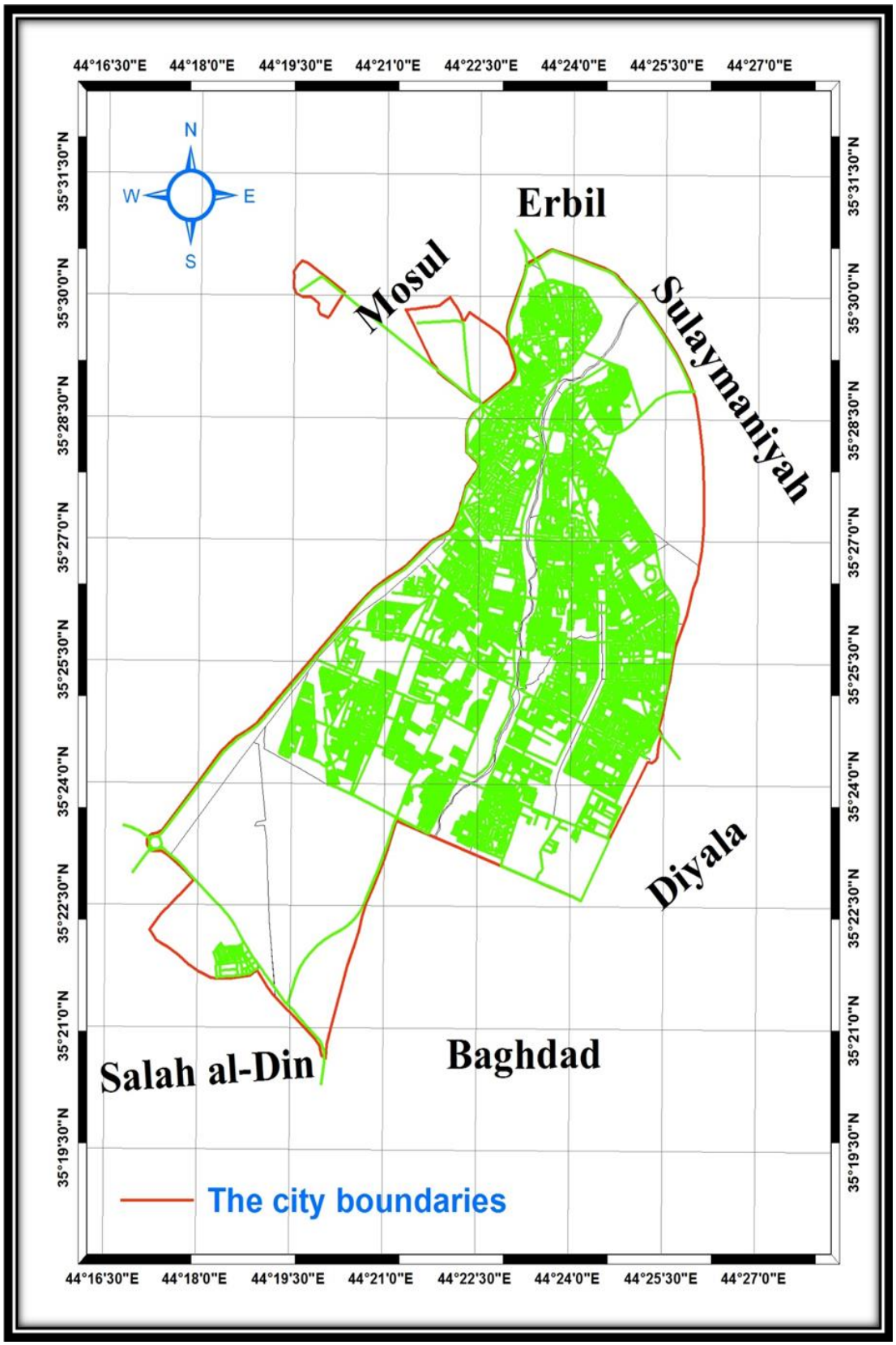


Figure 3 : Kirkuk boundaries

Where were result of this multiplicity strains and religions, terms its consist of different Mother tongue and languages such as Muslims, Arabs, Kurd, Turkmen, and other religions. Christian and Jews have lived in the castle of Kirkuk until after World War II, where immigrated Jews from country, then the Iraqi government dropped Iraqi nationality of them [4]. Which leads to continuously change in the process of population census in the city since the first statistical at 1957 until 1997 as shown in table 2 [5].

Mother Tongue	**1957**	**Percentage**	**1977**	**Percentage**	**1997**	**percentage**
Kurds	187,593	48.2	184,875	38 %	155,861	21
Arabs	109,920	28.2	218,755	45 %	544,596	72
Turkmens	83,371	21.4	80,347	17 %	50,099	7
Assyrians	1,605	0.4	0	0 %	0	0
Jews	123	0.03	0	0 %	0	0
Others	6,545	1.77	0	0 %	2,189	0.3
Total	388,829	100 %	483,977	100 %	752,745	100 %

Table 2 : Census Results for Kirkuk Governorate

The population density in Kirkuk, in terms of residential areas [6], as shown in the table 3. Through to the following figure 4 shows the preparation of the population in each residential area of the province of Kirkuk in the year 2011. In addition figure 5 shows the percentage of the population density for each residential area between the years of 1997- 2011.

ID	Name Residential	Population 2011	ID	Name Residential	Population 2011
1	Hay AL_Sena'ai	0	24	Hay Sare kahiya	16543
2	Hay AL_Tadamen	18891	25	Hay Bakler	7532
3	Hay AL_A'askeriy	29184	26	Hay A'arafa	8467
4	Hay AL_Syada	0	27	Hay AL_A'amlalsha'aby	2436
5	Hay AL_Kadesia	24568	28	Hay Shaterlo	2621
6	Hay AL_Salam	33845	29	Hay Almas	18065
7	Hay AL_Afaq	20731	30	Hay Raheemawa	89851
8	Hay AL_Sha'ab	12251	31	Hay Barodhana	8161
9	Hay AL_Rashed	20955	32	Hay AL_Intefada	11222
10	Hay AL_Hasar	15990	33	Hay AL_A'aroba	17460
11	Hay AL_Madina	10581	34	Hay AL_Iskan	15700
12	Hay AL_Bahar	10353	35	Hay Azadi	19669
13	Hay AL_Jamea'ae	21700	36	Hay Imamkasem	22657
14	Hay AL_Zohoor	12315	37	Hay AL_kala'ae	9316
15	Hay AL_Sekak	6301	38	Hay AL_Horiyea	33406
16	Hay AL_Taakhi	15217	39	Hay AL_Mansour1	14872
17	Hay AL_Gaz	5280	40	Hay Kasabhana	8519
18	Hay AL_Gernata	19769	41	Hay AL_Zahra'e	20731
19	Hay AL_Mansour2	17933	42	Hay Chakinlawa	17294
20	Hay AL_Kadrae	7919	43	Hay AL_ Masela	28467
21	Hay AL_Teseen	22750	44	Hay Periyadi	12628
22	Hay AL_Hamzely	14270	45	Hay AL_Sena'ai2	0
23	Hay AL_Kasa	22555	46	Hay Derwaze	103235
	TOTAL OF POPULATION				**804,745**

Table 3: Residential Areas and Population 2011

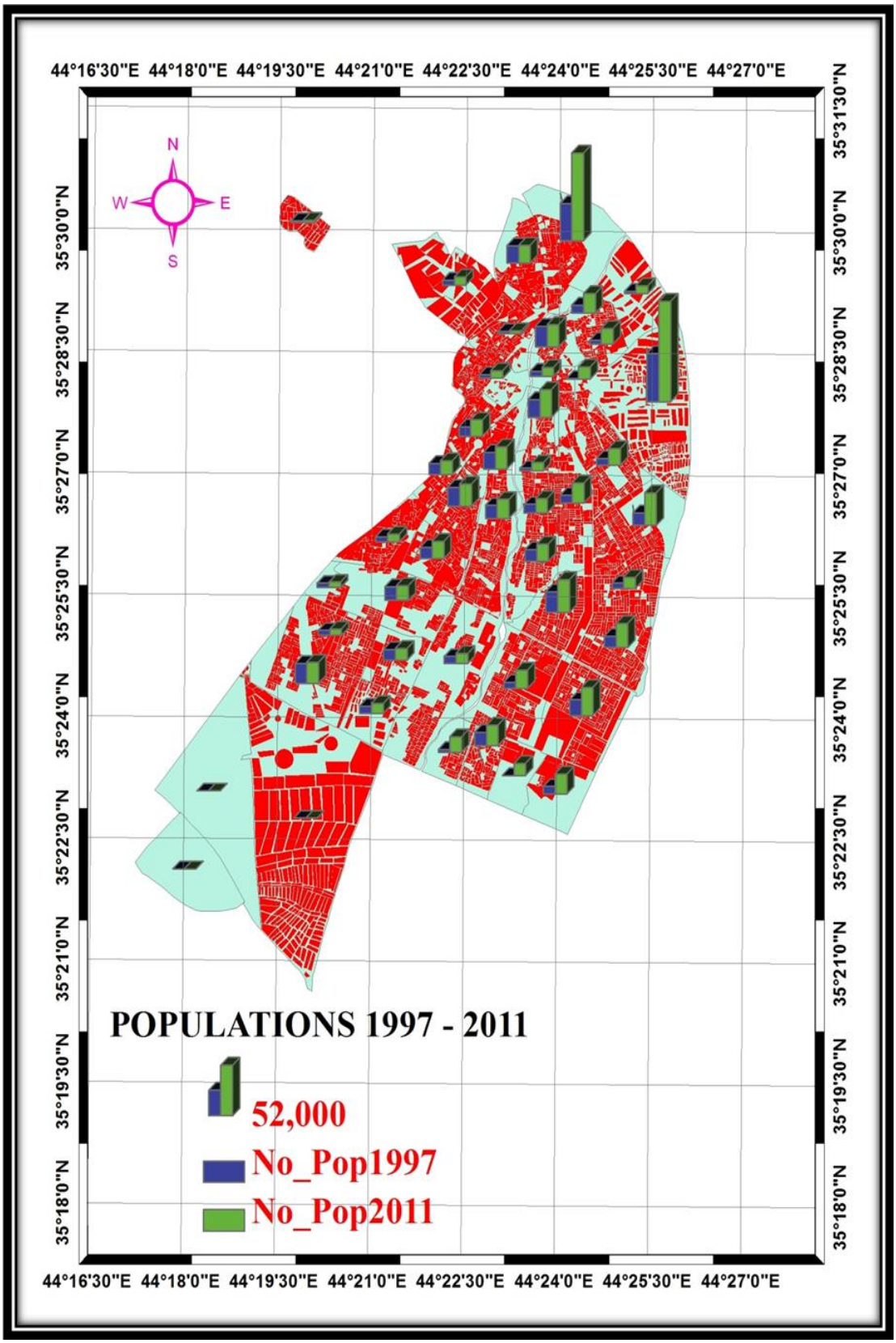


Figure 4: Populations in each residential area

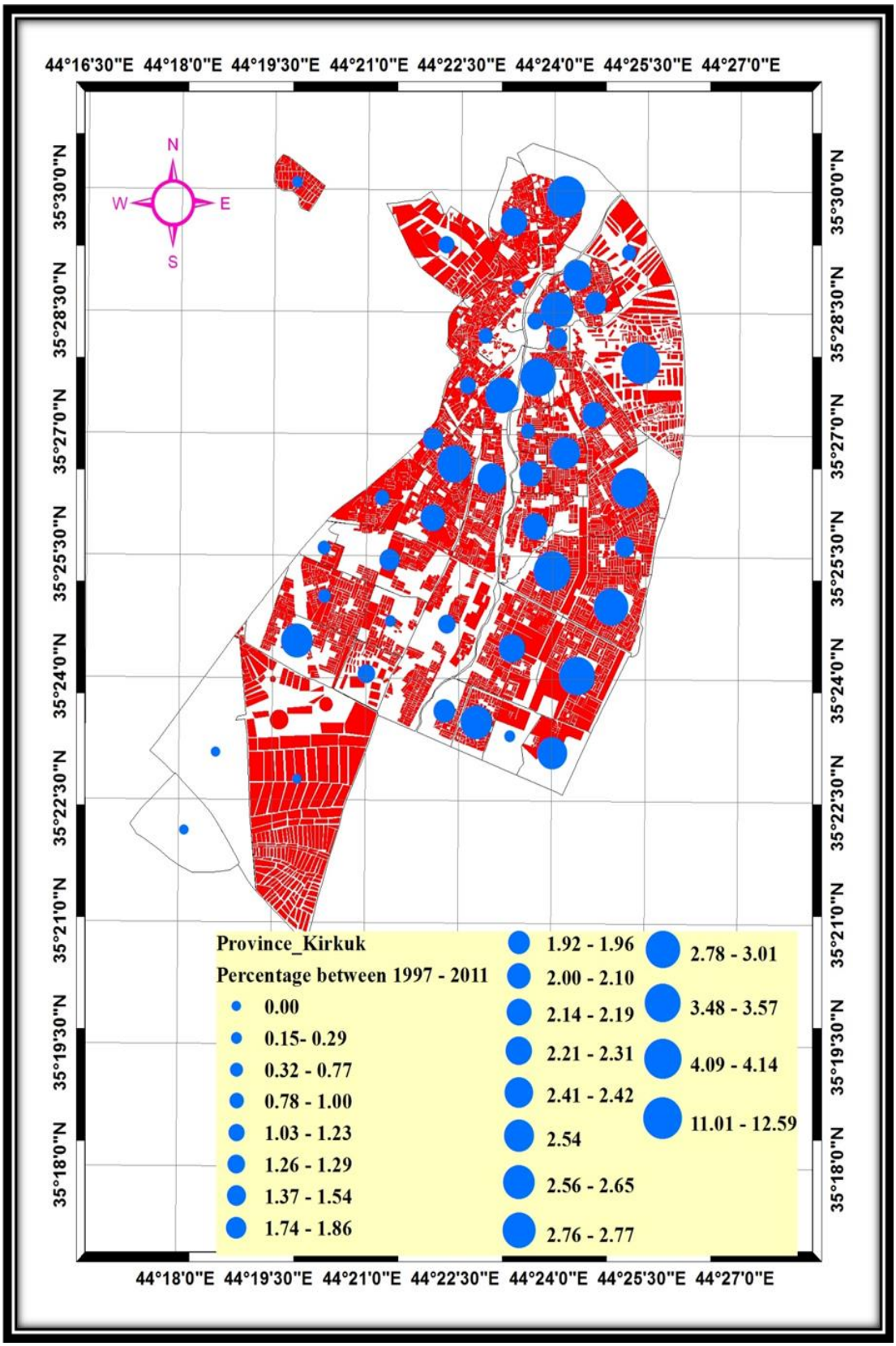


Figure 5: Percentage of populations in each residential area

It contributed the geological formation of the area on the flow of great Petroleum at 1927 which is called Babakirkir. It is near the city of Kirkuk, which led to the movement of the IPC to extract oil in an orderly that field at 1934, noting that the oil was mined in primitive ways before that time. Geophysical research confirmed the existence of a huge stockpile in the region is estimated at about 10 billion barrels of reserves any proportion of the world with a production capacity of up to 750 000 barrels per day [7].

In addition the existence of other fields in this oil-rich city such as field Jambour, Bai Hassan northern and southern field briefing and field Nana Cui Port. It contains the Petroleum wealth of Kirkuk on gas. It observed in the city of black gold ratio to vast oil wealth in this region of the world, usually it has been observed the existence of eternity fire. This fire permanent ignition over time and actually occupied (geological) due to leakage of gas from the oil field in the area Babakirkir for the existence of breaks in the earth's crust Dom oil in the area[7].

In general, region contains hydrogen sulfide gas (H2S), which pay attention when you had a way to stand with the prevailing wind direction in order to avoid inhaling the toxic gas.

2.2 Land Classification In Kirkuk

The concept land uses urban concepts wide and complex, and no matter how many opinions that they collect as a mutual relationship between humans and earth urban. As we know, the spatial distribution functions of the city has multiple functions includes residential uses, commercial uses, service uses, recreational uses, industrial uses, religious uses etc [8]. The service use consist of education service and health service.

It is based on the concept of land which uses in the city to multiple variables affecting one way or another in arranging these uses and structure spatially and along the period of time spaced [9].

2.2.1 Residential areas

The residential use of the main uses in many cities, so that no matter how many functions performed by cities stay associated to the availability of residence. We find such use occupies a wider area compared with the spaces occupied by other uses, as it pose the largest proportion of urban growth for all cities in the world, but the percentage varies from city to city [10].

The residential area in Kirkuk has developed because of population growth in the city as a result of the impact of two important factors of growth, migration, increasing demand on residence thus effective clearly in the expansion of the city and all directions particular towards the south and southwest of the city. It reflected negatively on the deprivation number neighborhoods in the city to enjoy the basic services being located within or outside the basic design [11], as shown in figure 6. Pose residential area in the city which is the largest proportion of all using area where up to 37.487 km2 at a rate of 33.5 % [12], according to shown in the table 4.

2.2.2 Commercial areas

That means function of commerce. The region where he overcomes business on any other activity, they are characterized by the concentration of heavy for shops dealing different commodities. Also the goods include some light industry, handicrafts and comprising various services such as the offices of lawyers and companies transporting goods and doctors' offices, travel, tourism offices, hotels and other services. It aims exercised from behind and earn a profit increase of income under the standard commercial profit. Total area of commercial use in the city is about 1.607km^2 a proportion of 1.434% [13] .

For this side it plays an important role in moving large wheel business investment by international and local companies. It leads an increase in the quick process of urban upgrading so increasing standard of living of the individual as a result in a significant reduction in the level of unemployment as shown in figure 7.

2.2.3 Industry areas

The function of important industrial functions for the role in the economic construction of cities. They contribute an operation of a significant number of labor in the development of the city. The service population and represents industrial use wider area of commercial use and has the power of competition comes second place after the commercial use is concentrated in the city. It creates a new urban environment and important factor in labor migration from the countryside into the city. It differs from the distribution of industries within cities, may be factories individually or in the form of clusters consisting of a number of small factories and light industries are located mostly near the consumer. While medium industries or larger and located outside the city [14], as shown in figure 8. Total area of industry use in the city is about 9.007km2 a proportion of 8.041% .

2.2.4 The services consists of three main parts

2.2.4.1 Health service

In this side we can representation by private and public hospitals and several small health service, which covered wider and safe for citizens in this area. The existence of health services in fixed positions and points, it produces injustice for inequity of the population in other locations. Also I have lots of studies proved that there is a relationship between the level of health of the population and distance from the sites health care services. So the level of health improves the population through overall coverage for all residential areas and population density of health services subject to global criteria constant in terms of fixed open any building of new hospitals and health units so that theywill as close as to be residential areas [15]. Health planning is drawind a detailed policy for the provision of health services to citizens in the form of programs and projects. The aim is achieving the level of health of the individual and his community specific characteristics in the period of time the ability. So the best to exploit the possibilities of the physical and human resources available [16], as shown in figure 9.

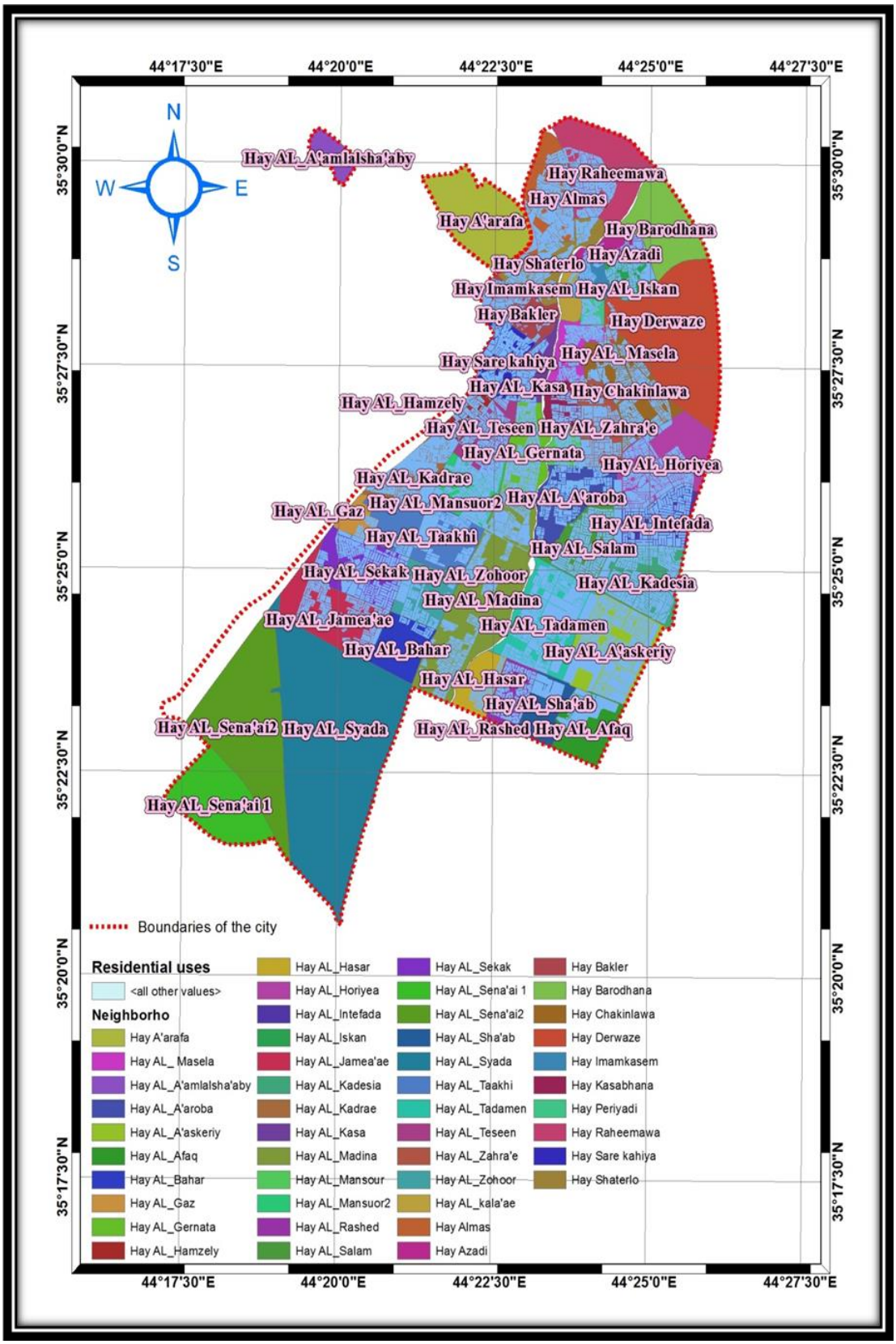


Figure 6 : Residential area in Kirkuk

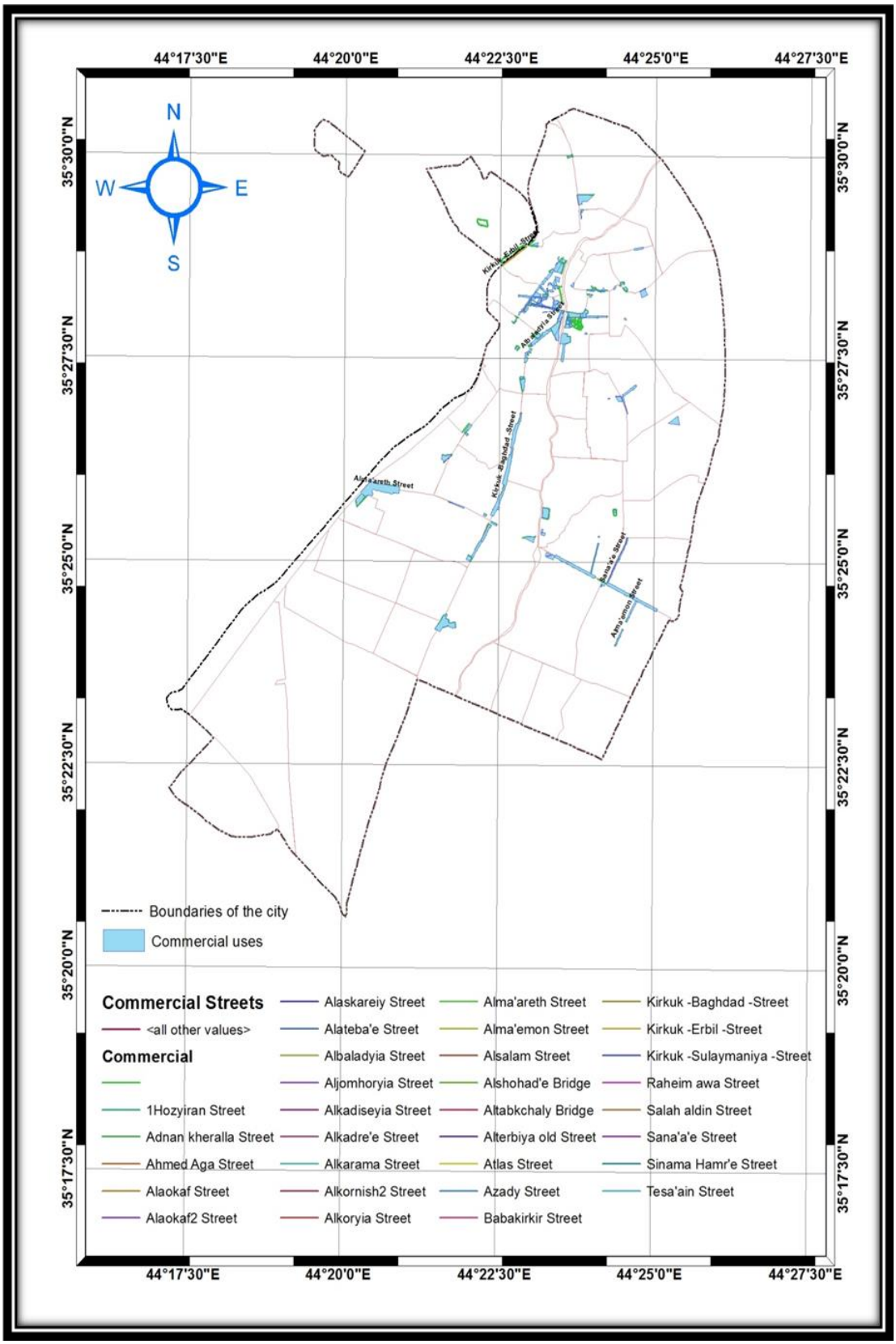


Figure 7 : Commercial area in Kirkuk

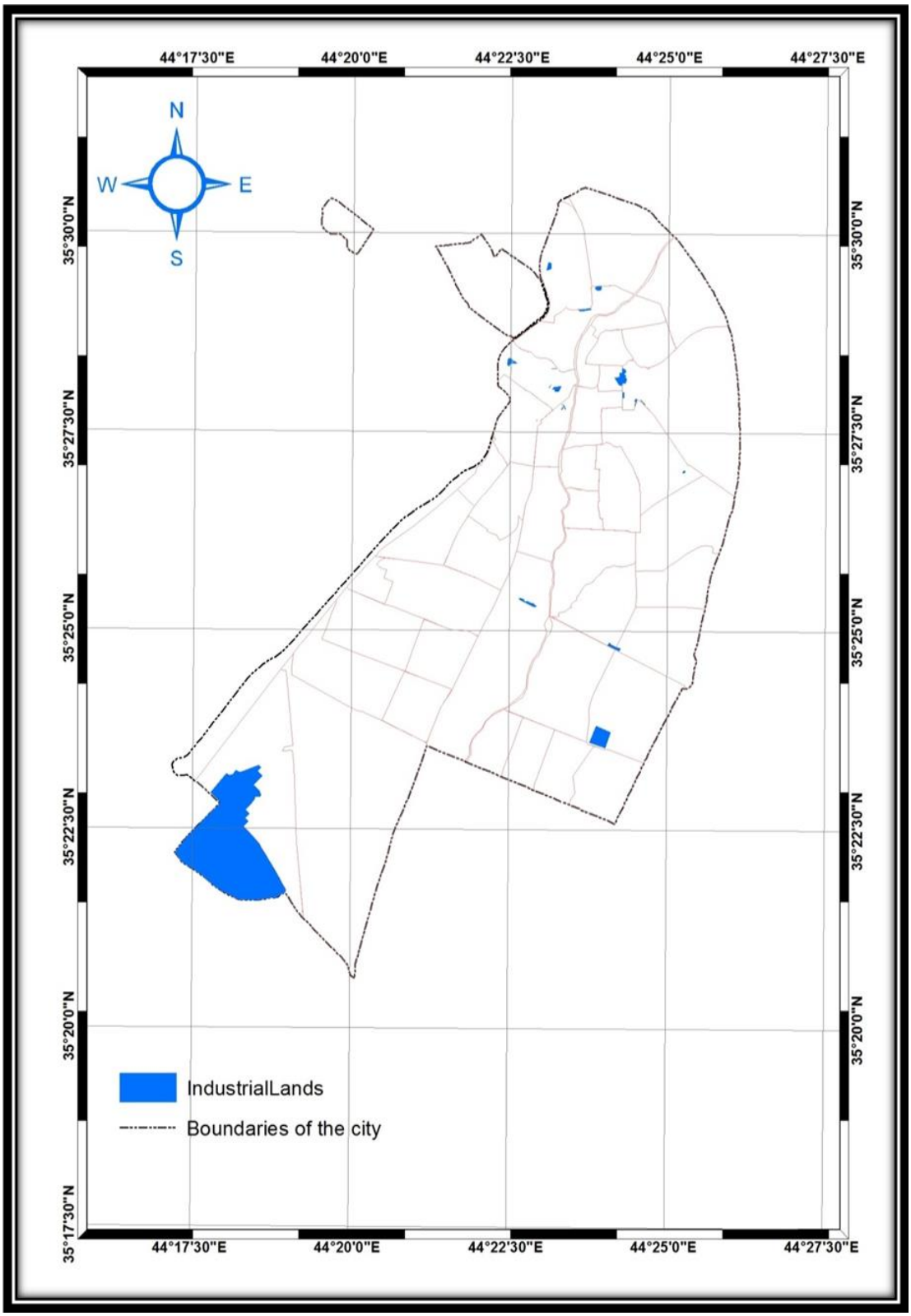


Figure 8 : Industrial area in Kirkuk

2.2.4.2 Educational areas

The use of education is one of the most important using of the land in the structure of modern city because it holds the largest proportion of the area of the city up to 4.285 km2 as proportion up to 3.937% from the service uses that areas approximately 8.489 km2 as proportion up to 7.579% from the region as shown in table 4. As his role effectives directly in the life of age categories many and its role in the progress of scientific, cultural, economic and social development. So it becomes necessary to develop standards that define the optimum distribution educational institutions at different stages of the universities and colleges belongs. It also includes the technical institutes underneath and technical institutes and technical colleges and institutes of arts and vocational training institutes, beside vocational schools and Preparatory industry, trade, agriculture and nursing all stages of study [17].

The criteria used for the educational institutions should be closed to residential areas and the population density of this region. It absorb all students and all age categories in schools either second criterion is provides transportation for students close to schools movement to their residential areas or near them. This is one of the important factor in progress of the wheel educational which take into account that the schools are near the main street to provide transportation network [6]. As shown in figure 10.

2.2.4.3 Security areas

The security services, which will be reviewed here at police stations -whether local or main- provides security services for the citizens and working to do safety. Most important basic factors influence to define criteria for planning police services, which determines the efficiency of the service and its importance [18]. The area of this region about 1.219 km2, as proportion up to 1.061% of the total service uses in this study area, as shown in figure 11.

2.2.5 Recreational areas

In fact recreation knows that activity practiced by people in their spare time away from other duties such as work commitment family. The researchers believe social

field that recreation is one of the methods for breathing instincts. In addition, it seems them useful in the field of recreation to relax and disposal of the trouble and stress activities are used by the intended population recreational services Recreation and listen and spend their leisure time and weekly holiday and yearly vacation, as shown in figure 12. Terms researchers divided geographically distributed recreation uses four levels. These are neighboring, local, regional and national [19]. The greenery area of this region about 3.009 km2, as proportion up to 2.686% of the total land uses in this study area.

2.2.6 Religious areas

The relationship between function and religious life of the cities close relationship, historical, religion in nature group process, so this religion was an essential factor in genesis several cities. Whenever most sequence in the history of the stronger this relationship most. When the Sumerians did not establish cities without governance and building, but the city is the worship of the sacred domain. Influenced factors, many religious on the genesis of the city through the emergence of the temple, which gives the religious character of the city's population and divides the distribution of these services to mosques and Hussiniyat, churches and places of worship for Sabean, as shown in figure 13. It is our duty construction the houses of worship near or within the range of uses of residential, commercial and industrial. The area of use of religious about 4.555 km2 as proportion up to 4.066 % [9].

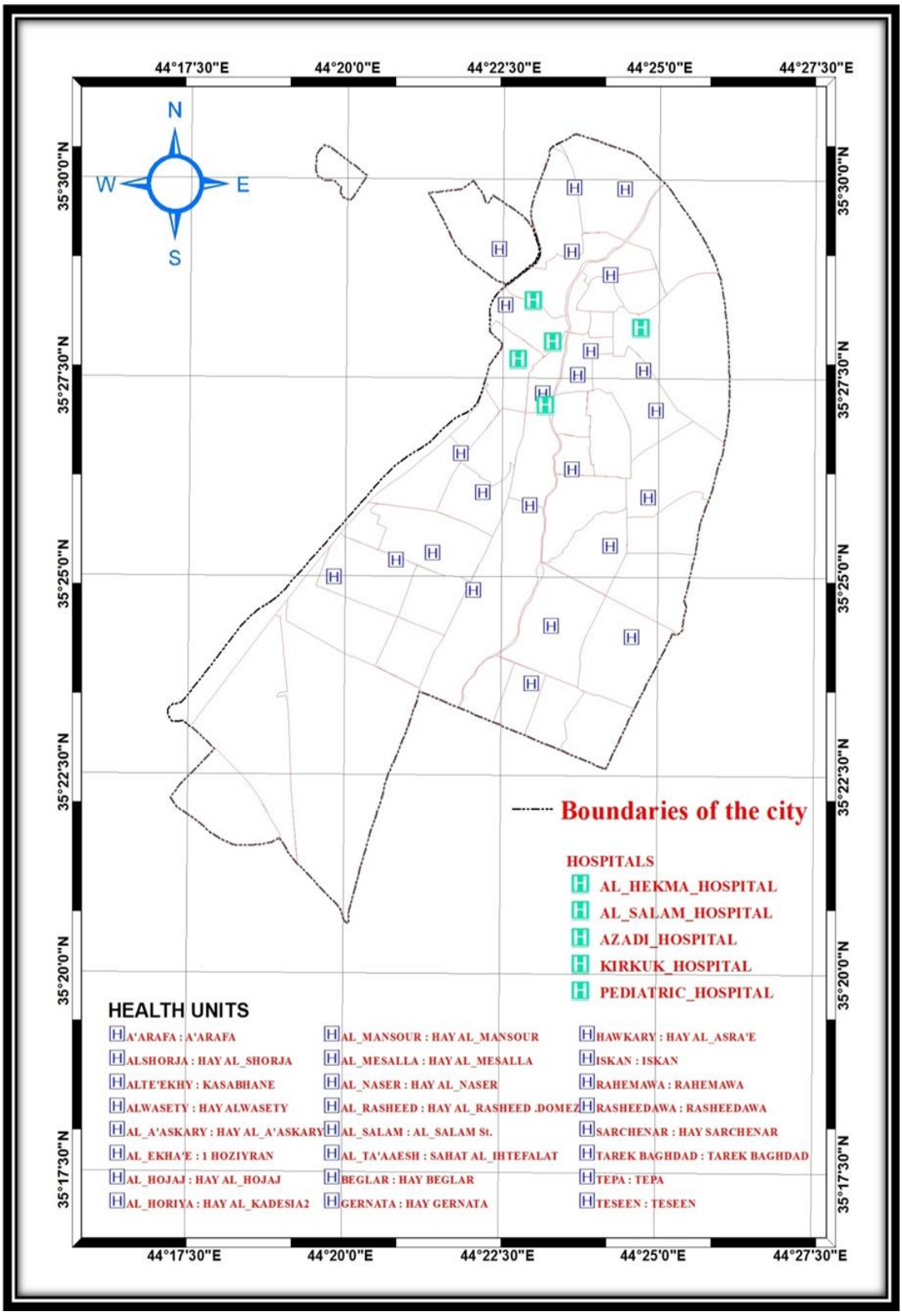


Figure 9 : Services uses (Health Areas)

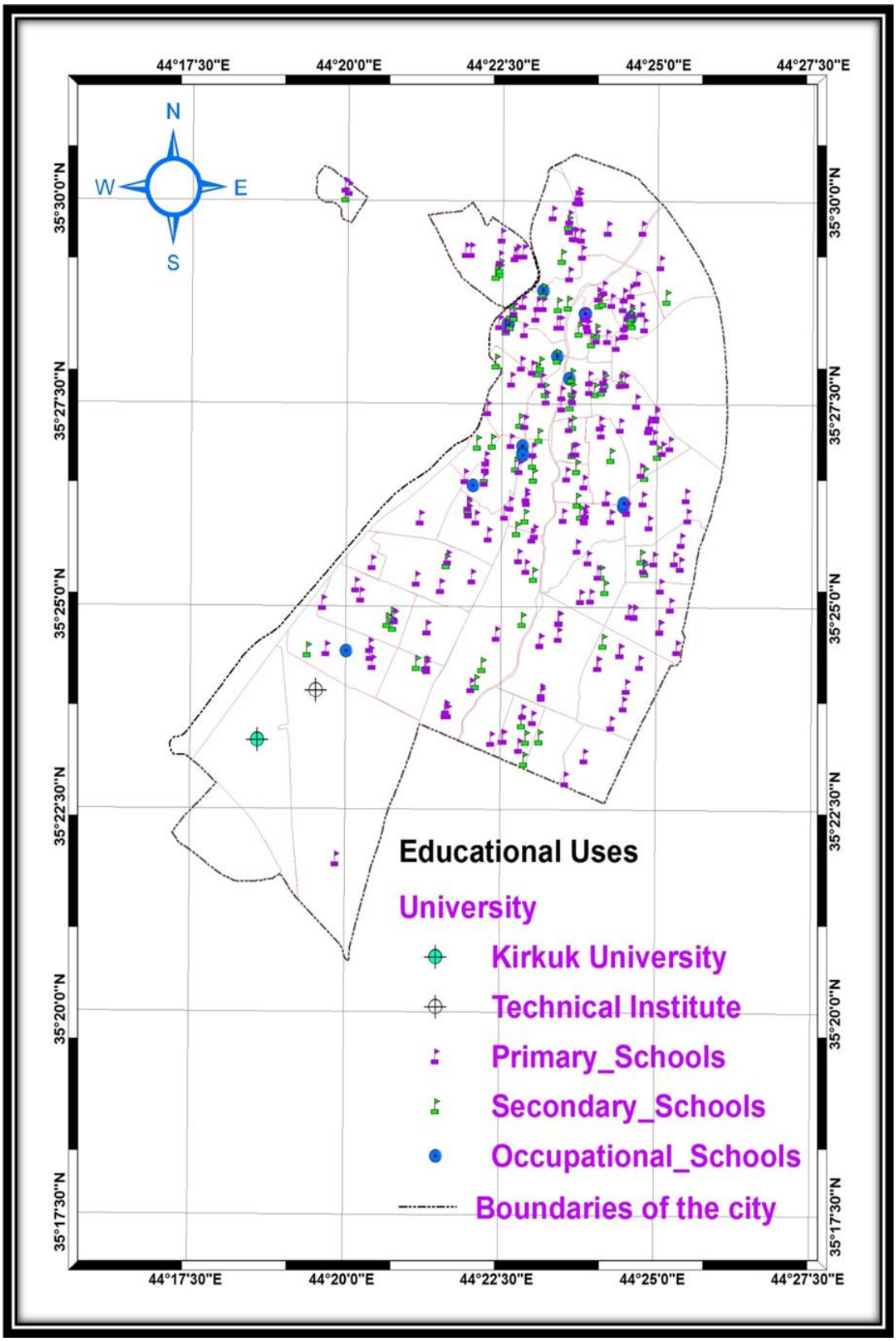


Figure 10 : Services uses (Education Areas)

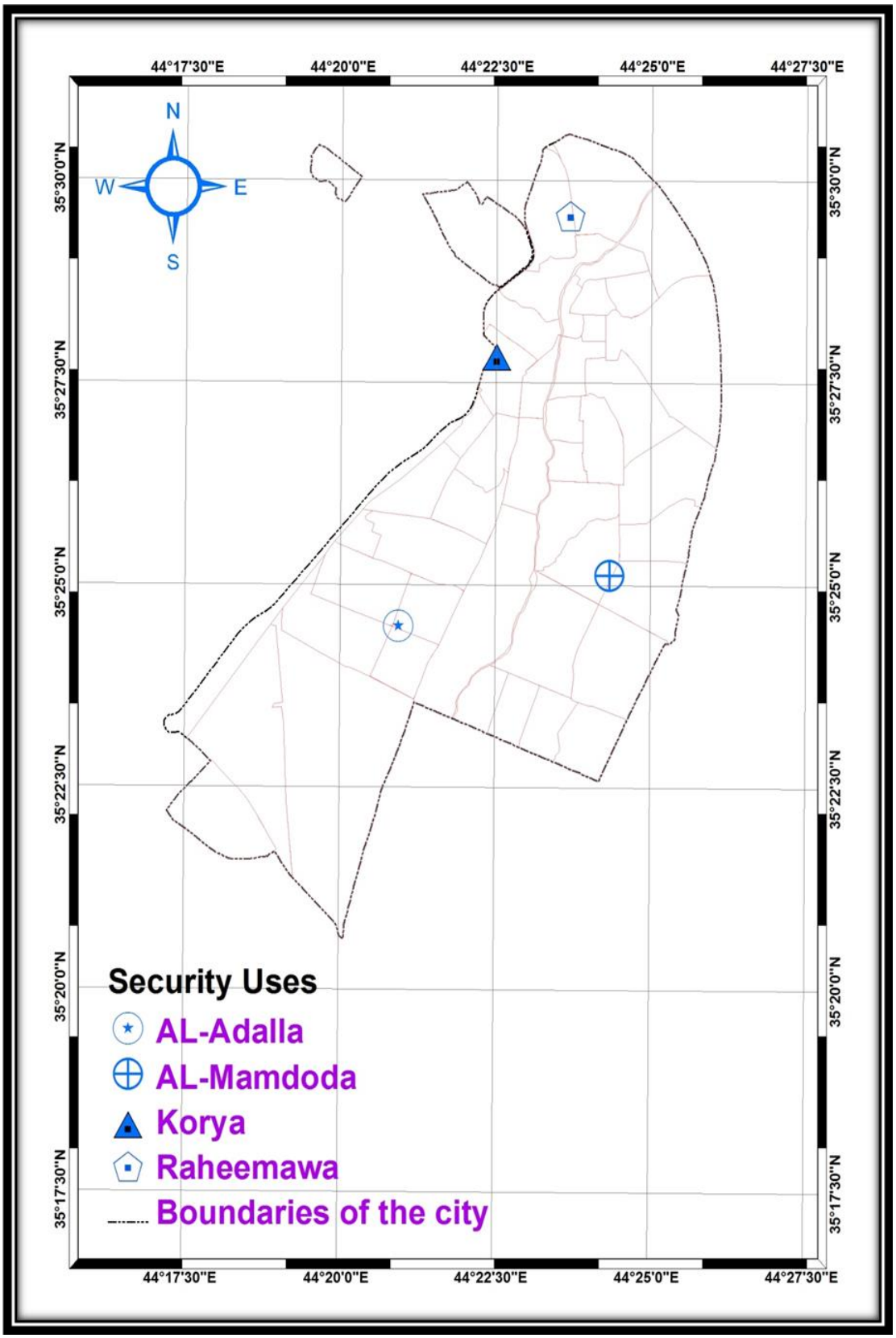


Figure 11 : Services uses (Security Areas)

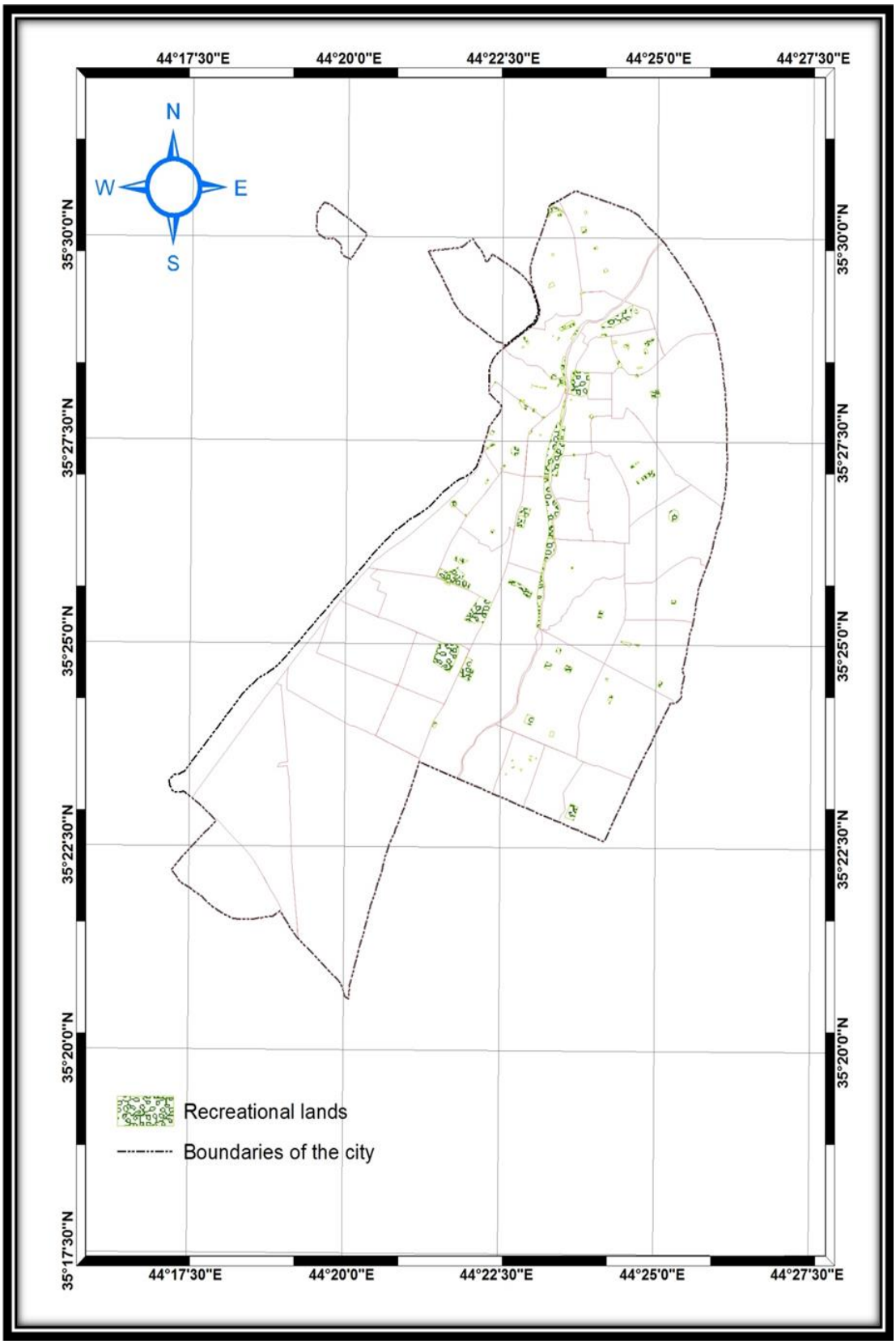


Figure 12 : Recreational Areas

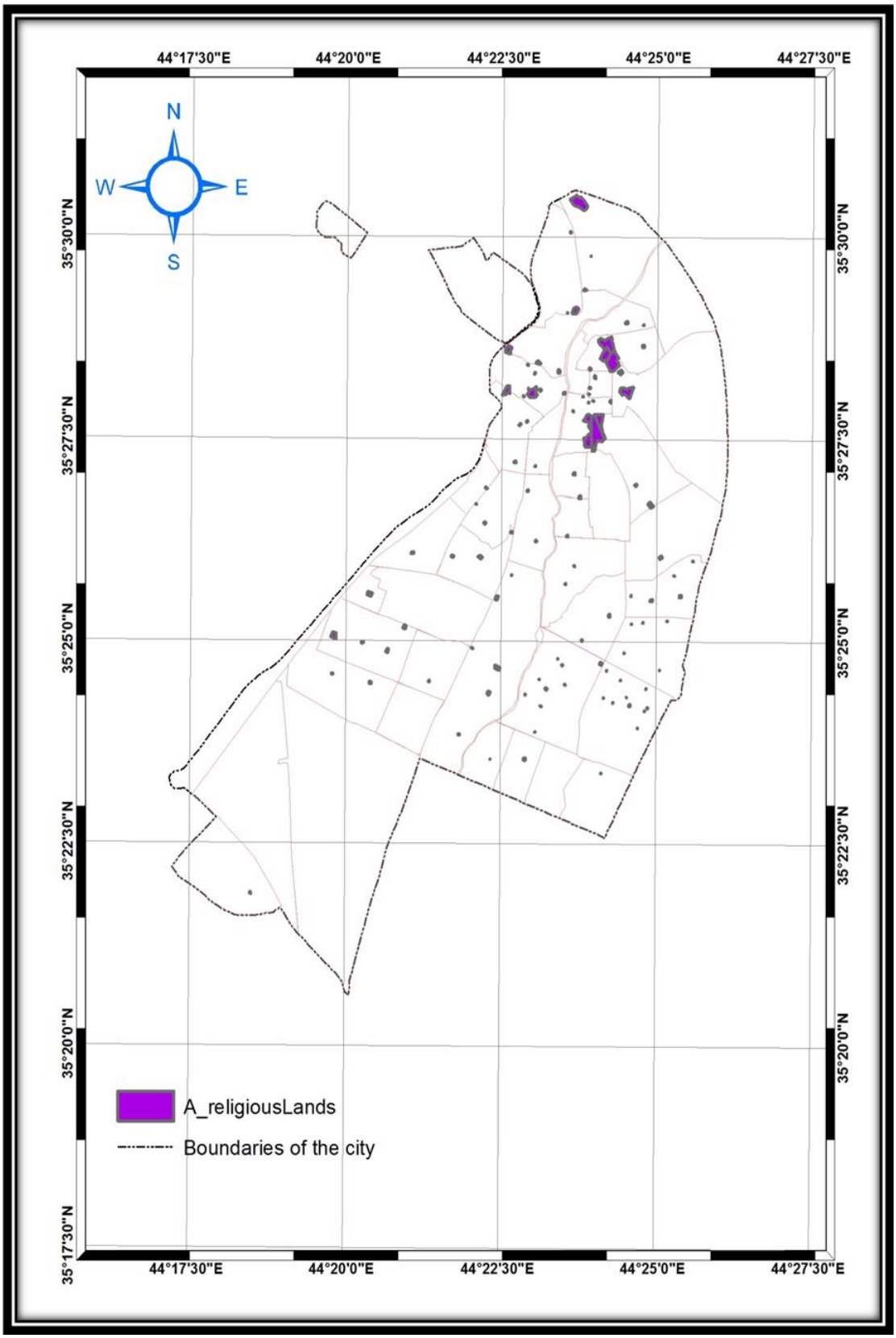


Figure 13 : Religious Areas

ID	Land Area	Area (km2)	Percentage
1	Residential areas	37.487	33.5
2	Administrative areas	1.594	1.396
3	Commercial areas	1.607	1.434
4	Recreational areas	3.009	2.686
5	Industrial areas	9.007	8.041
6	Health areas	2.083	1.859
7	Education areas	5.659	5.052
8	Religious areas	4.555	4.066
9	Random building areas	4.405	3.933
10	Transportation areas	17.376	15.514
11	AL_Kasa river areas	5.266	4.701
12	Unused areas	19.205	17.15
Total		112 km2	100 %

Table 4 : Land Areas in Kirkuk

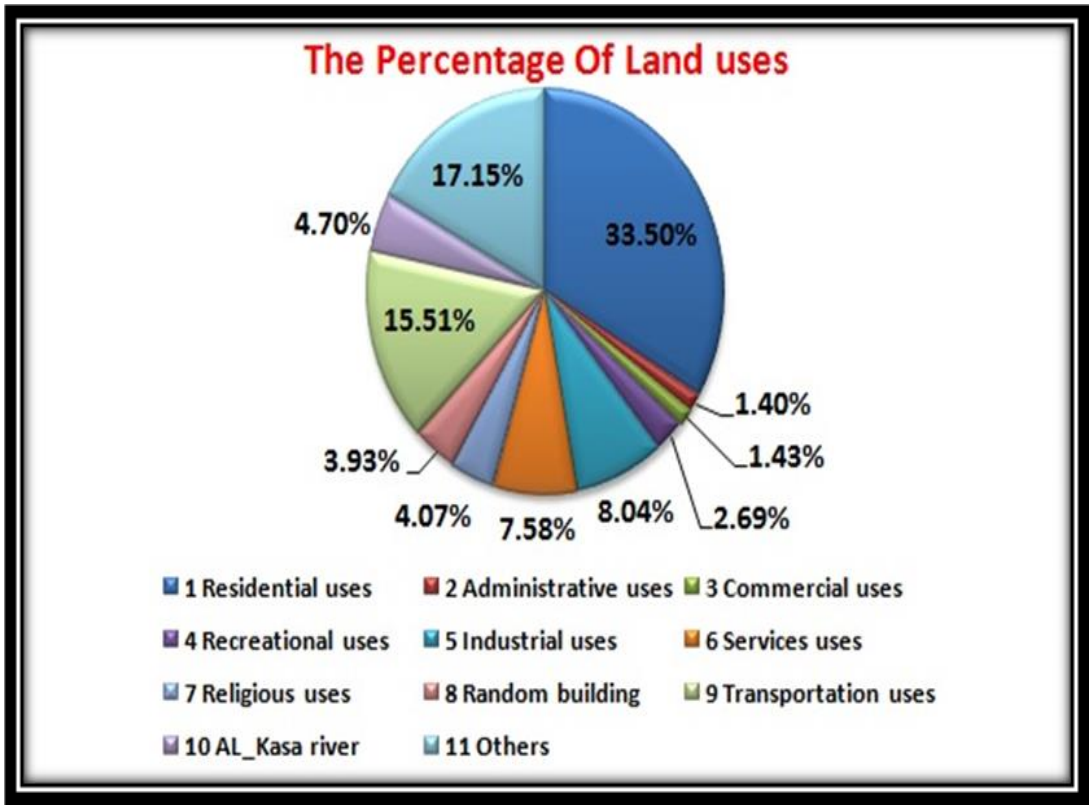


Figure 14 : Pie charts of land areas

2.3 The Road Network In Kirkuk

We can define grid pattern streets as external shape resulting from the arrangement and interaction and hierarchy spaces streets adjacent components of the network of streets in the city, which represents the foundation diagram of the city, and varied patterns of street network depending on several factors. The h conditions in location and the size of the city and task functional, providing the potential implementation and properties population and development pattern [6].

Classified roads (transportation network) depending on the nature and the movement of state. Two levels methods roads extended surface, which is called planar roads, means that a flat earth in the form of a horizontal any containing the start point to end point, or what is known as roads two-dimensional (2D) and they belong to roads extended above the surface of each of land and water, either non-planar roads refers to the roads of the three dimensions (3D) represented by roads, which extends below the surface of the earth, such as the metro, tunnels and trains, which constitute its main air cover such as air transport represented by airplanes [20].

The different patterns of road networks in cities and their models depending on the size and function of the city and its development pattern, prompting researchers to develop categories of city road networks in order to organize the urban environment [21], and these patterns are division into three parts organic pattern, radial pattern and networking pattern. The following figure 15 shows these patterns.

2.3.1 Organic pattern

This pattern is characterized by non-regularity both in direction and widening. The features of the system twisted alleys and narrow streets, this created without design or planning. Shows this pattern in older neighborhoods where it is difficult to provide services in these streets, such as health services, lifting waste vehicles and fire brigade. It has a difficulty to access these vehicles because the small alleys of land tracts and narrows streets [22].

2.3.2 Radial pattern

The advantage of this pattern along the main streets of the city center towards the edges on the radial shape, so that the radial network associated with each other by straight or curved streets help to reduce the length of the distance between the neighborhoods located at the end of the street and the city center, and enhances this pattern site's (C.B.D) because most of the streets extend them or pass them or then converge [23].

2.3.3 Networking pattern

This type consists of network from the main streets, which are distributed in the form of squares or rectangles and intersect with each other approximately at right angles and equal suitable distances [24], the advantage of this type of traffic easily due to straighter of street, the buildings also facilitates the establishment of basic services, according to geometrical pattern, this pattern appears in the most of modern districts. This table 5 shows the area of these three patterns in the city by the Urban Planning Directorate in Kirkuk .

ID	Roads Pattern	Area km2	Percentage
1	Organic Pattern	1.366	7.86
2	Radial Pattern	2.178	12.54
3	Networking Pattern	13.826	79.6
Total		17.37	100 %

Table 5 : Area of Roads Pattern in Kirkuk 2011

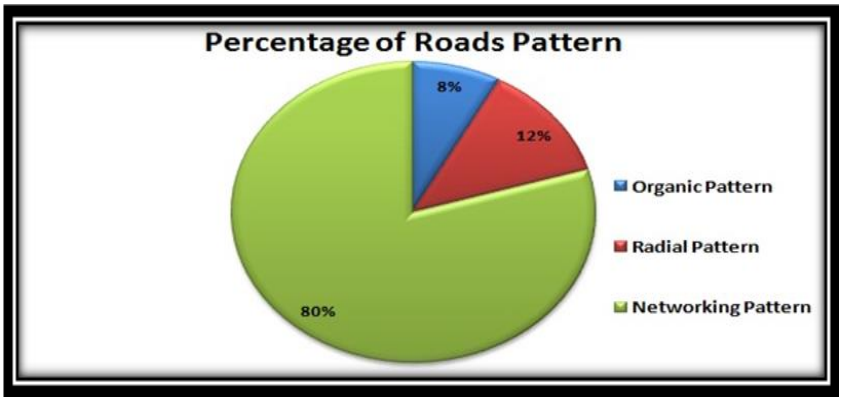


Figure 15 : Pie chart the percentage of roads pattern

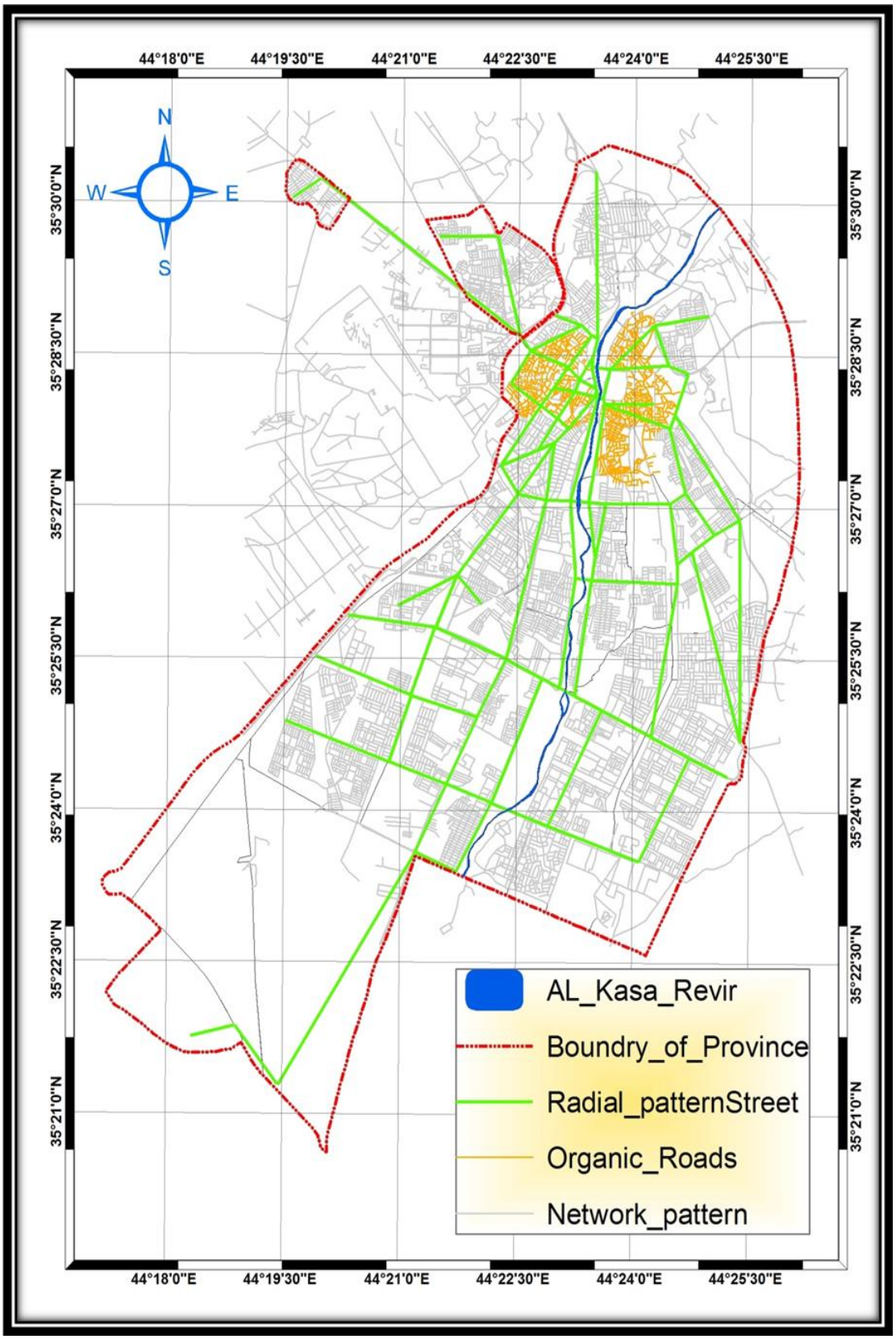


Figure 16: Roads pattern in Kirkuk

2.4 Geographic Information Systems (GIS Technology)

GIS is a technology that integrates geographic features and spreadsheets to evaluate easier understand the true problems of the world. What is the geographic information system began at 1960? The invention of maps that can be programmed used a simple code and stored in the computer to allow for changes in the future if necessary. The earliest version of a GIS was known as Computer mapping and simple line work involved to represent the land features. This was a huge change from mapping the era when the maps to be created painstakingly by hand. Even small changes required to create a new map. Opposed to a flat sheet map, the map can be generated GIS offers many different layers of information which provides a unique way of thinking in a particular geographical area as shown in figure 17. By connecting the maps for databases and GIS enables users to visualize, manipulate, analyze and display spatial data [25].

The advantage of geographic information systems as combining the inquiry own databases and query with the possibility of viewing and analysis and visual processing geographic data from maps and satellite images and aerial photographs operations, a feature that distinguishes GIS from the usual information systems and makes them available to many public and private applications to interpret events and calculate the indicators and develop strategies.

For example: the contemporary challenges in today's world population explosion, pollution, urban sprawl on agricultural areas, and natural disasters, all of these things involved in the geographical dimension including distinguishes it from other problems.

At the local level or the individual problem of finding the best location for residence or create a lab or a new company from the series commercial branches or finding the best soil type fits planting a new crop or to determine the best path to the road network of the fire truck or ambulance or internal bus for the citizens of all these things collected by worker according to specific geographical and global criteria [26].

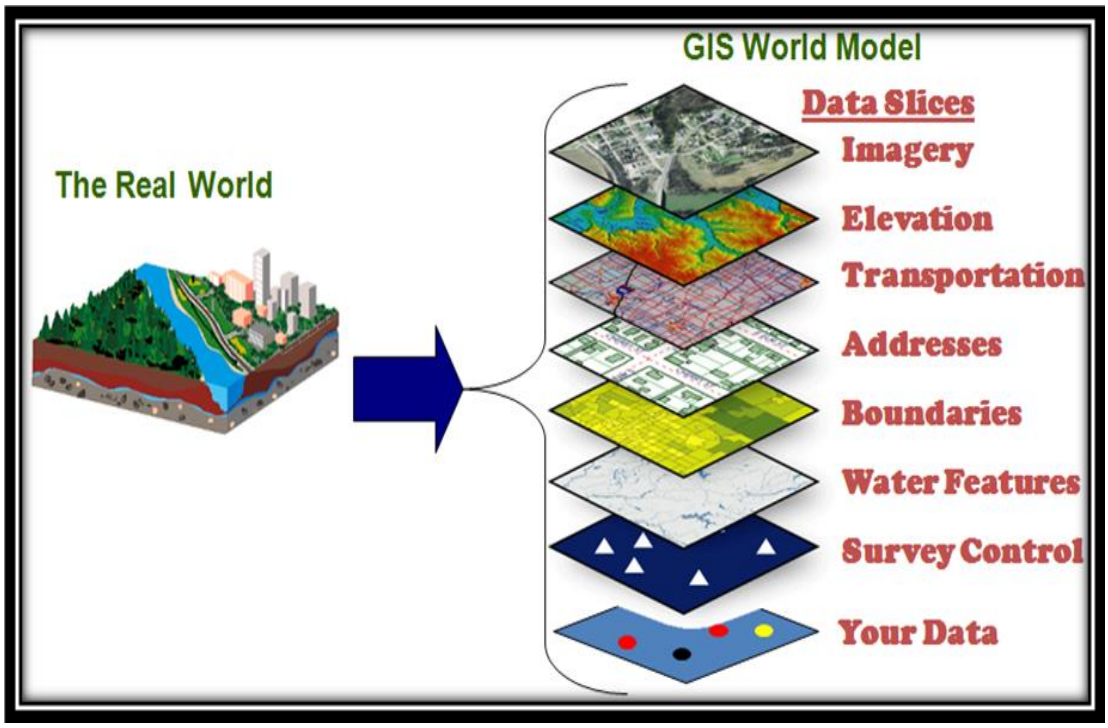


Figure 17 : GIS technology

2.4.1 Necessity to use GIS

Having evolved into a geographic information systems in various fields and disciplines such as urban planning, environmental protection, land use and management of utilities and other because of their ability to organize and analyze geographic information where the advantage of the following capabilities :

1- Connectivity between spatial and non-spatial data.

2- The ability to deal with several layers of data at one time.

3- Analytical ability.

4- Contribute to support decision-making.

2.4.2 GIS components

GIS integrates five key components as shown in figure 18.

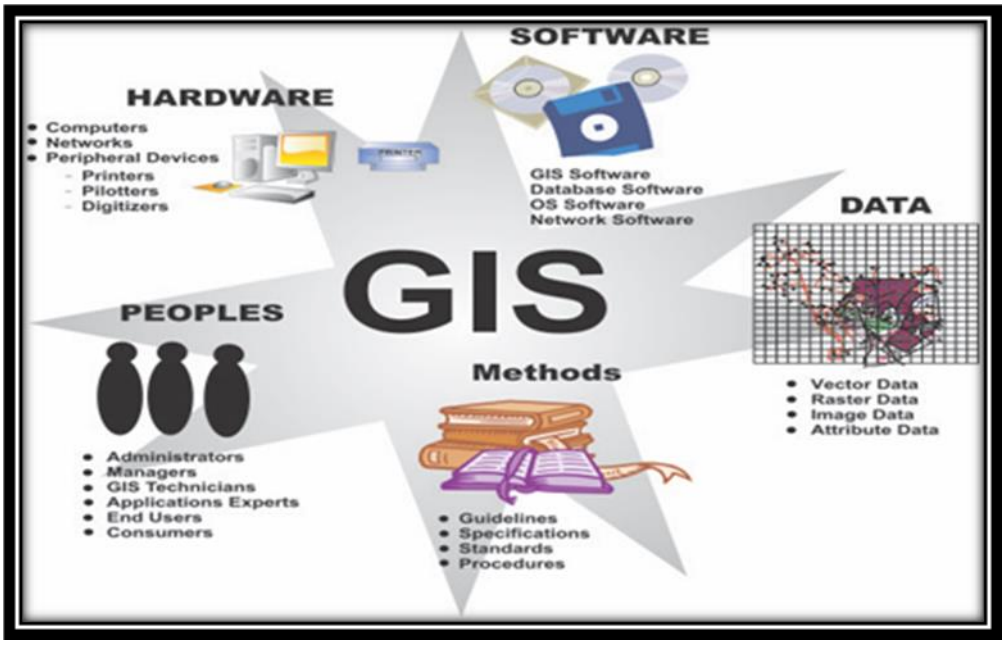


Figure 18 : Five key components of GIS

2.4.2.1 Hardware

The concept of the machine in any information system is the computer that is running on that system. Now GIS on many kinds of computers programs start operating from the Central Computer Services (Main Frame) to serve the huge projects to personal computers (Personal Computer) which can be used in business alone or in a network of personal computers group, in addition to the Besides the proliferation of GPS devices on the surface of the earth (GPS), which is used to identify specific points on the surface of the earth coordinates.

2.4.2.2 Software

GIS software provides the tools and methods for the storage, analysis and display of geographic information. One of the key components in the GIS software tools for the introduction and adaptation of geographic information with the Graphic User Interface (GUI) tool for easy communication between the device and the user.

The programs consists of a set of basic components, which include:

1- Tools for storing different forms non-spatial or geographical data.

2- Integration with the Database Programs (Relational Database).

3- Search tools and analysis and presentation.

4- Graphic user Interface (GUI) facilities to deal with programs.

5- Connectivity tools to work relationships (Topological Relationships) between the elements of the geographical information system.

6- Tools and methods allow for a large number of users enter data and work at the same time and with high efficiency (Multi- User Management).

2.4.2.3 Data

Data is the most important components of GIS data vim division within the geographical information systems to:

- Non-Spatial Data (Tabular Data): It includes data tables and statistics about various natural elements can be represented by nature.
- Spatial data: they include geographic data that represent nature and can be assembled from aerial photographs, and satellite imagery, and digital maps .. (Arial Photos, Satellite Images, Digital Maps) The geographic data and related data tables may can be self-assembled "or purchased from one of the sources of sale data [27].

2.4.2.4 People

The technology and (GIS) have limited value if they are without the individuals who manage the system and create plans to apply to the problems of reality. As well as falls surfers (GIS) of technical specialists who design and develop the system, to those who use it in their everyday work**.**

2.4.2.5 Methods (Procedure)

The geographic information system is successful, which works on the basis of good design plan and work rules, which are the models and practices of each institution

specialized process. For examples of means of analytical application functionality science such as climate or hydrological or urban planning through GIS, or the application of the means of quality control to ensure data entry accuracy, network analysis, or other analytical tools that serve different applications.

2.5 Previous Studies In Different Services

There are several studies which this thesis depended to these studies:

1- Land use and cover change assessment using Remote Sensing in Dohuk city in Iraq via GIS By Jambally Mohammed, 2013. Master thesis. Purports researcher in this research on the importance of LULC, where this cover is subject to continuous changes in all parts of the world, in particular in densely populated areas. In this study back the increase to human activities, including population growth and the urgent need to provide optimum residence. Dohuk city, like many other cities of Iraq, which is experiencing rapid urban growth with lack urban planning systems are considered. The researcher here to restore urban planning of the city using the uses of the land according to international criteria for the provision of the best residence for the residents of the city in terms of the establishment of the infrastructure pillar, and the establishment of schools, health services and internal transportation network during RS and using GIS technology, measurement and analysis of urban growth in the city and information through three times periods (1998-2007-2011) where he used these new technologies referred to in the mapping and identification and evaluation of land use and direction of urban growth and address the current lack of information by providing accurate data [28].

2- Distribution and planning of public services in the Qalqilya city in Palestine using GIS technology By Nidal Rifat Ahmed Anaya, 2004. Master thesis. This study dealt with planning and distribution of public services in the city of Qalqilya using systems and included educational, health and administrative services, and cultural (GIS) geographic information and recreational, in terms of distribution, efficiency and characteristics of urban and suitability to the requirements of the population in the city. The study aimed to highlight the importance of applying scientific methods in planning, particularly in public services planning, and to identify the most important reasons that hinder the application of planning standards in the city and then study addressed the most important criteria to be used in public service planning and that the researcher

applied to the study area in addition to the review of the fact located in the study area and to identify the most important characteristics that distinguished them public services. Among the most important findings of the study, there is a shortage in many of the necessary medical specialties to the citizen, such as heart and kidney disease and cancer, in addition to the lack of centers, first aid at the district level and the lack of coordination between the existing city health centers, as well as the lack of upgrade hospitals in the level required, as the study found the presence of dispersion in the distribution of administrative services and the concentration of each in the commercial center of the city perimeter [29].

3- Analysis and evaluation of the distribution of health, educational, cultural and recreational services in Nablus By Awni Abdulhady Mashaky, 2008. Master thesis.

This study aimed to :

- Highlight the importance of spatial and regional planning of good services.
- Checking extent to match the distribution of health, education and cultural services with criteria sites.
- Help decision makers and planners to make decisions accurately planning and high quality.

Findings of the study :

- There are interest by the government of education and health services sector, as opposed to cultural and recreational services that have not been distributed locations, and not to rely on specific criteria.
- Decrease in secondary schools for girls in the north of the mountain, and near Balata and Askar, and the decrease of kindergartens in residences.
- There are schools outside the scope of universal standards because of its distance from residential areas, such as North Asira Secondary School for boys, which far more than 7 km away from some of the houses, and two schools about 2 km, which is outside the appropriate criteria, and some rural communities lacking basic schools such as Nasiriyah.
- Equitable distribution of educational services for population centers.

The researcher found the following recommendations:

- The provision of minimum basic schools in the lightly populated residential areas such as Nasiriyah.

- Provide other distant sites for schools from residential areas so that they are suitable distance for students.
- Supply basic schools on the other sites which are located extension the main streets, and in particular, which is located on the street between cities [30].

4- The spatial distribution of the efficiency of public health centers in Fallujah city using GIS Anbar University By Ahmed Mohammed Al-Dolaymi, 2009. Master thesis. The study addressed the spatial distribution of the efficiency of public health centers in the city of Fallujah using GIS spatial distributions through the field in the program for the analysis of spatial data, using the method of standard distance and the presumption of relevance and neighborhood center actual rate average geographical center. And identify areas of customization, as well as the use (ArcGIS 9.3) software to analyze the link between the health service variables. Statistical bag and showed the results of the analysis of the low level of efficiency of the health centers services in terms of their spatial locations and the number of medical and technical staffs reviewed the spatial distribution of the study to the Centers for Public Health and Population in the city and addressed the future planning for the needs of the city's public health centers and hospitals based on the number of local standards such as after the health center or hospital from residential areas. This study presents a set of conclusions
in the study of the spatial distribution efficiency (GIS) the most important of the possibility of employing (GIS) to public health centers, the adoption of local standards [31].

5- Planning and analysis and the development of commercial services in Tulkarem using GIS By Mohammed N.Abdulsalam, 2003. Master thesis. The researcher in this study refers mainly reality of commercial services for the city of Tulkarem, this thesis included the problem of the distribution of commercial services in the city mentioned above. As well as this thesis highlight on the historical stages through which the city of geographical properties, which in turn passed through several stages of planning. As the study concentrated on analysis of the reality of commercial services in the supported city maps and aerial photographs.

Also the thesis included several objectives, the most important analysis of the reality of commercial services in Tulkarem and put some perceptions and proposals that contribute to the development of these services in the future. In addition to other goals

concentrated in linking population and urban development and economic development, which is reflected on the reality of the current business services analysis, evaluation and draw conclusions.

Finally, the study showed the most important problems of the city of Tulkarem in this aspect and the development of suitable solutions and suggestions for the best results out of these problems [32].

6- Distribution and planning of educational services in Salfit using GIS technique By Heba M.Hamoda, 2009. Master thesis.

This study addressed the planning and distribution of educational services in Salfit, characterized the study of being dealt a section of the most important sectors in the community - which relied wheel Progress and prosperity of the province of the same geographical importance. The study aimed to survey educational services, to get to know the extent of locations match, the specifications with universal standards as well as local standards (Palestinian), and also clearly visualize the distribution of those services. Also this study described as the most important obstacles to the application of those standards, and in order to achieve this study was concepts related to planning, particularly planning educational services, as well as geographic information systems where the use of its potential in the spatial analysis of the sites of those services. In addition the study was descriptive in its approach to the analytical method in the context of data analysis through collected from the concerned authorities (Directorate of Education in Salfit) or by scanning field for kindergartens and schools of Salfit, were also measured the level of satisfaction with these services through the distribution of forms to a sample of students as well as schools manager and kindergarten. In the result, the study recommended that the study of urban development trends and population growth rates to choose the best sites for new schools and away from the spontaneity in the selection of school sites and follow the principles and standards of planning [33].

7- Spatial analysis of urban transportation network of the Kuwait city By Mohammed AL-Khozamy Aziz, 2002. Master thesis. Kuwait, one of the rare Arab countries that have adopted a series of urban plans successive aimed to progress the band Urban, in terms of a balanced spatial distribution of land use on the systematic development of residential suburbs luxury customized to the citizens, and also provides all the basic services for the life of a well-off, such as, health, educational, industrial and commercial, religious and recreational services .

This urban development is also accompanied to the city to set up a network that routes (internal transport) developed that rely on the structure and clear begin of highways whose form ring and radiation main road that separates the residential areas and subsidiary and secondary roads within the residential areas to connect the pieces of land within these areas.

Characterized by the importance of the urban transport network in terms of geographical studies have been selected to determine the spatial characteristics of the network in terms of geographical distribution and its relationship to urban areas and population.

The spatial analysis automated systems that rely to GIS technique research one of the most important messages in the generation of the current evolution of computer technology and RS through access to high results in terms of quality and accuracy compared to the old traditional ways of analytical.

This study seeks to achieve a number of goals :

- Applied GIS technique in the field of urban transport in this province by depending on method automated spatial analysis.
- Cartographical representation of the pattern and the relative geographical distribution for urban transport network on the basis of urban areas.
- Highlight the spatial relationship between the spatial density of the urban transport network and the distribution of the population.
- Highlight the spatial relationship between the urban transport network and main road network.
- Show the spatial relationship between the urban transport network and centers attract the daily movement of passengers.

Applied of quantitative indicators to measure the degree of coherence (Connectivity) to explain the mutual relationship between the network node via the links by depending on the Beta and Gama index, also Alpha [34].

CHAPTER 3

METHODOLOGY

3.1 Data Collections

Geographical information system able to use the information on maps, satellite images, aerial photographs and statistical data, provided a common spatial relationship between these data. It can use the geographic information system of focus and find the relations between the various subjects that exist on the map and the data collection process is the factor that controls the time within the geographic information system and because of the nature of the data collection process takes time and a very big effort. As well as the relations between the different subjects to determine the required data.

3.1.1 Spatial data

Spatial data has a spatial component means that data are connected to a place in the earth, maps showing the map of Iraq and a map of residential areas in Kirkuk (study area), as shown in figure 19, which was obtained by the center for geographical studies in Kirkuk province. As has been noted previously images in the first chapter (1.2).

1.Shape files :

The shape file format is a popular geospatial vector data format for (GIS) software, that has extension (.shp). It is developed and keeping up by Esri as a generally open requirement for data interoperability between company and other GIS software products. The shape file format can spatially describe vector features like points, lines, and polygons, representing, for example, , rivers, water wells and lake. Every item usually has attributes that describe it, such as name or high temperature, as shown in figure 20.

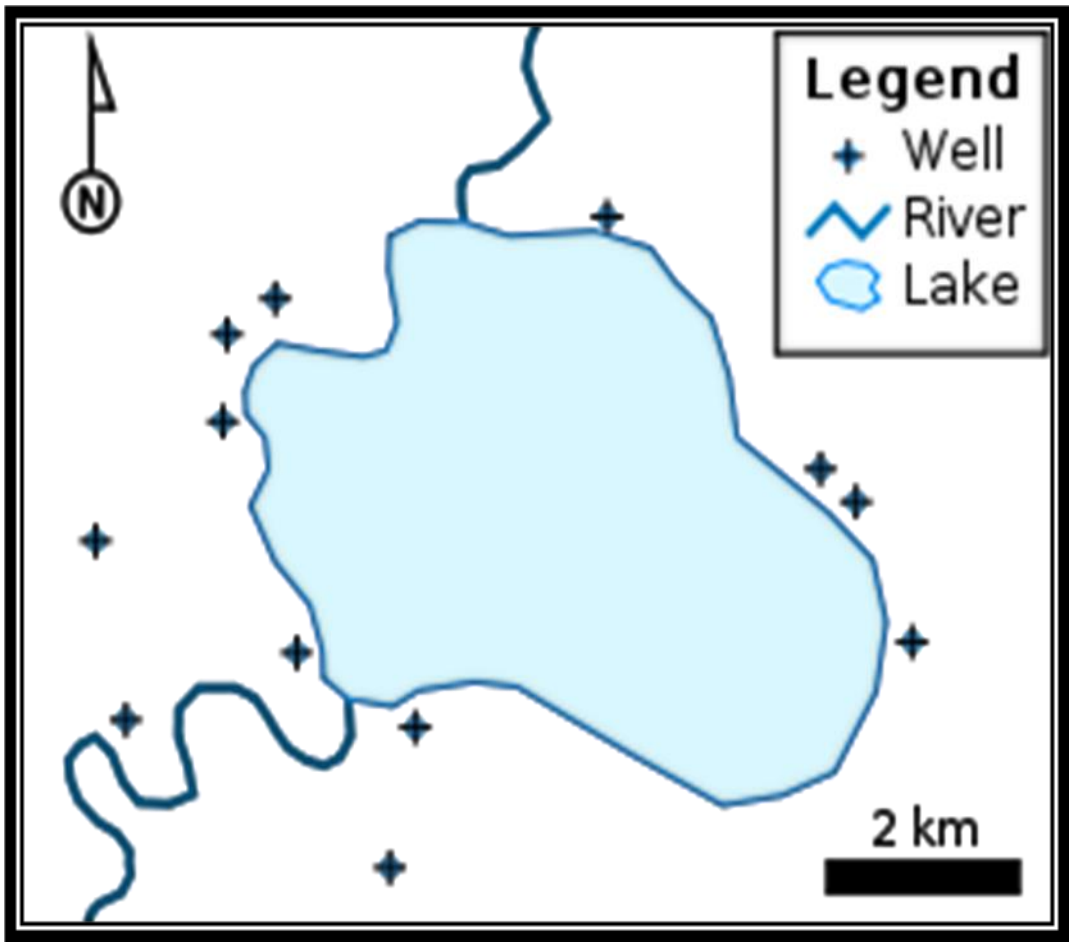


Figure 19 : Shape files

As the researcher using (Arc GIS 10) software in his research and the application of the following commands to add the names of residential areas in the English language and the calculation of the total city area of each residential area through the following commands:

- Add filed command :

  Open the attribute table then right click on the table options, after that add a new field and put name of filed also type of data that putted, as shown in figure 20.

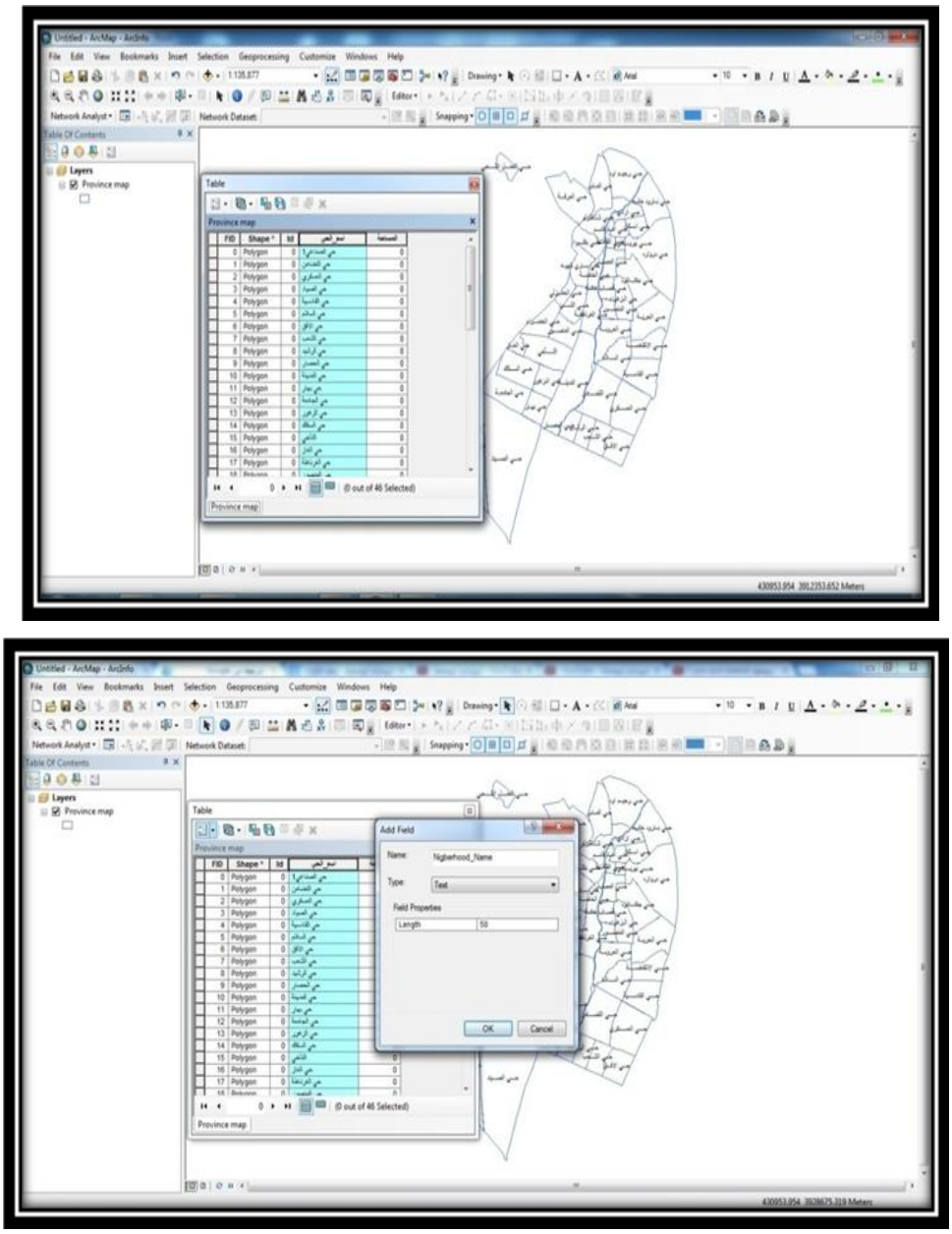


Figure 20: Add filed command

- Editor command:

By activate editor command in the existing software and then put the labels in English for the names of areas, then worked to save the editor, after that stop editor, finally make exporting data from the layer properties (right click) chooses (Data), then export data into (.shp) files. As shown in figure 21.

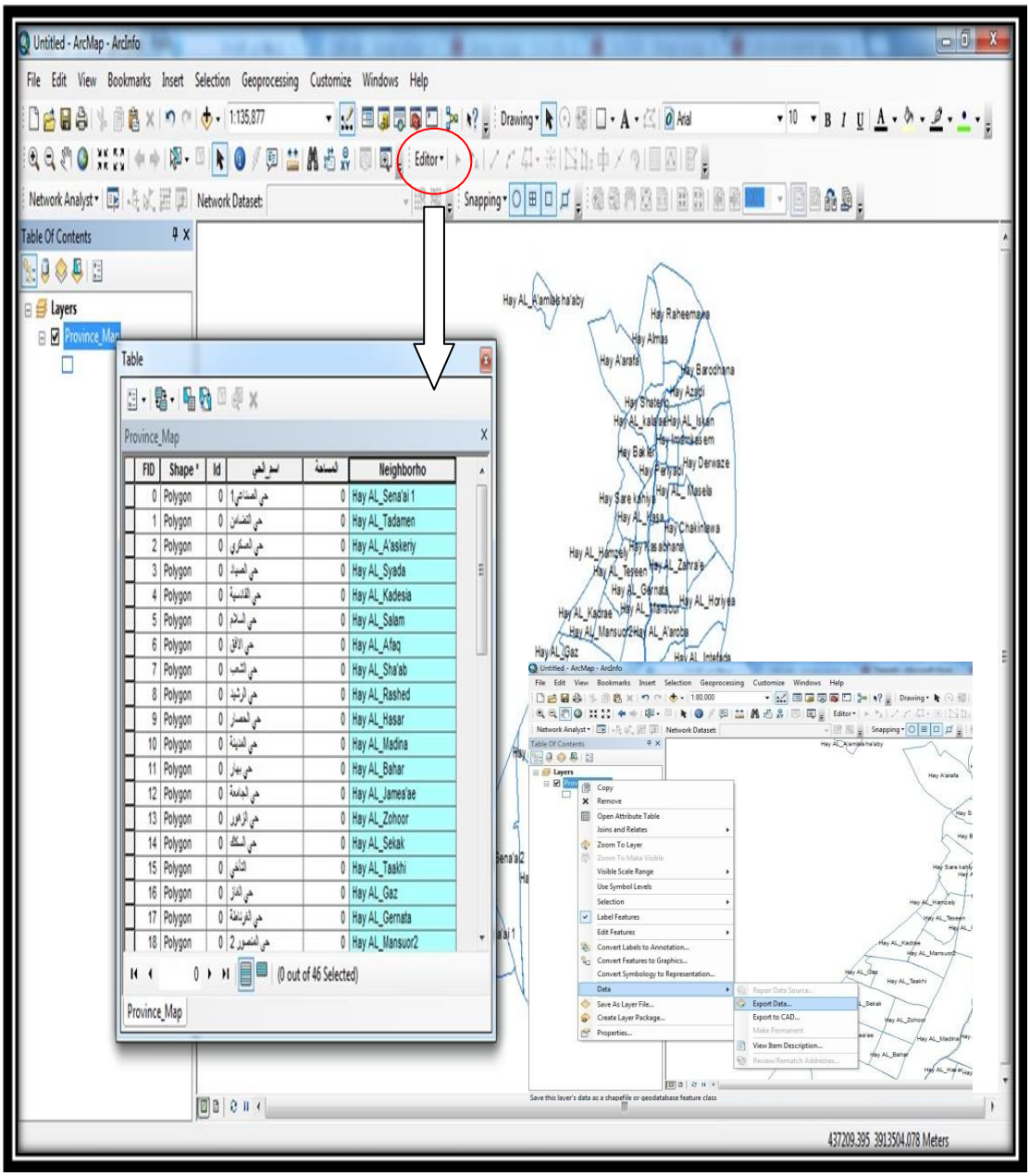


Figure 21 : Editor command

- Measure command:

To calculate the area for each residential area then putted into the attribute table that related province map and show the result or information for each filed in the attribute table by button command that called Identify, as shown in figure 22.

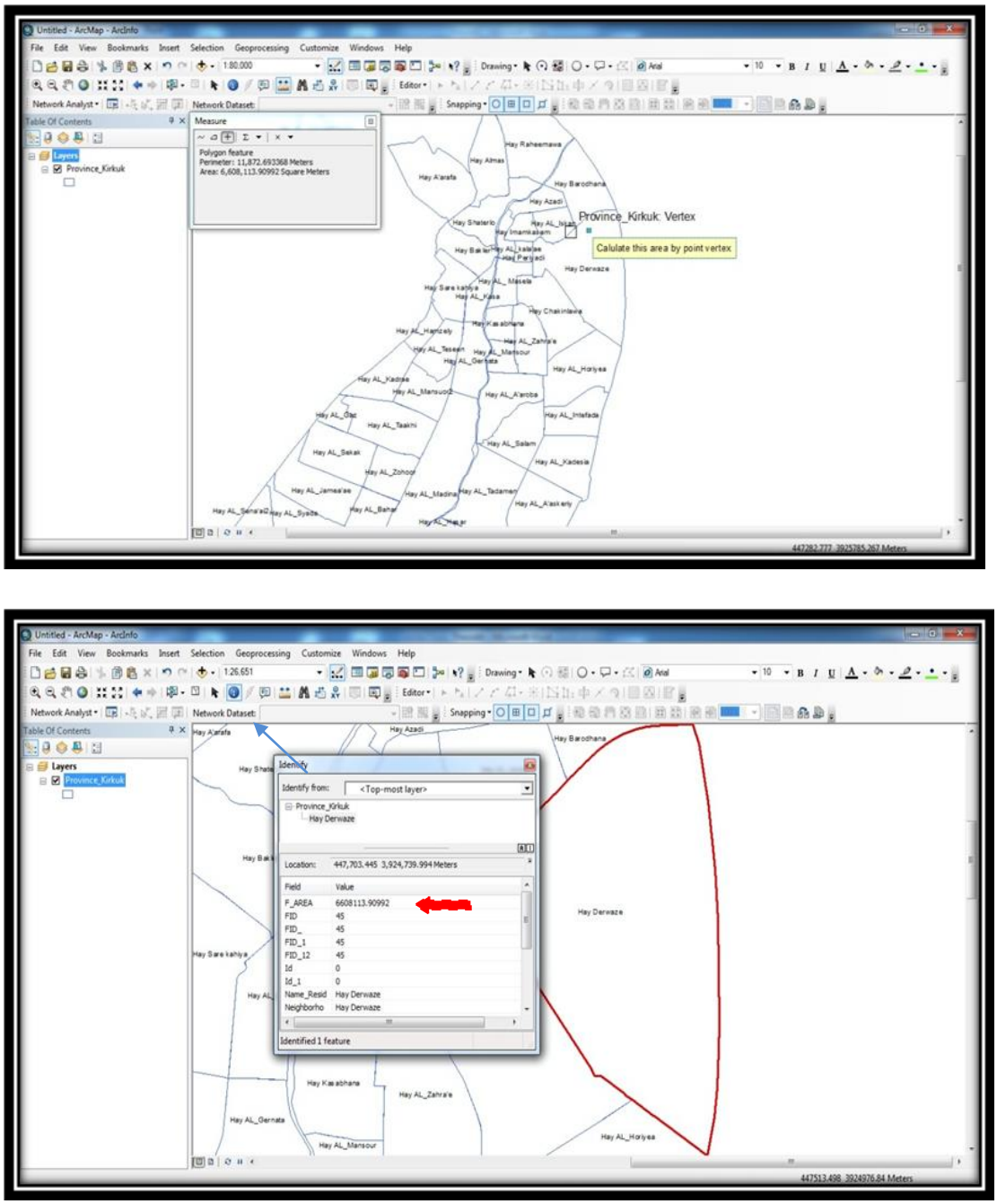


Figure 22: Measure & identify commands

After these procedures are going to layer properties and go to the symbols and choosers (Categories-Unique Values) to show the names of the provinces, according to area representing by colors, in addition show the label on the map, as shown in figure 23. After that going to (Layout view) in the bottom left of the software interface, as well as choosing the grids for making map grid form layer properties, then insert the north arrow also inserted the legend and title and scale bar. Finally we are doing

exporting map from file to save the map like image format like (.Jpeg), as shown the result in figure 24.

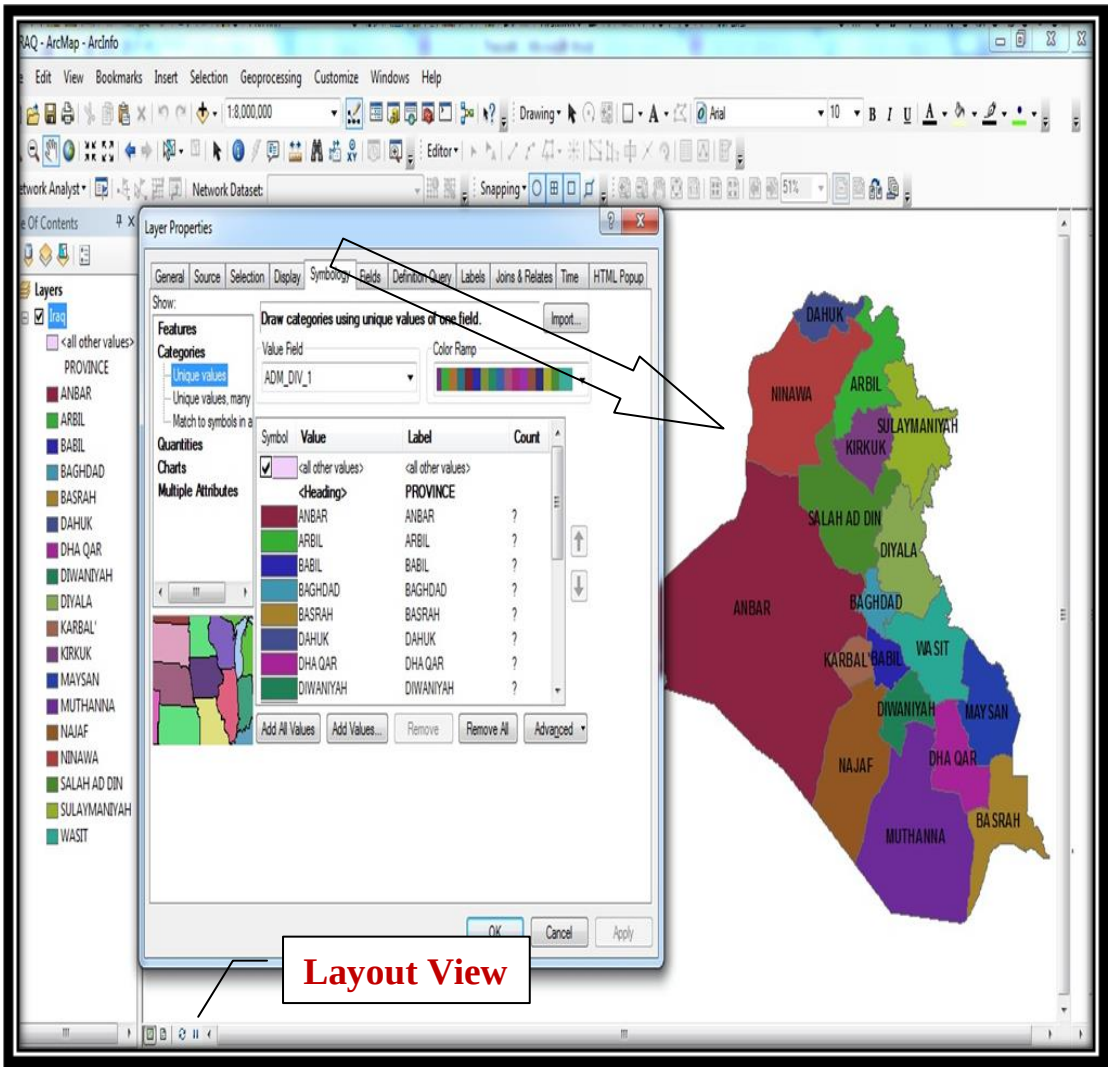


Figure 23 : Map symbols & label Show & layout view button

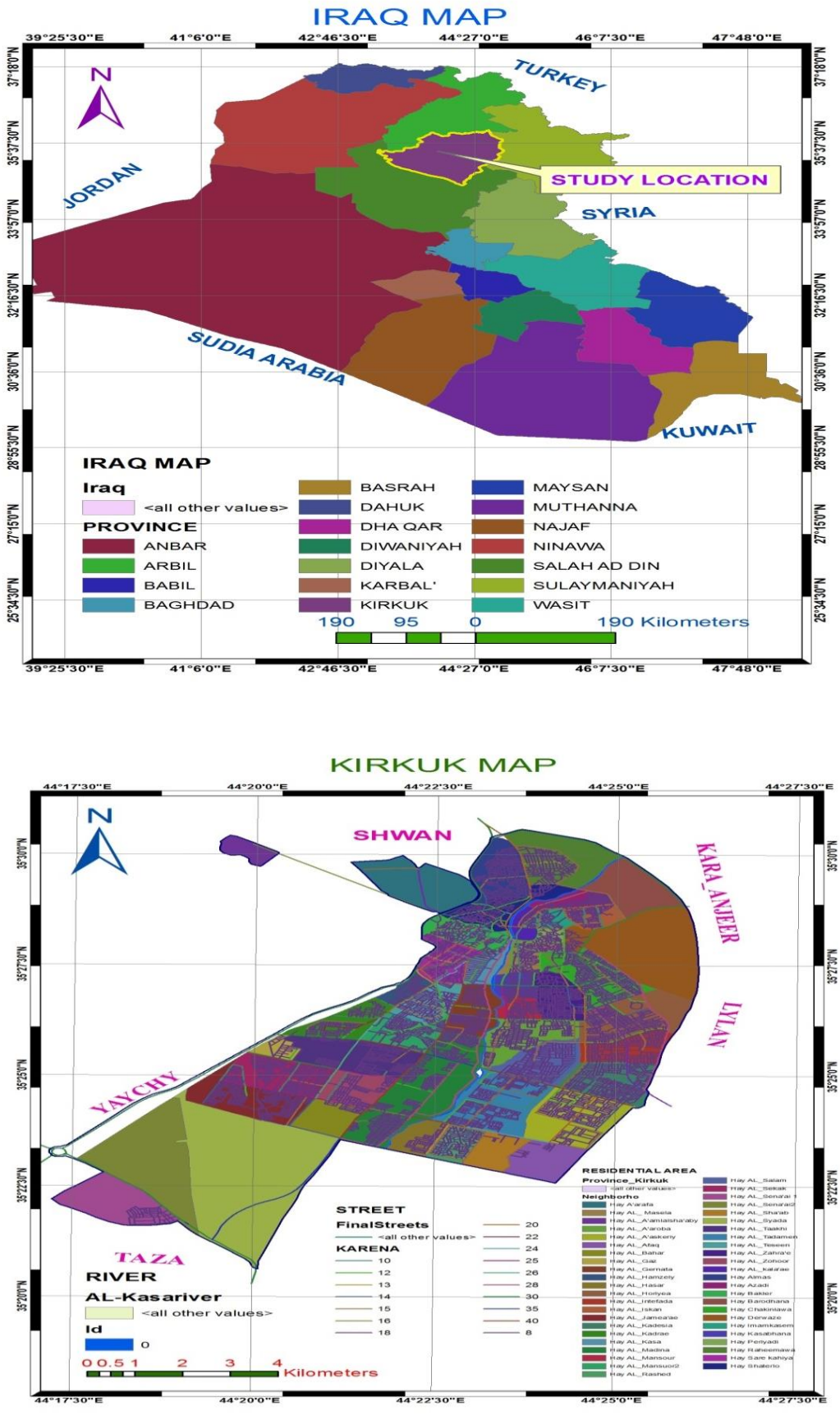


Figure 24 : Iraq & study location maps within residential area

2. Aerial photographs:

This data is further important data (Raster Data) in Kirkuk province, that has extension (.img), and was taken from Kirkuk University / College of Education / Board of Graduate Studies / Department of Geography as shown in Figure 21.

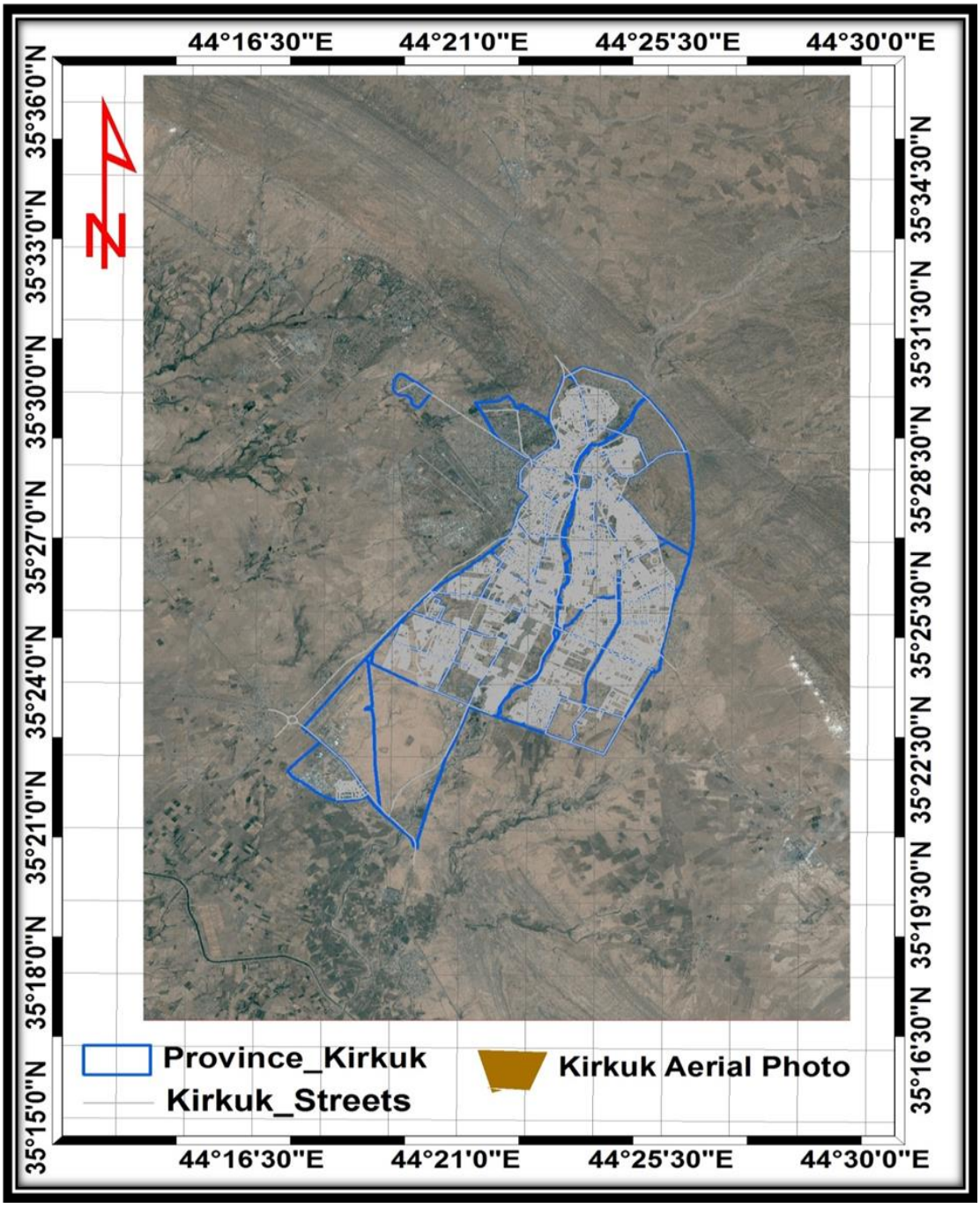
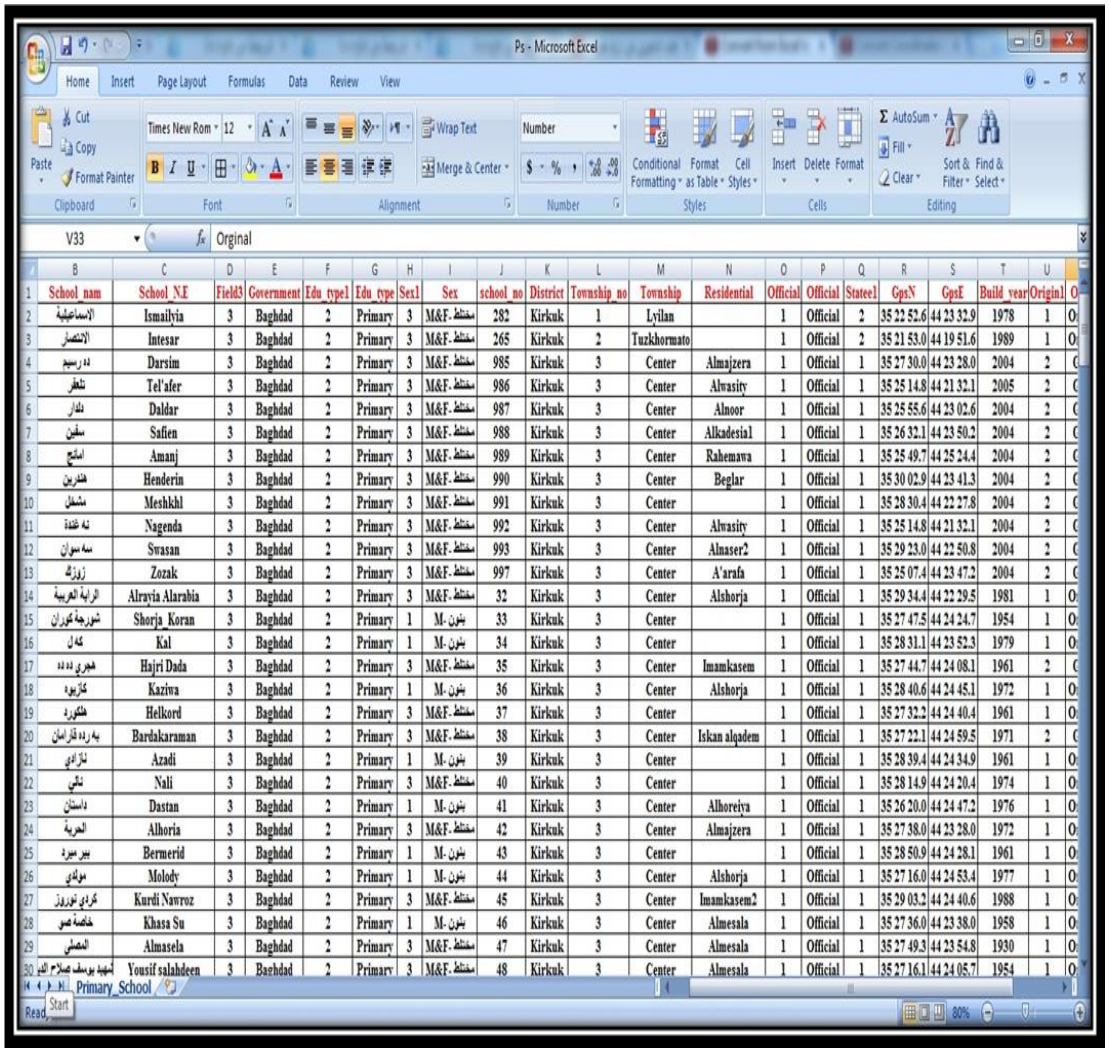


Figure 25 : Kirkuk aerial photo

3.1.2 Non spatial data

This type of data representation by (point) consists of Microsoft Excel sheet which includes the GPS of the schools in the city center of Kirkuk. As well as these information provided by General Directorate for Educational Kirkuk. So the researcher separated these data in to primary schools table, as shown in figure 26, and thus converted into (.shp) by Arc GIS by add (FID) primary key in the excel sheet, as shown in figure 27.

In addition to building a database by Excel table for each population density residential area in the city during the years 1997 - 2011 that obtain from Census Kirkuk Directorate as shown in the figure 28, and the researcher after converting to Shapefile by merging it with a map of areas of Kirkuk, by (Join Related) command in the Arc GIS software, as shown in figure 29 and figure 30 and 31.



	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	School_nam	School_N.E	Field3	Government	Edu_type1	Edu_type	Sex1	Sex	school_no	District	Township_no	Township	Residential	Official	Official	Statee1	GpsN	GpsE	Build_year	Origin1
2	الاسماعيلية	Ismailyia	3	Baghdad	2	Primary	3	M&F- مختلط	282	Kirkuk	1	Lyilan		1	Official	2	35 22 52.6	44 23 32.9	1978	1
3	الانتصار	Intesar	3	Baghdad	2	Primary	3	M&F- مختلط	265	Kirkuk	2	Tuzkhormato		1	Official	2	35 21 53.0	44 19 51.6	1989	1
4	دەرسیم	Darsim	3	Baghdad	2	Primary	3	M&F- مختلط	985	Kirkuk	3	Center	Almajzera	1	Official	1	35 27 30.0	44 23 28.0	2004	2
5	تلعفر	Tel'afer	3	Baghdad	2	Primary	3	M&F- مختلط	986	Kirkuk	3	Center	Alwasity	1	Official	1	35 25 14.8	44 21 32.1	2005	2
6	دلدار	Daldar	3	Baghdad	2	Primary	3	M&F- مختلط	987	Kirkuk	3	Center	Alnoor	1	Official	1	35 25 55.6	44 23 02.6	2004	2
7	سفين	Safien	3	Baghdad	2	Primary	3	M&F- مختلط	988	Kirkuk	3	Center	Alkadesia1	1	Official	1	35 26 32.1	44 23 50.2	2004	2
8	امانج	Amanj	3	Baghdad	2	Primary	3	M&F- مختلط	989	Kirkuk	3	Center	Rahemawa	1	Official	1	35 25 49.7	44 25 24.4	2004	2
9	هندرين	Henderin	3	Baghdad	2	Primary	3	M&F- مختلط	990	Kirkuk	3	Center	Beglar	1	Official	1	35 30 02.9	44 23 41.3	2004	2
10	مشخل	Meshkhl	3	Baghdad	2	Primary	3	M&F- مختلط	991	Kirkuk	3	Center		1	Official	1	35 28 30.4	44 22 27.8	2004	2
11	نەغدة	Nagenda	3	Baghdad	2	Primary	3	M&F- مختلط	992	Kirkuk	3	Center	Alwasity	1	Official	1	35 25 14.8	44 21 32.1	2004	2
12	سەسوان	Swasan	3	Baghdad	2	Primary	3	M&F- مختلط	993	Kirkuk	3	Center	Alnaser2	1	Official	1	35 29 23.0	44 22 50.8	2004	2
13	زوزك	Zozak	3	Baghdad	2	Primary	3	M&F- مختلط	997	Kirkuk	3	Center	A'arafa	1	Official	1	35 25 07.4	44 23 47.2	2004	2
14	الرابية العربية	Alravia Alarabia	3	Baghdad	2	Primary	3	M&F- مختلط	32	Kirkuk	3	Center	Alshorja	1	Official	1	35 29 34.4	44 22 29.5	1981	1
15	شورجة كوران	Shorja_Koran	3	Baghdad	2	Primary	1	M- بنون	33	Kirkuk	3	Center		1	Official	1	35 27 47.5	44 24 24.7	1954	1
16	كەل	Kal	3	Baghdad	2	Primary	1	M- بنون	34	Kirkuk	3	Center		1	Official	1	35 28 31.1	44 23 52.3	1979	1
17	هجري دەدە	Hajri Dada	3	Baghdad	2	Primary	3	M&F- مختلط	35	Kirkuk	3	Center	Imamkasem	1	Official	1	35 27 44.7	44 24 08.1	1961	2
18	كازيوة	Kaziwa	3	Baghdad	2	Primary	1	M- بنون	36	Kirkuk	3	Center	Alshorja	1	Official	1	35 28 40.6	44 24 45.1	1972	1
19	هلكورد	Helkord	3	Baghdad	2	Primary	3	M&F- مختلط	37	Kirkuk	3	Center		1	Official	1	35 27 32.2	44 24 40.4	1961	1
20	بەردەقەرامان	Bardakaraman	3	Baghdad	2	Primary	3	M&F- مختلط	38	Kirkuk	3	Center	Iskan alqadem	1	Official	1	35 27 22.1	44 24 59.5	1971	2
21	ئازادي	Azadi	3	Baghdad	2	Primary	1	M- بنون	39	Kirkuk	3	Center		1	Official	1	35 28 39.4	44 24 34.9	1961	1
22	ئالي	Nali	3	Baghdad	2	Primary	3	M&F- مختلط	40	Kirkuk	3	Center		1	Official	1	35 28 14.9	44 24 20.4	1974	1
23	داستان	Dastan	3	Baghdad	2	Primary	1	M- بنون	41	Kirkuk	3	Center	Alhoreiya	1	Official	1	35 26 20.0	44 24 47.2	1976	1
24	الحرية	Alhoria	3	Baghdad	2	Primary	3	M&F- مختلط	42	Kirkuk	3	Center	Almajzera	1	Official	1	35 27 38.0	44 23 28.0	1972	1
25	بير ميرة	Bermerid	3	Baghdad	2	Primary	1	M- بنون	43	Kirkuk	3	Center		1	Official	1	35 28 50.9	44 24 28.1	1961	1
26	مولدي	Molody	3	Baghdad	2	Primary	1	M- بنون	44	Kirkuk	3	Center	Alshorja	1	Official	1	35 27 16.0	44 24 53.4	1977	1
27	كردي نوروز	Kurdi Nawroz	3	Baghdad	2	Primary	3	M&F- مختلط	45	Kirkuk	3	Center	Imamkasem2	1	Official	1	35 29 03.2	44 24 40.6	1988	1
28	خاصة صو	Khasa Su	3	Baghdad	2	Primary	1	M- بنون	46	Kirkuk	3	Center	Almesala	1	Official	1	35 27 36.0	44 23 38.0	1958	1
29	المصلى	Almasela	3	Baghdad	2	Primary	3	M&F- مختلط	47	Kirkuk	3	Center	Almesala	1	Official	1	35 27 49.3	44 23 54.8	1930	1
30	أسهيد يوسف صلاح الدين	Yousif salahdeen	3	Baghdad	2	Primary	3	M&F- مختلط	48	Kirkuk	3	Center	Almesala	1	Official	1	35 27 16.1	44 24 05.7	1954	1

Figure 26 : Primary schools excel sheet

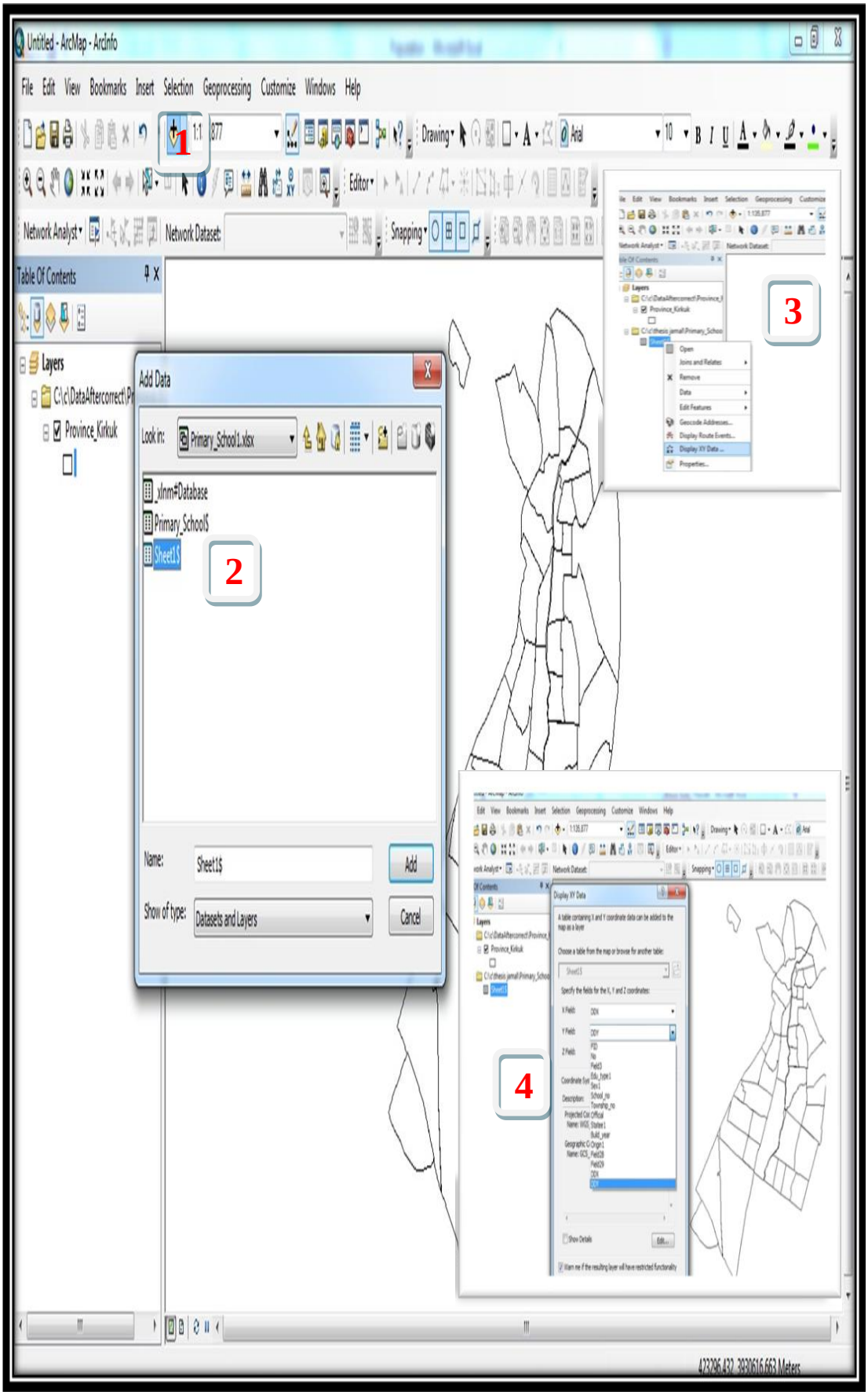


Figure 27: Steps for converted excel sheet into .Shp

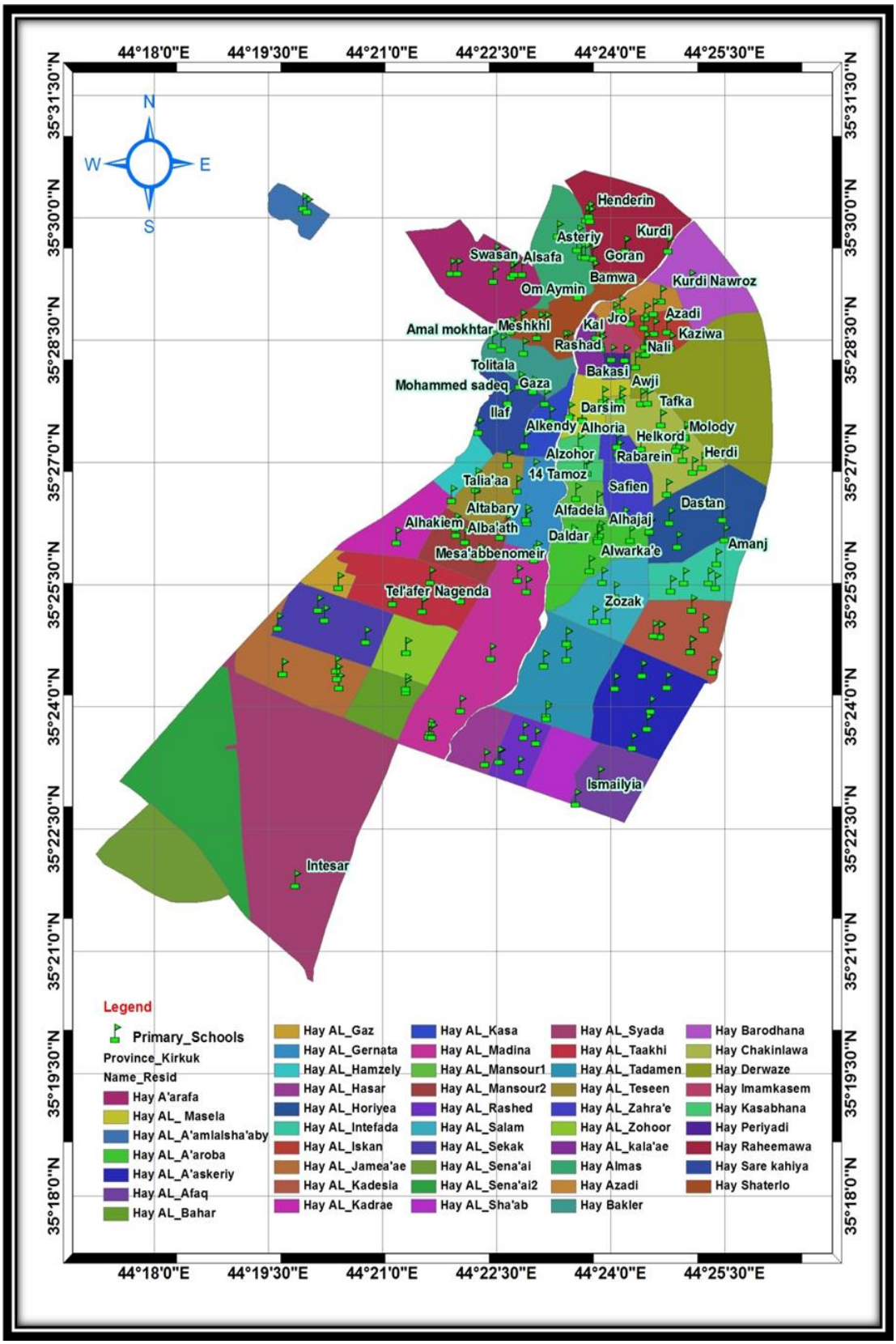
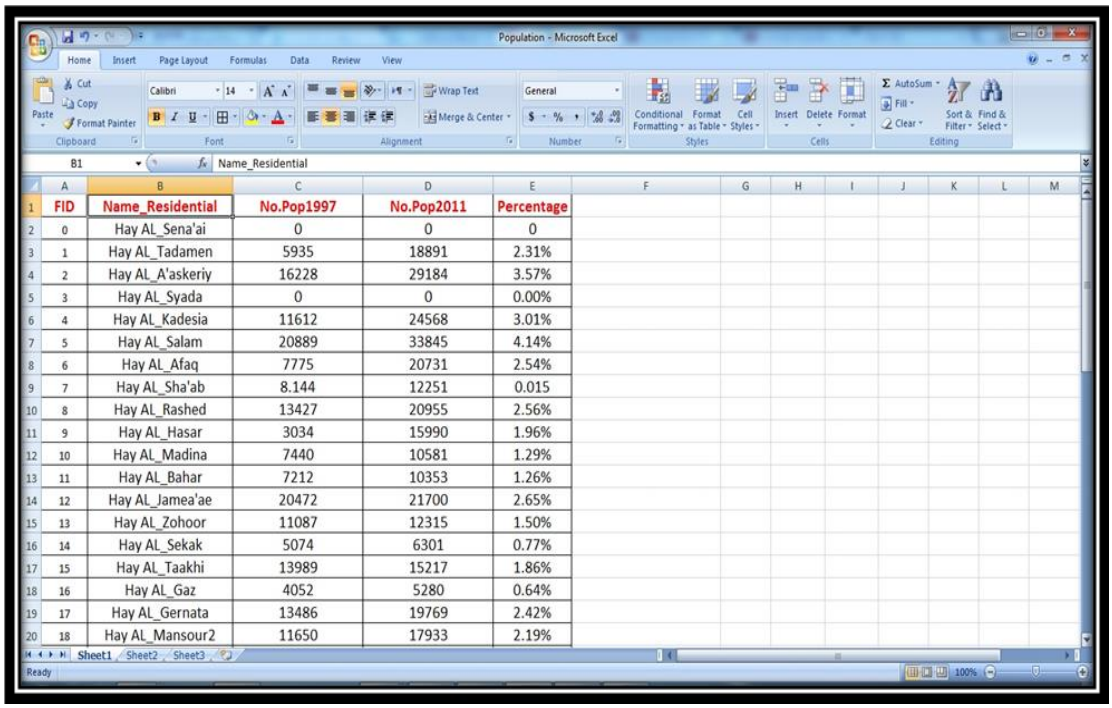


Figure 28: Primary schools after converted form excel sheet into (.Shp)



Population - Microsoft Excel

B1: Name_Residential

FID	Name_Residential	No.Pop1997	No.Pop2011	Percentage
0	Hay AL_Sena'ai	0	0	0
1	Hay AL_Tadamen	5935	18891	2.31%
2	Hay AL_A'askeriy	16228	29184	3.57%
3	Hay AL_Syada	0	0	0.00%
4	Hay AL_Kadesia	11612	24568	3.01%
5	Hay AL_Salam	20889	33845	4.14%
6	Hay AL_Afaq	7775	20731	2.54%
7	Hay AL_Sha'ab	8.144	12251	0.015
8	Hay AL_Rashed	13427	20955	2.56%
9	Hay AL_Hasar	3034	15990	1.96%
10	Hay AL_Madina	7440	10581	1.29%
11	Hay AL_Bahar	7212	10353	1.26%
12	Hay AL_Jamea'ae	20472	21700	2.65%
13	Hay AL_Zohoor	11087	12315	1.50%
14	Hay AL_Sekak	5074	6301	0.77%
15	Hay AL_Taakhi	13989	15217	1.86%
16	Hay AL_Gaz	4052	5280	0.64%
17	Hay AL_Gernata	13486	19769	2.42%
18	Hay AL_Mansour2	11650	17933	2.19%

Sheet1 Sheet2 Sheet3

Ready

Figure 29: Population Excel Sheet

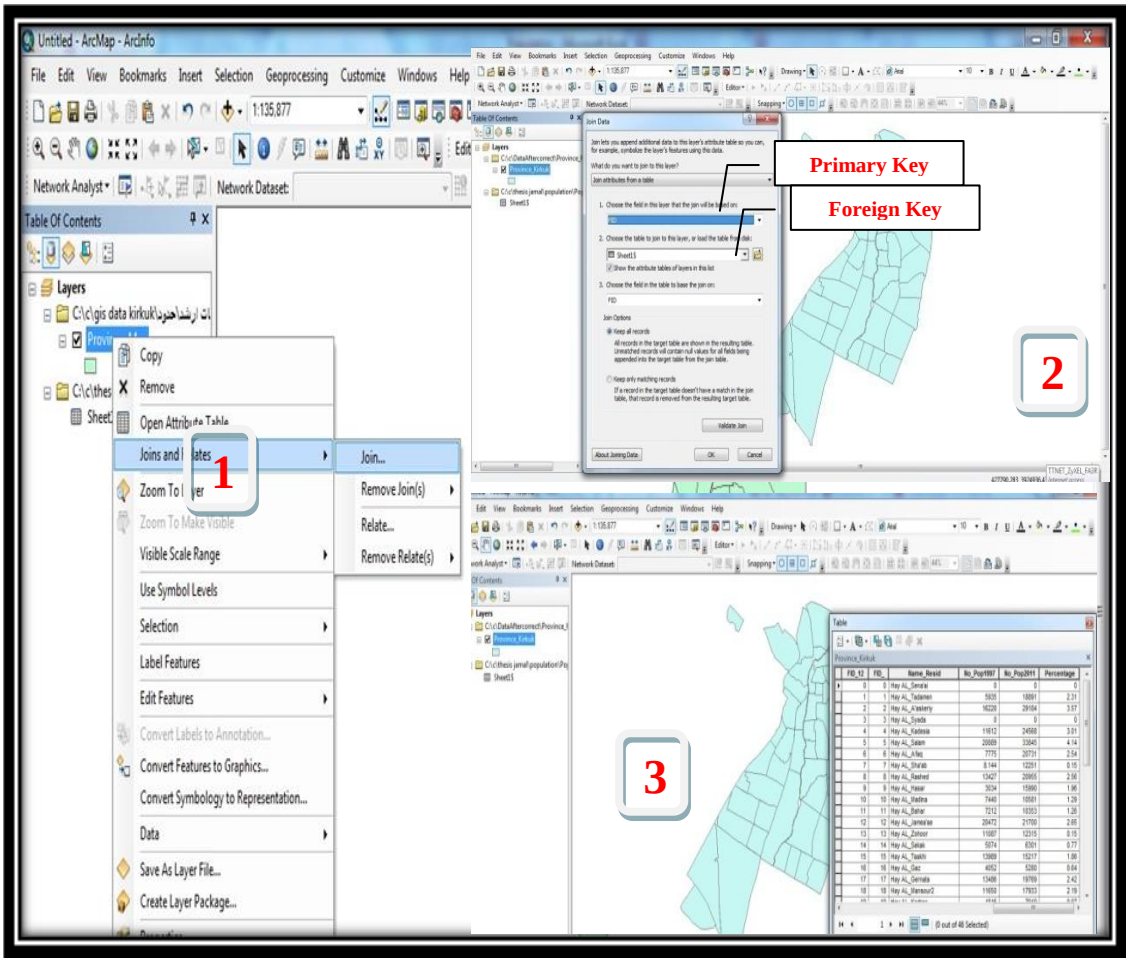


Figure 30 : Population (Join related)

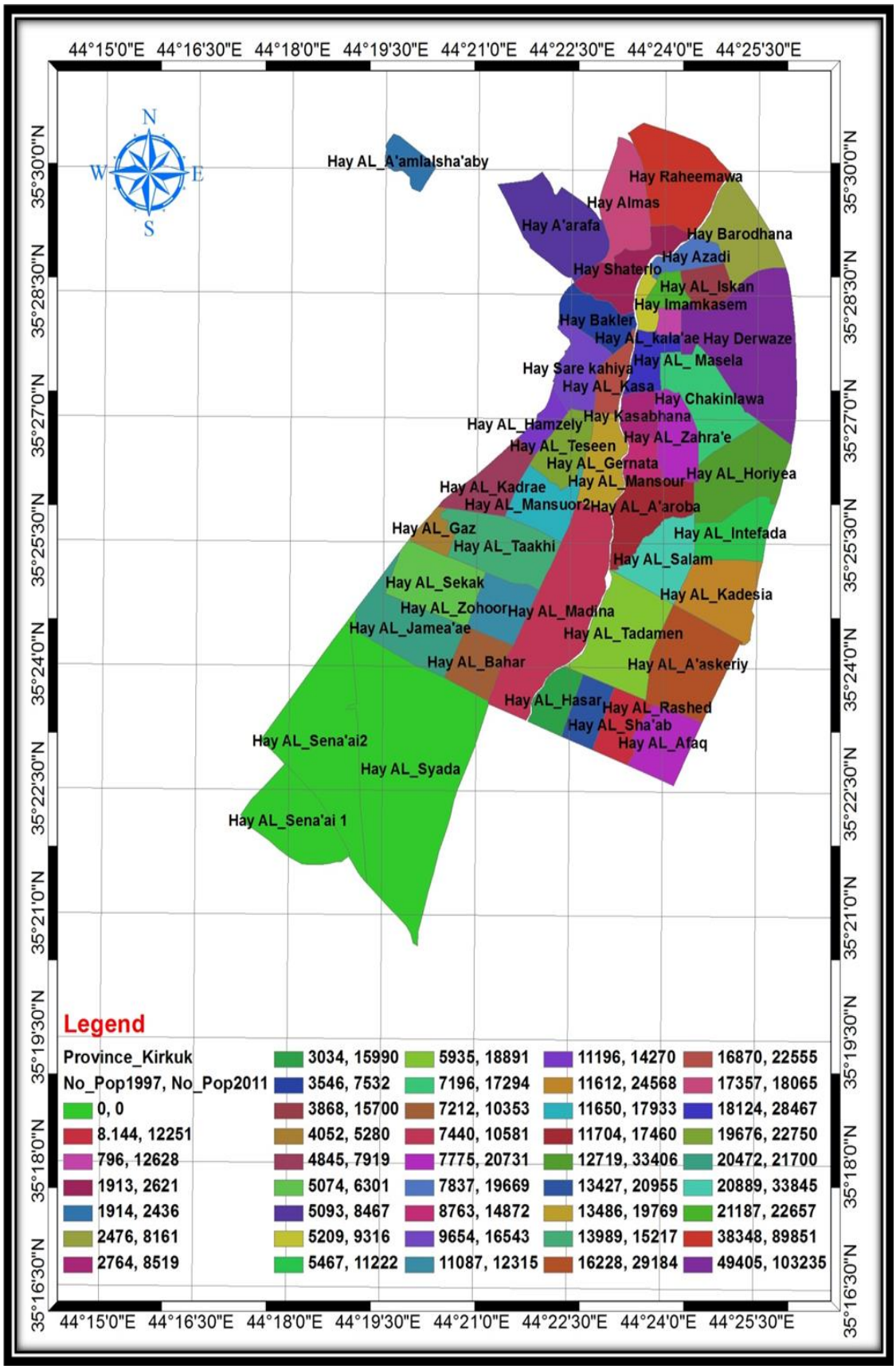


Figure 31: No. of Population for each district after join from excel sheet

In addition to tables of police stations in the city that have been taken coordinates by Google Earth, because of the bad security situation in the country's public and private province if it was difficult to go there and take the information or even by GPS device. And have led convert these coordinates by Google Earth through this program (UTM conversion), as shown in figure 32, of geographical system to Universal Transverse Mercator coordinate system (UTM), as shown in figure 33, the form of coordinates are read by Arc GIS obtained as shown in Figure 34.

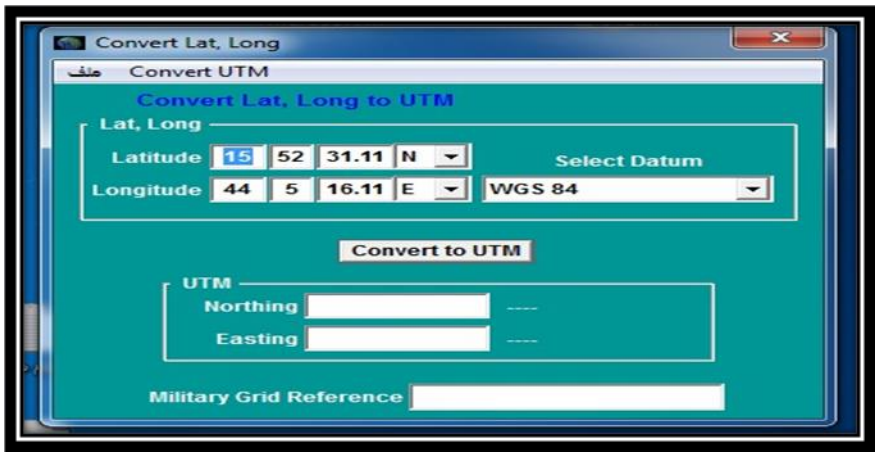
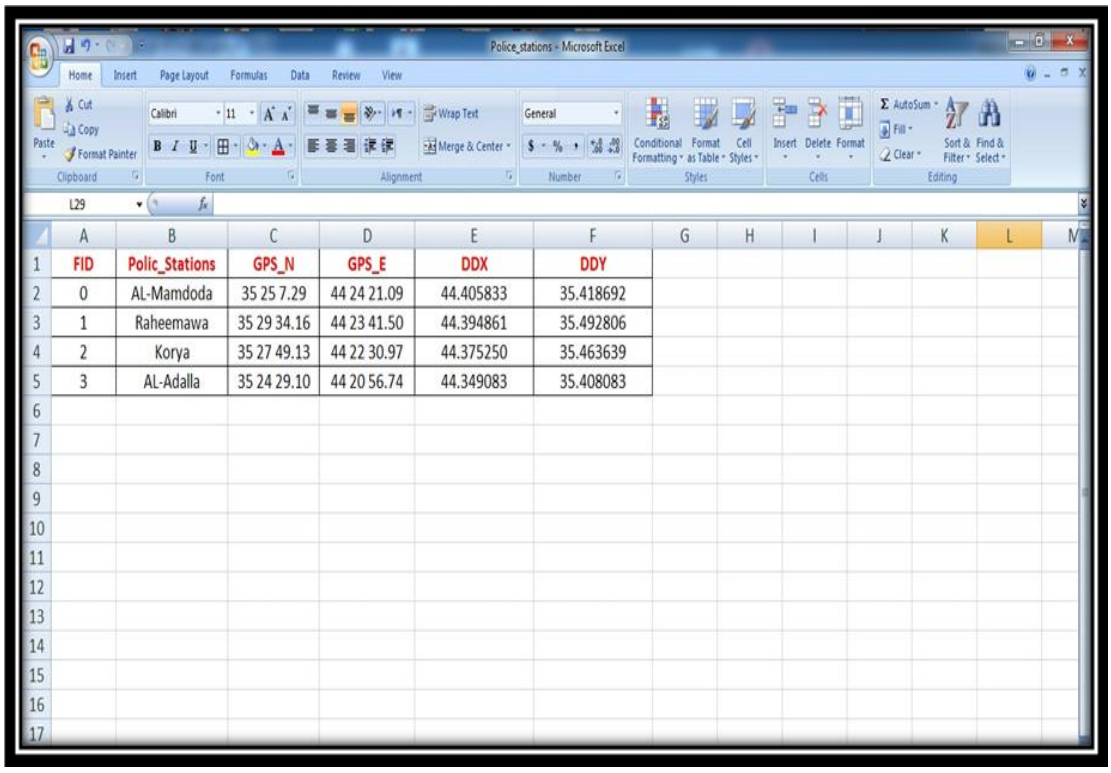


Figure 32: UTM conversion application



Police_stations - Microsoft Excel

	A	B	C	D	E	F
1	FID	Polic_Stations	GPS_N	GPS_E	DDX	DDY
2	0	AL-Mamdoda	35 25 7.29	44 24 21.09	44.405833	35.418692
3	1	Raheemawa	35 29 34.16	44 23 41.50	44.394861	35.492806
4	2	Korya	35 27 49.13	44 22 30.97	44.375250	35.463639
5	3	AL-Adalla	35 24 29.10	44 20 56.74	44.349083	35.408083

Figure 33: Police stations coordinators excel sheet in Kirkuk

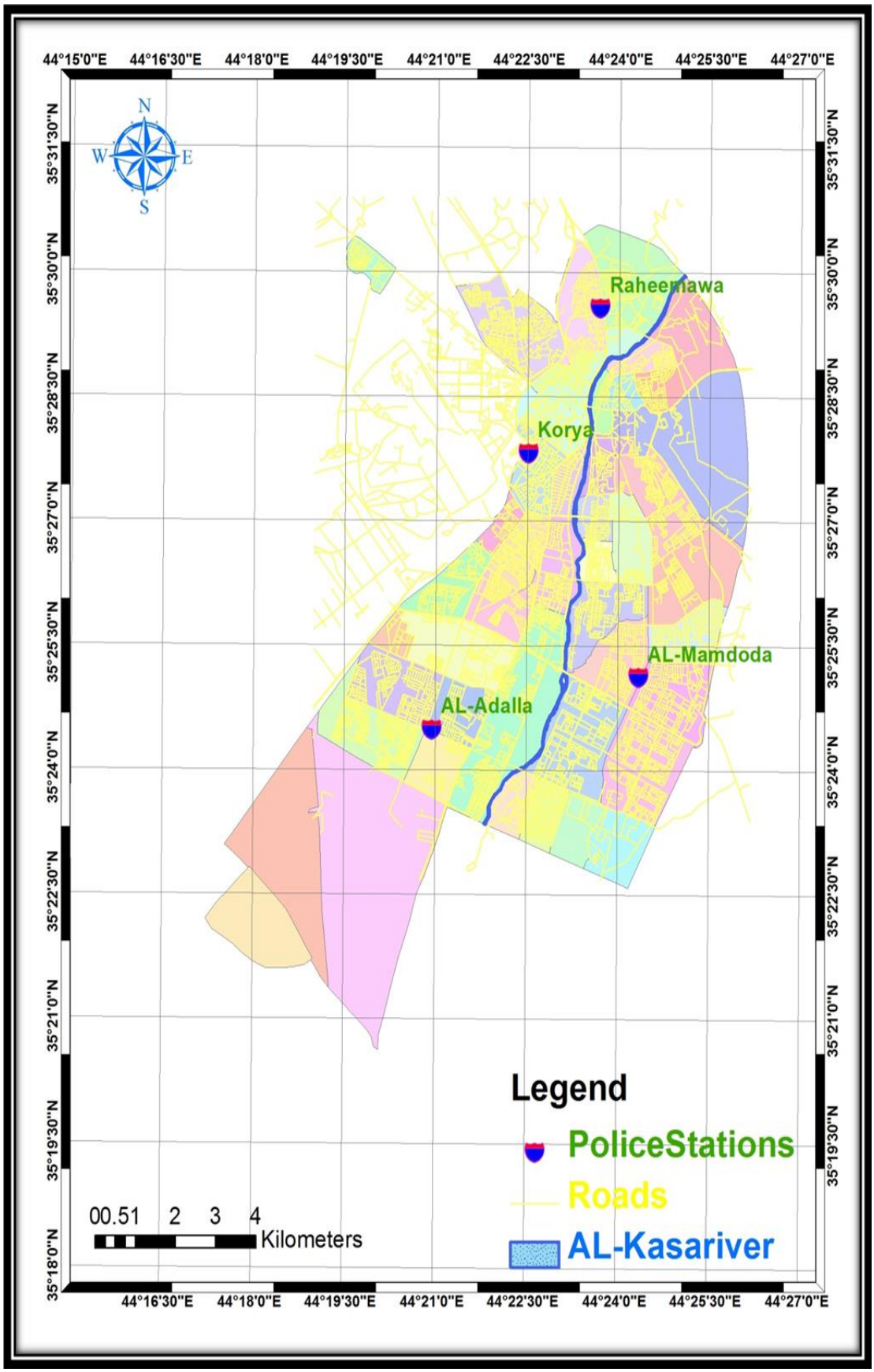


Figure 34: Police stations in Kirkuk

3.2 Arc Catalog

The Arc Catalog application provides a catalog window that used to classify and deal with different types of geographic information for Arc GIS Desktop. The kinds of information can controlled and managed in Arc Catalog includes:

- Geo-databases.
- Raster files.
- GIS services published Via Arc GIS Server.
- Globe documents, 3D scene documents, as well as map documents, and layer document.
- Models, and Python scripts also Geo-processing toolboxes.
- Universal -based metadata to this GIS information elements.
- And much more.

Arc Catalog regulated these meaning (catalog tree) during analysis that able to work with to categorize your GIS datasets and Arc GIS documents, search and find information items, and to administer them. Arc Catalog displays this details in a structure observation and allows you to choose a GIS entry view its properties, and to access tools to activate on the selected item, as shown in figure 35.

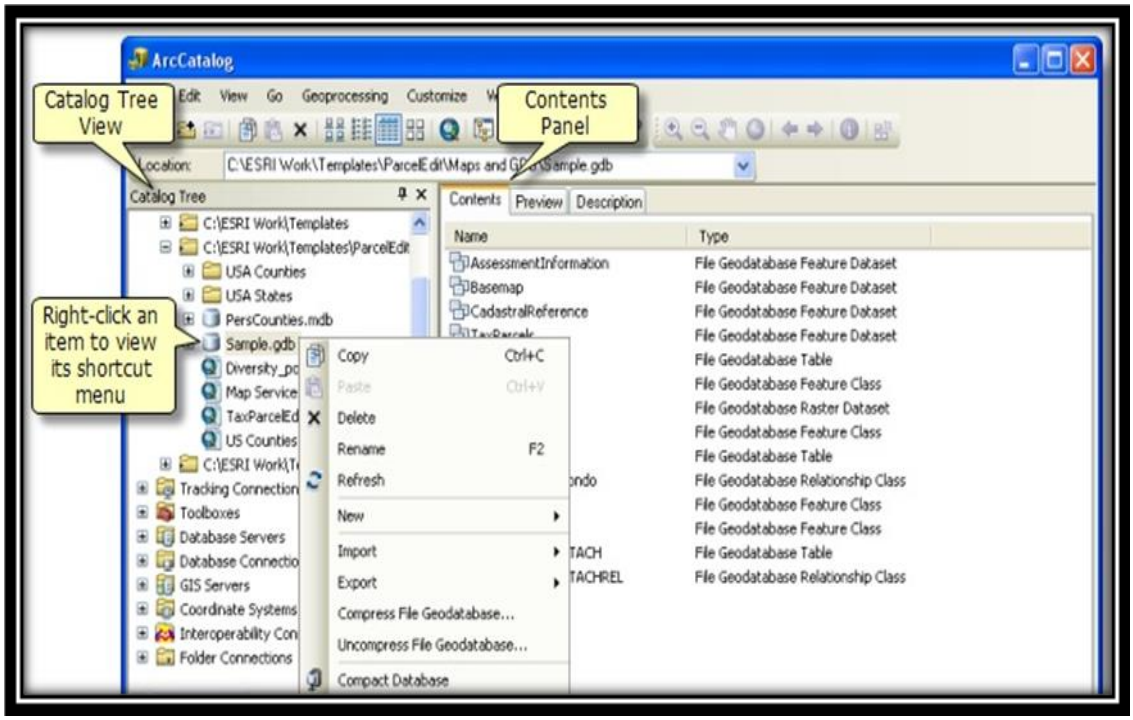


Figure 35: Arc catalog interface

As the researcher using mentioned application in above, by applying it on the streets network during the build (File Geodatabase → Feature dataset → Feature class to creation Network Dataset), as shown in figure 36, in the city to find the shortest route (shortest path) and to provide a service for the transfer of citizens in terms of coverage of the largest and closest distance from the place of citizen's residence to place of work, educational services, health services which mean health units and hospitals. In addition to the commercial areas of the shopping recreation or by buss (Transportation Network). which covers the middle and lower classes of society in Kirkuk.

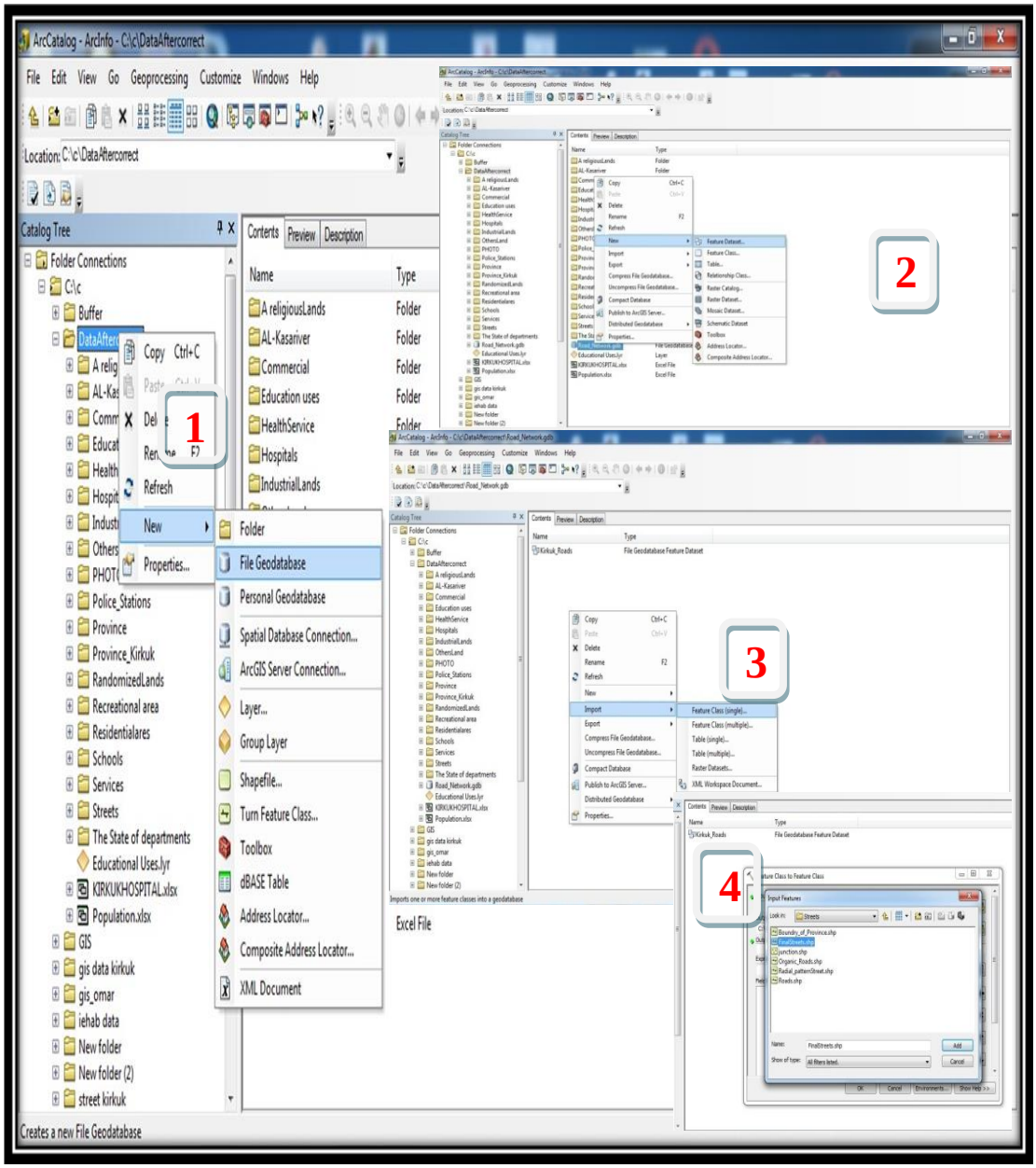


Figure 36: Network dataset creation

3.2.1 Topography system

Means a description and drawing detailed place, which science who specializes in the representation of natural phenomena and artificial details of an area located on the surface of the earth forms and graphics distinctive, as is done by the results you get on the ground or dropping and the representation of the projects on the ground, including the transportation network of roads through the drawn diagrams or paint for this purpose.

The maps topographic, are maps represent an elected group of phenomena of the surface of human and natural land, including the topography of the surface of the earth, according to a large Scale, which gives a comprehensive and accurate information about the areas where phenomena, forms and spaces and patterns of spread of real locations, including road transport network, which is one of the human phenomena and clear monuments [6].

The road network in the real topographic system and between the system topology; which takes into account the factors and characteristics mentioned but differs in workers (distance and time) with the survival of the cost factor and the pattern of land use are close in terms of systems topography and topology, which means that the topographic system: requires the construction of the transport network, depending on the natural determinants the human cost and the difficulty of planning and implementation, as well as differs from the topological system, which is characterized by a lack of proportion cornering and straight stretch with a short distance (Shorts path) and lack of time, and the lack of vehicles in costs.

3.2.2 Topology system

System topological known as processing-neighborly relations that exist between geometric shapes, a relationship which is not affected deformed shapes, topology does not care dimensions or spaces or sizes or forms of elements and spatial components, but also determines the spatial relationships relative among them, the map topology It seeks to simplify the road network form converted to just straight lines between the different nodes located on them. And the topological structure of spatial data to facilitate and

accelerate all spatial analysis operations and ensure good quality of the numerical map of where each thread elements.

Topological relations in geographic information systems are:

1. Connectivity relationship: which specifies none of the strings tied to any of the decade

2. Direction relationship: It is known that the direction of the node to node in the chain.

3. Adjacency relationship: which specifies none of the polygons on the left and none of them to the right of the chain.

4. Nestedness relationship: which specifies the spatial elements located within the polygon can be elements of this nods or chains or polygons [35].

Other than noted above, there are important reasons necessitated the researcher to build the topology system for the purpose of create and operate a the network dataset, and these reasons are:

- Not connectivity lines (roads) to each other, as show in figure 37.
- Straighter lines of roads with an intersection points where these items are not in this case, for build of the nods and divided on a regular basis, a key factor in the creation of the (Network Analyst) and activated, as shown in figure 38.

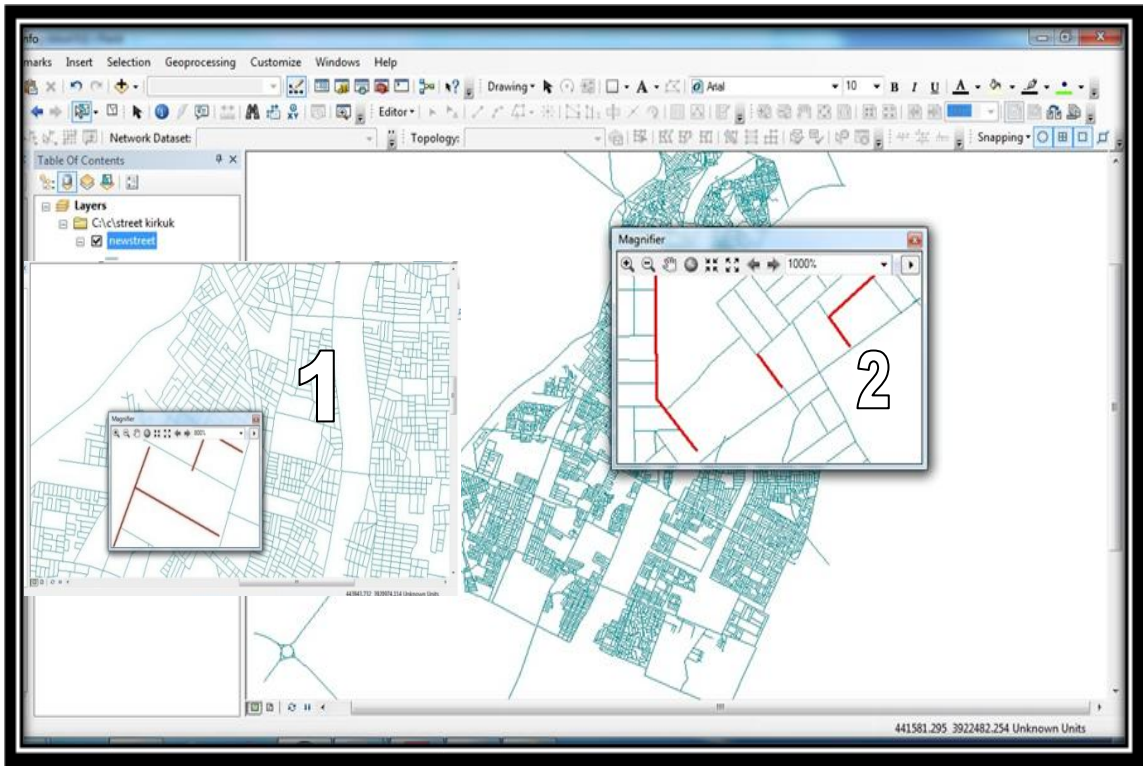


Figure 37 : Not- connectivity lines in roads network

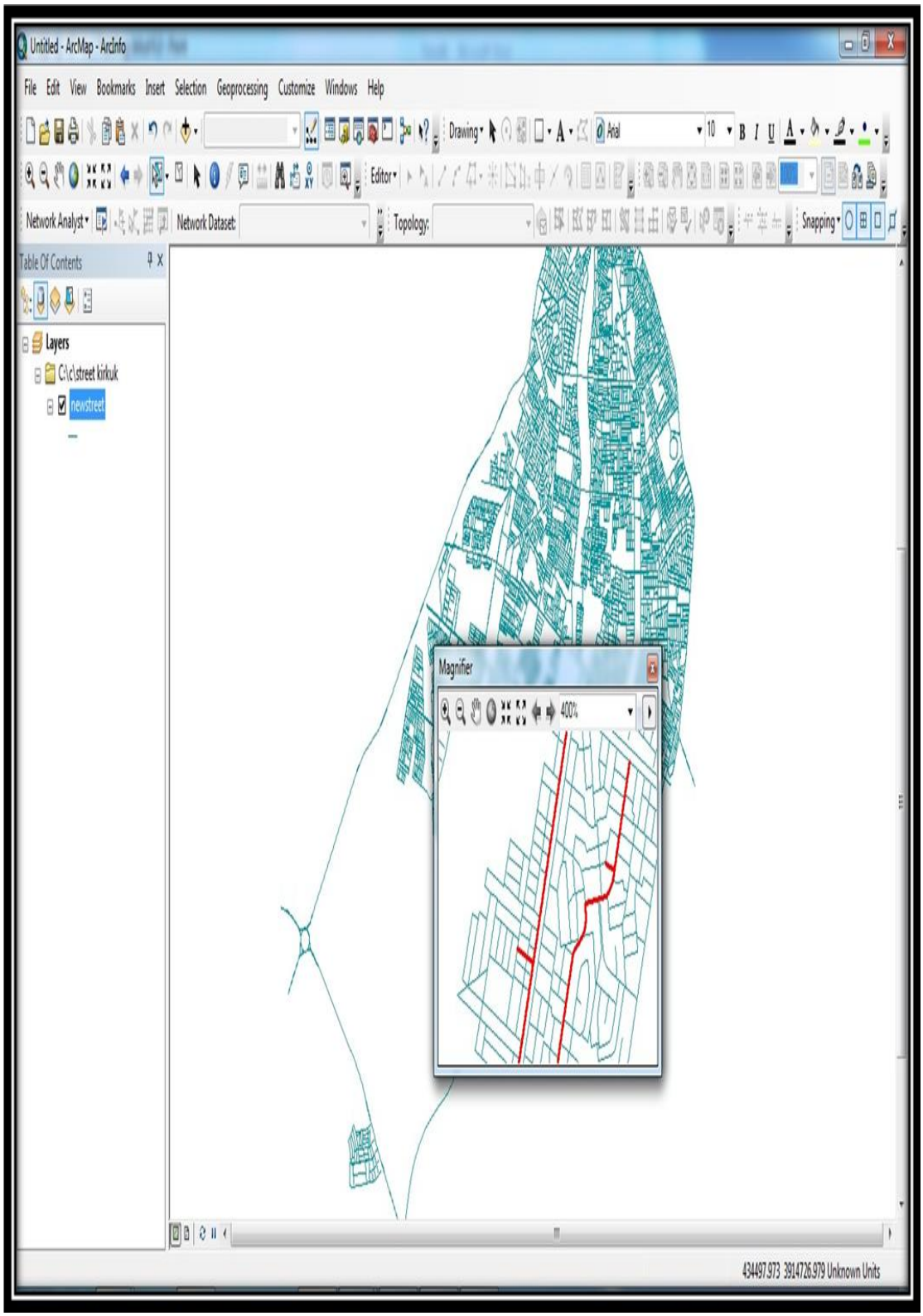


Figure 38 : Straighter lines of roads

To solve these problems, the researcher building an integrated topology system by creating (File Geodatabase → Feature dataset → Feature class to creation Topology system) Via Arc Catalog, as shown in figure 39 and 40 also 41.

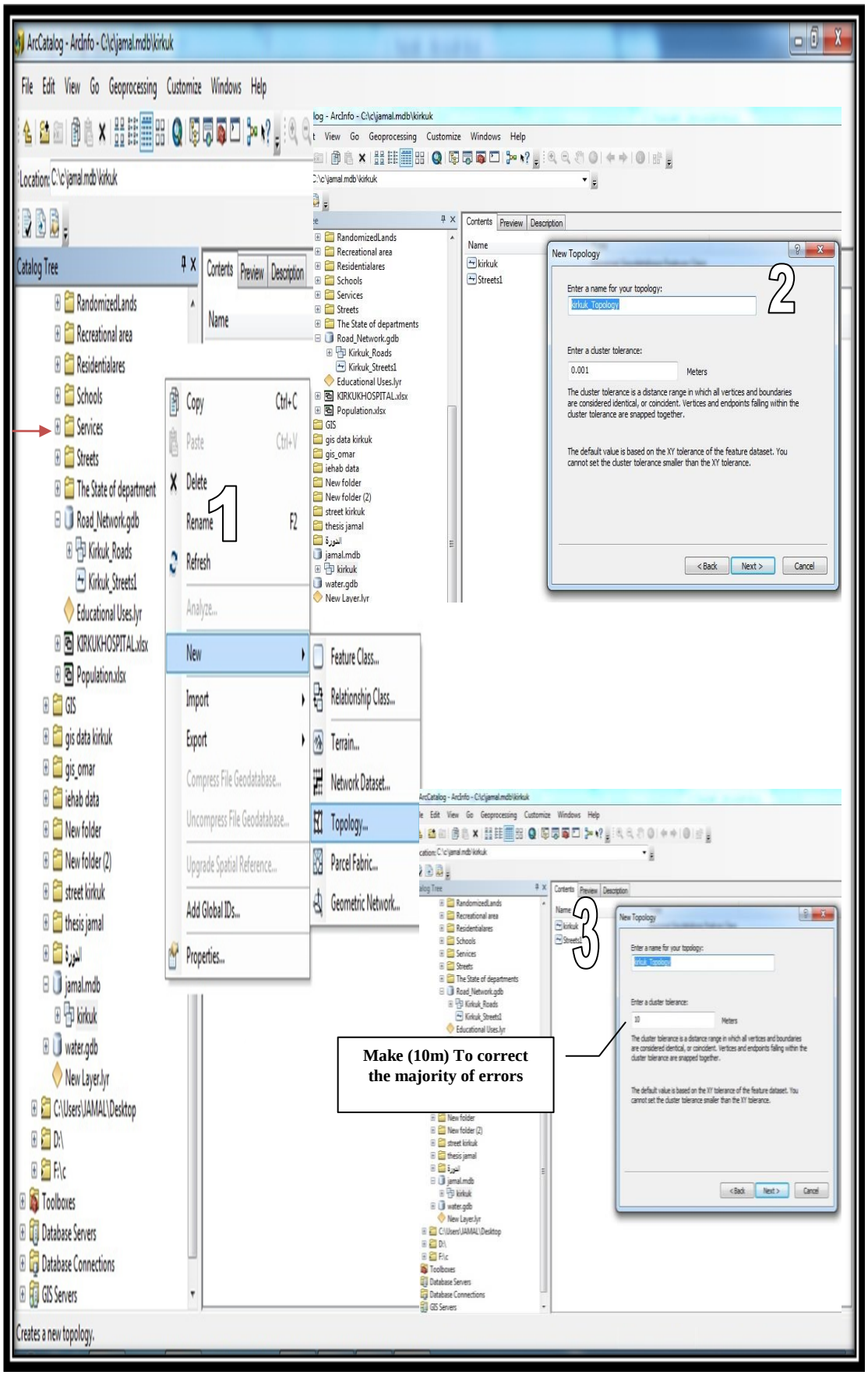


Figure 39 : First step of topology creation

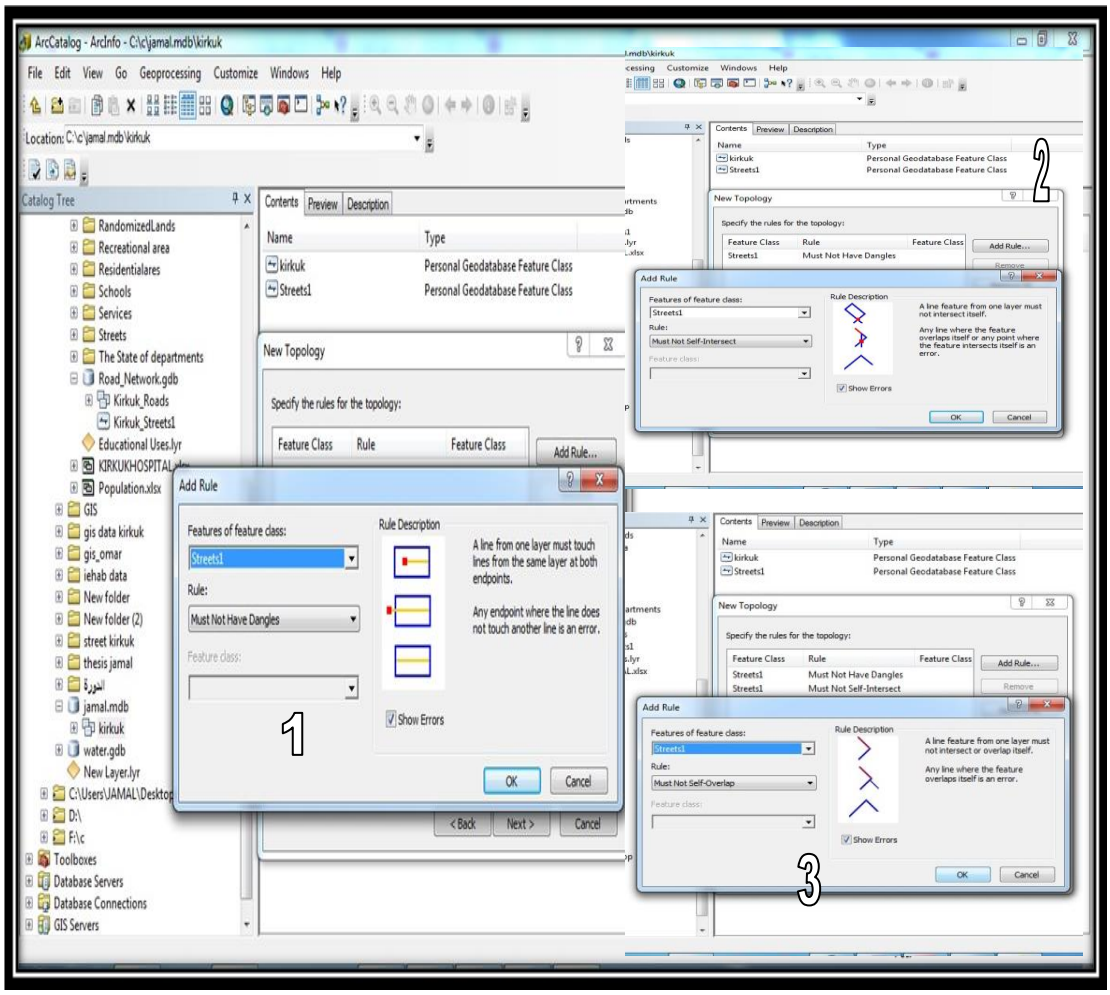


Figure 40: Second step of topology creation

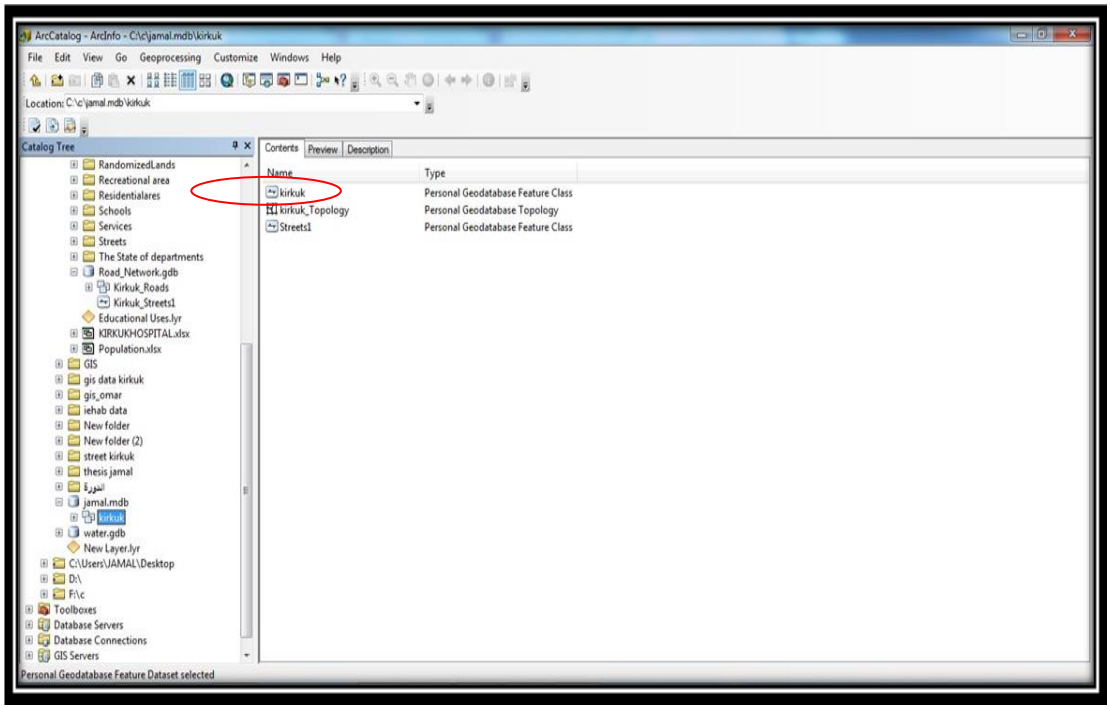


Figure 41: The last step is to build the system topology

After that, open the result by adding form arc map software, then we found that have not yet been completed, as shown in figure 42.

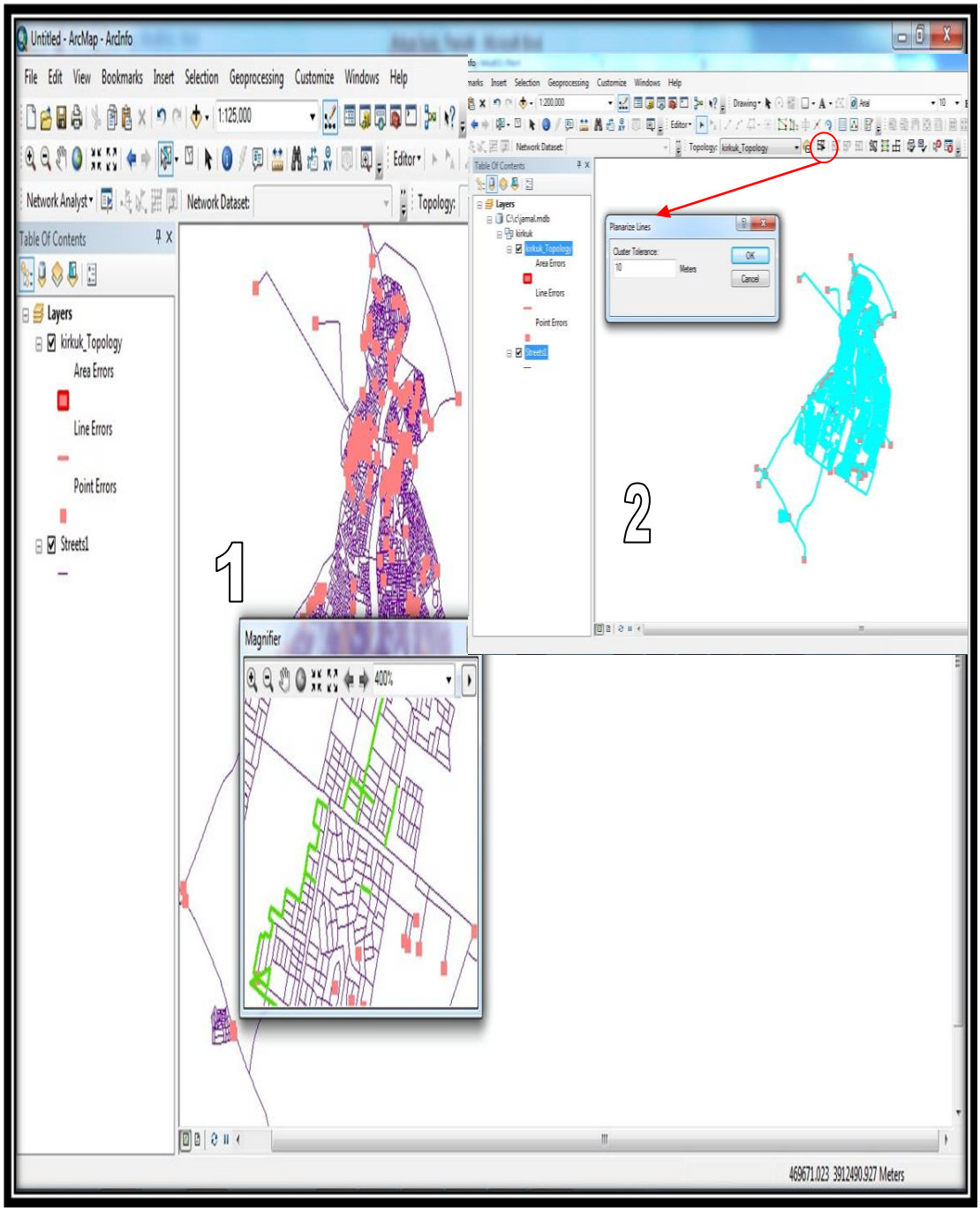


Figure 42: Found some error try to corrected

We completed analysis for the errors through the use of command topology after activated by command editor to correct all the remaining errors for the purpose of the establishment of a (Network dataset) of any faults and work well, as shown in figure 43.

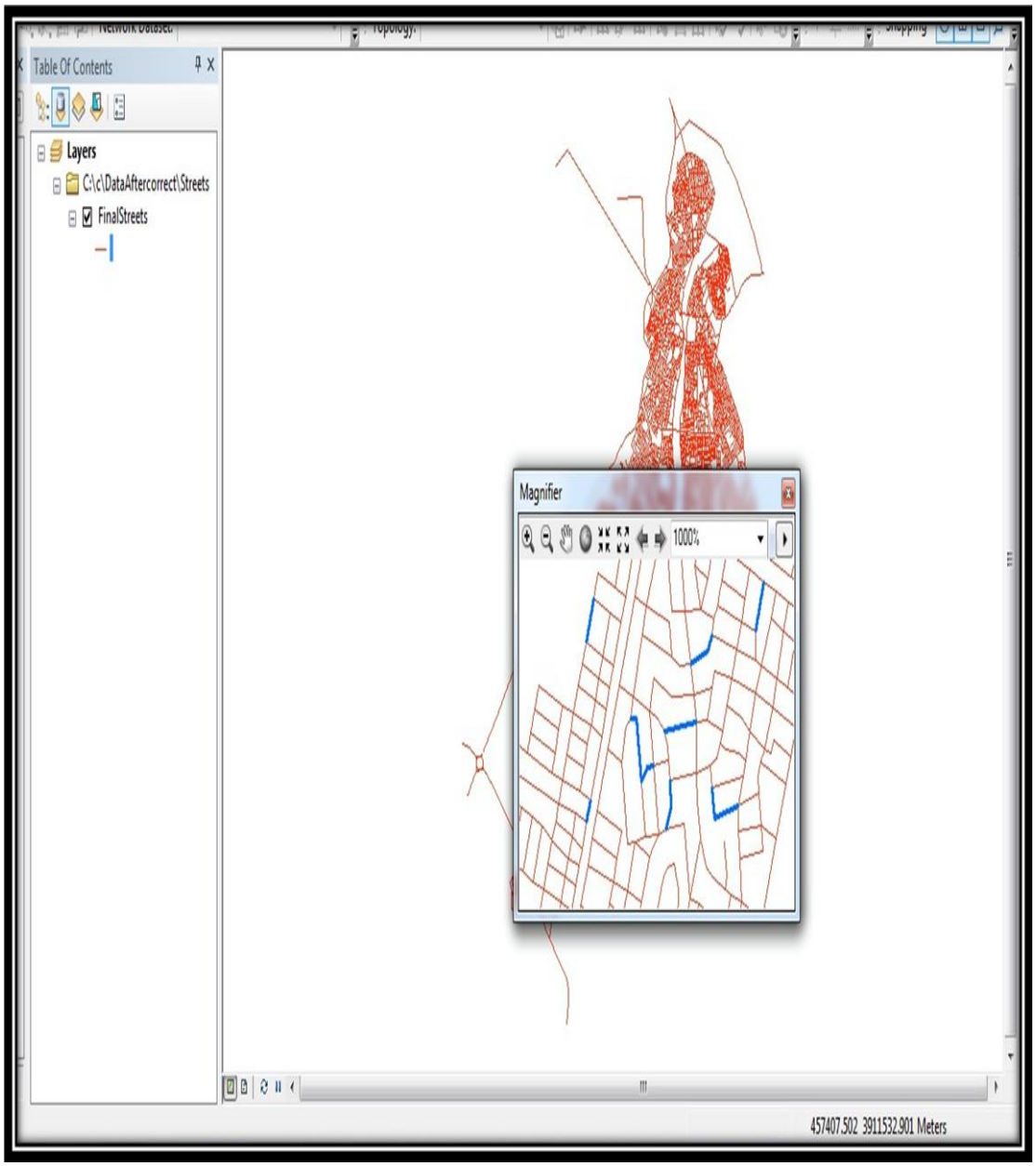


Figure 43 : Corrected & exported clean data without errors

3.3 Shortest Path

The subject of shortest path, cost and technical evolution in transportation network sector has been accompanied by convergence of spatial and temporal and make some sites converge more than it is because the distance (dimension) coefficient for measurement and the difference between the two nodes because it means different relationships between the two systems topographic and topological and which do not

represent the same characteristics distances. System has used the topological long a go mainly athletes to express cartographer and that its use was justified when the representation of the path between two nodes, and the distance between them is not suitable much to express the economic, social and cultural spatial events, for example, (the shortest and least expensive way is not necessarily the shortest in length, but is the several roads economy between two nodes, here the distance, speed and low cost plays an important role in building the topology map, and the light is extracted efficiency and ease of access between neighborhoods and to measure the degree of interdependence through metrics (Beta, Gamma, and Alpha, ... etc.) to determine the contact sites and points to determine the shortest distance to extract the network structure in the city, which movement pattern between different nods. As shown in figure 44 and figure 45 and figure 46.

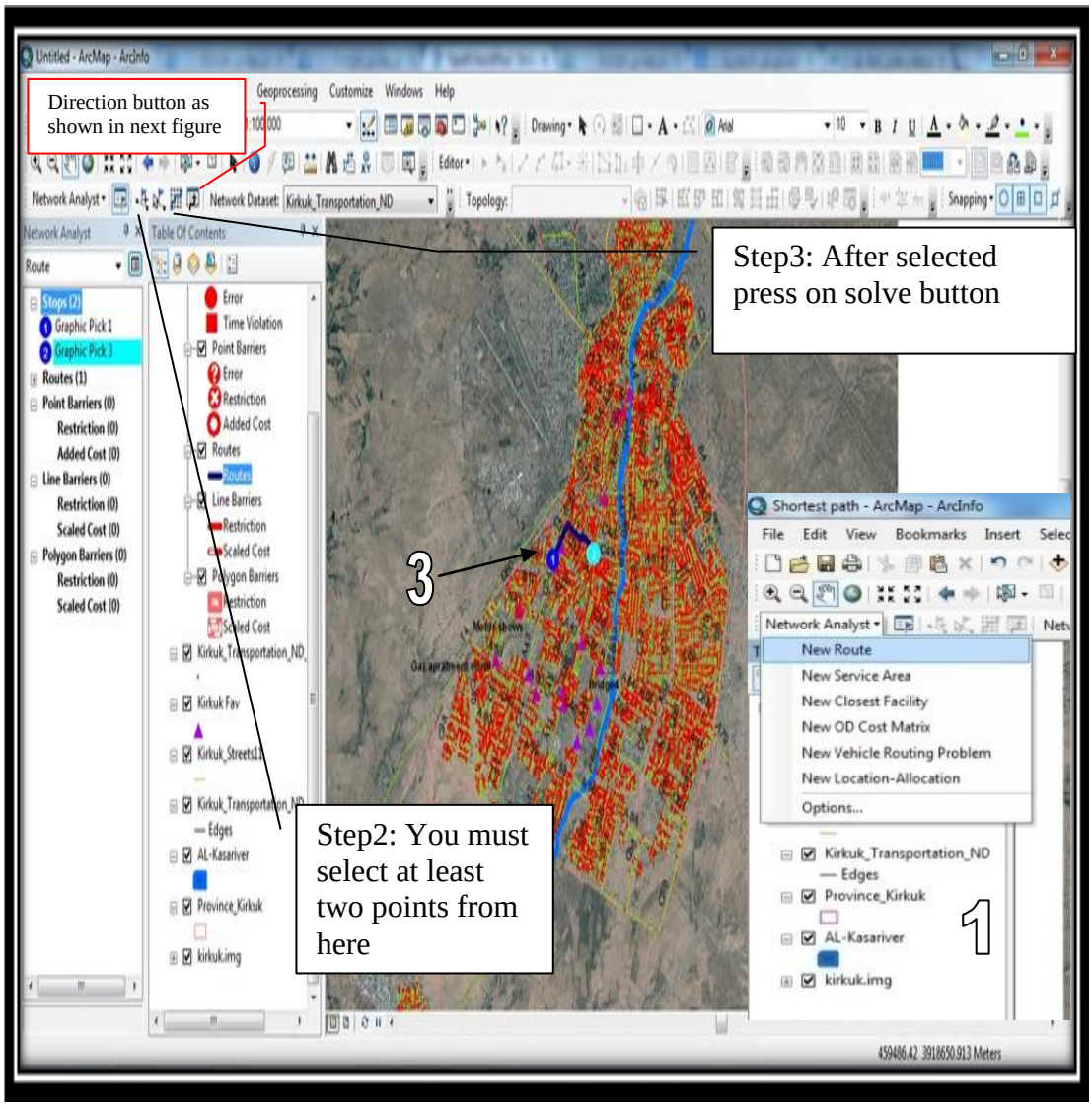


Figure 44: Activated shortest path

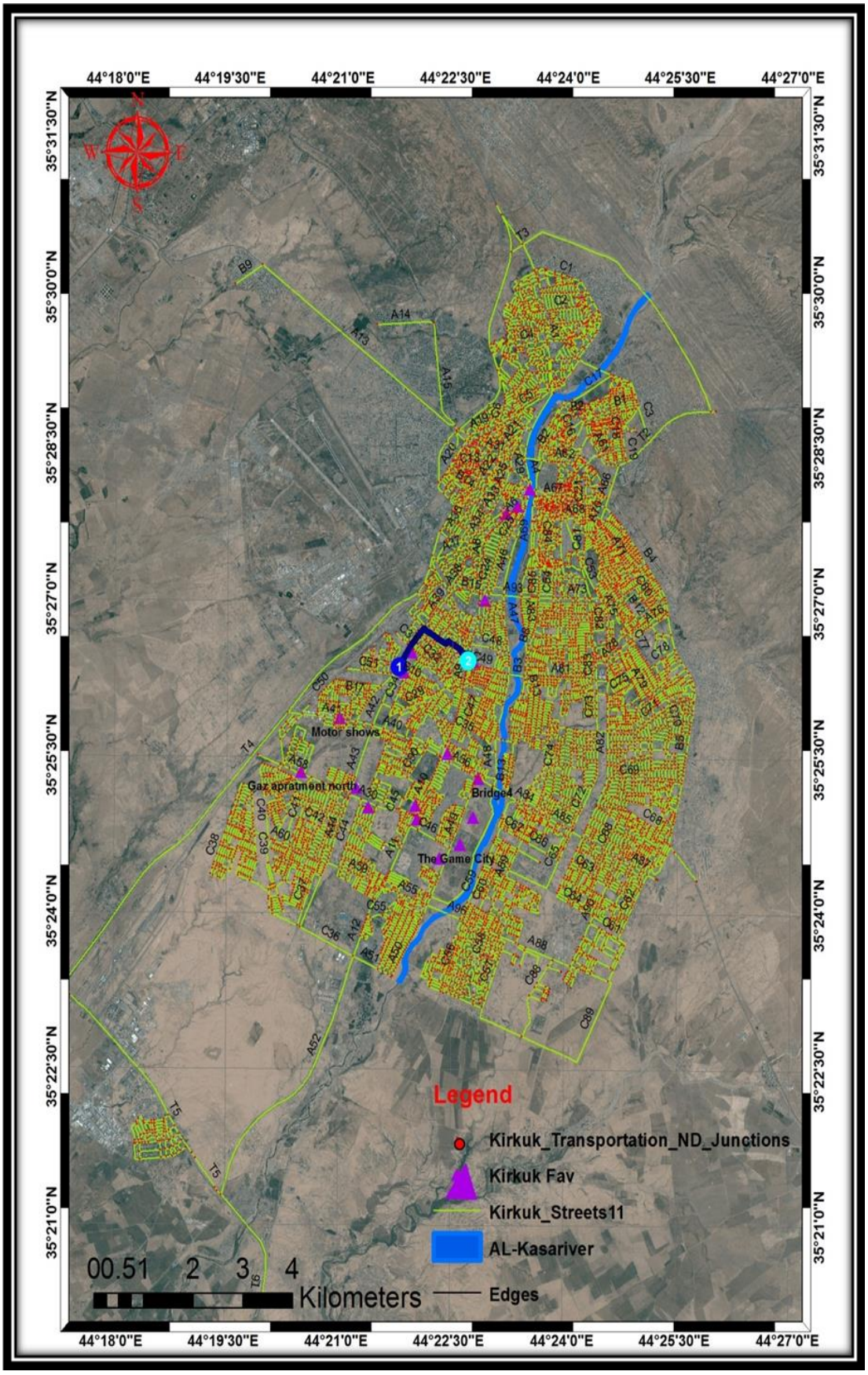


Figure 45 : Found shortest path

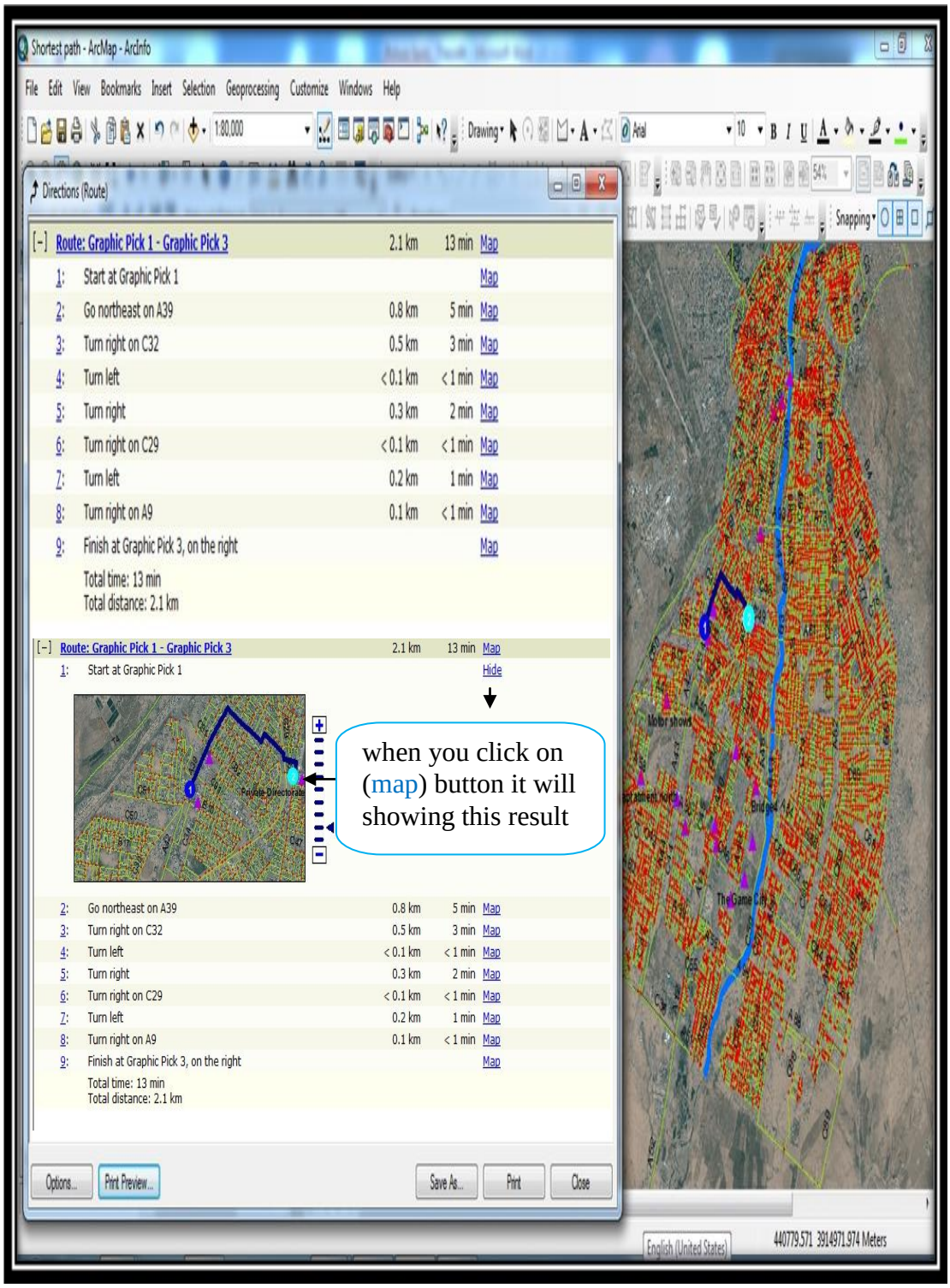


Figure 46: Direction of shortest path

CHAPTER 4

FINDING

4.1 Residential Area

Due to the increase occurring in population density between the 1997 - 2011 according to the last census of the city, as mentioned in (2.1), the need to invest with a population density areas require little to exploit the empty spaces also by the city government and the application of urban expansion in urban cities and bridging the conditions the needs of the citizen, the government providing infrastructure in these areas and give licenses, according to established procedures and to provide the necessary services to the citizens to build homes in the residential areas, as shown in the following figure 47.

Through the results as shown in figure 47, the researcher found :

1- Aarfa district add new residential area.

2- Barodhana district add new residential area.

3- Darwaza district add new residential area.

4- A'amalsha'aby district add new residential area.

5- Sayada build new district in this area.

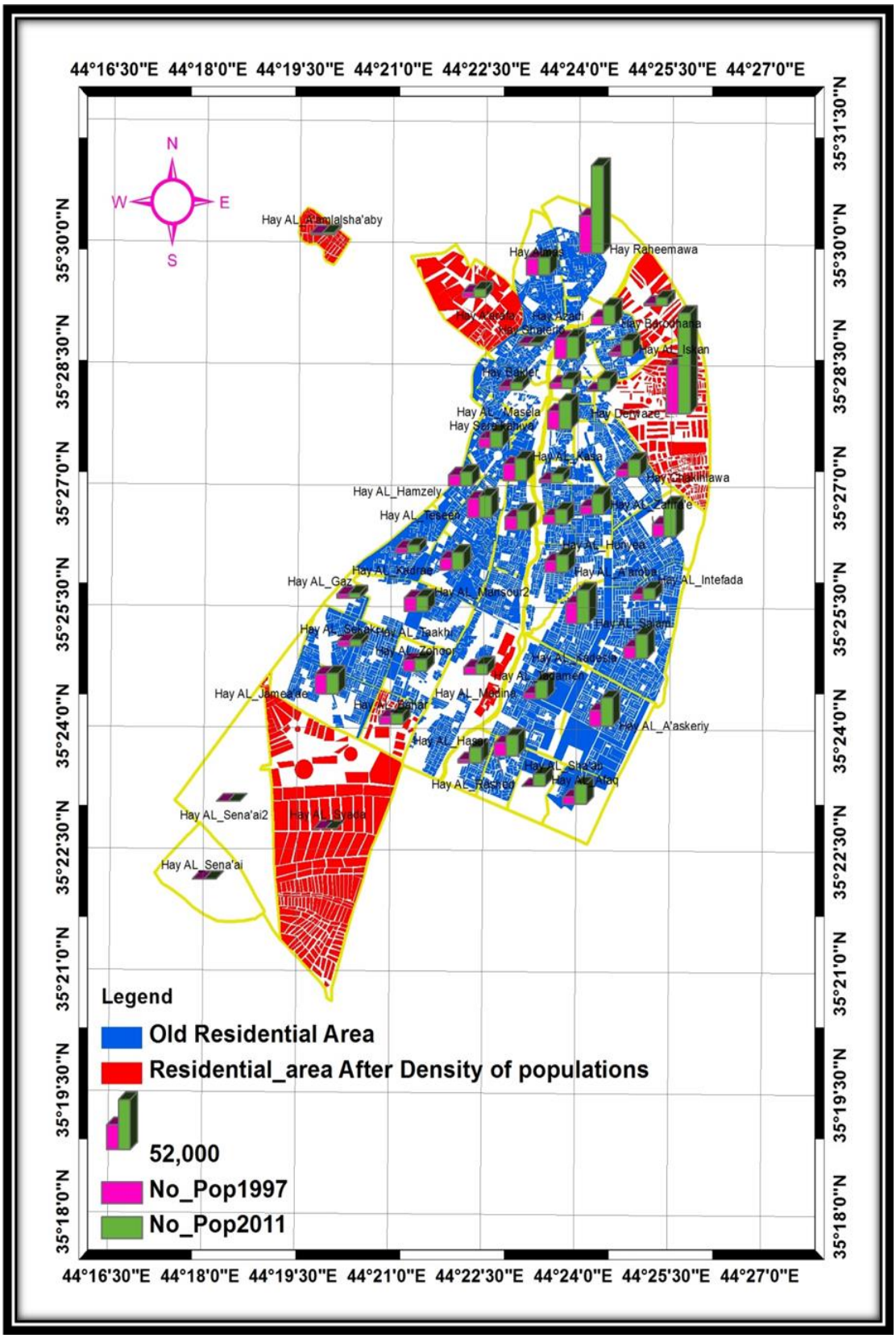


Figure 47: Effective of population for each residential area

4.2 Buffering Operations

A buffer is a section of memory used to temporarily storing output or input data. In case of GIS, the type of buffering are lines ,points, and polygons for the design of a district of a particular width around a point or a line or a polygon area. Where the researcher use and applied of this service to residential areas through the use of criteria.

4.2.1 Education area

In this side, where the researcher applying Buffer service to find an area of educational services in the city. Educational services of the important services that must be provided to members of any locality, which often are a key element in the urban planning of any clustering, so the choice of location for educational buildings depends on planning grounds commensurate with the educational institution and its important role in the community, which included two important part, primary schools and secondary schools.

- **Primary Schools**

After buffer service applied to this type of educational services for a distance of (500 m) form residential areas, according to the standards set by the Iraqi Ministry of Planning, based on international standards, we were saw some of residential area are not covered for this service from primary schools, as shown in figure 48.

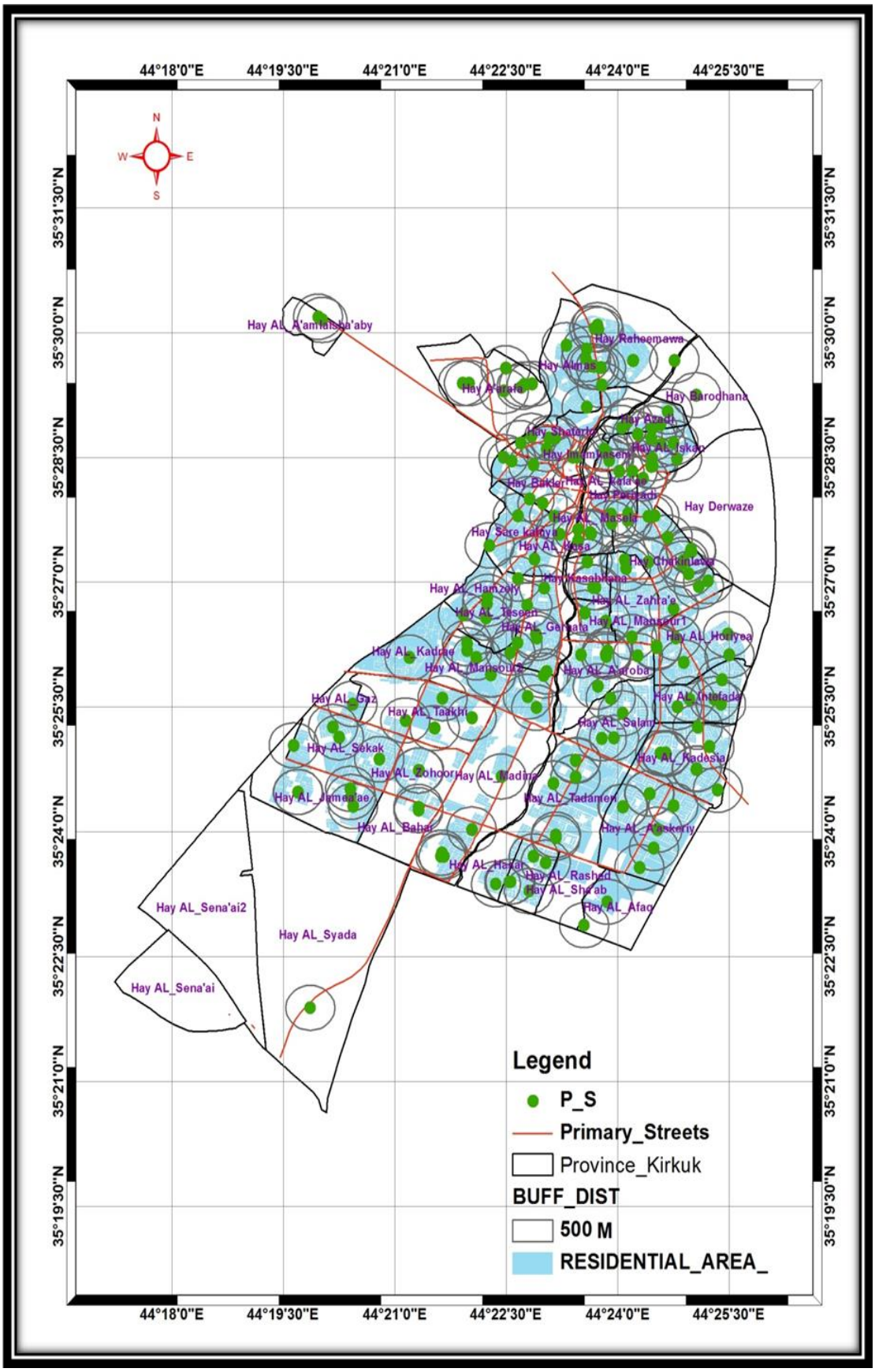


Figure 48: Primary schools with 500m buffering

In addition distance between the primary streets and primary schools where it should be distance school on the primary street far away from (20m), according to the international standards in order to preserve the lives of the students during their exit from the school, they found red schools under risk because of nearest from primary streets, as shown in figure 49 and 50.

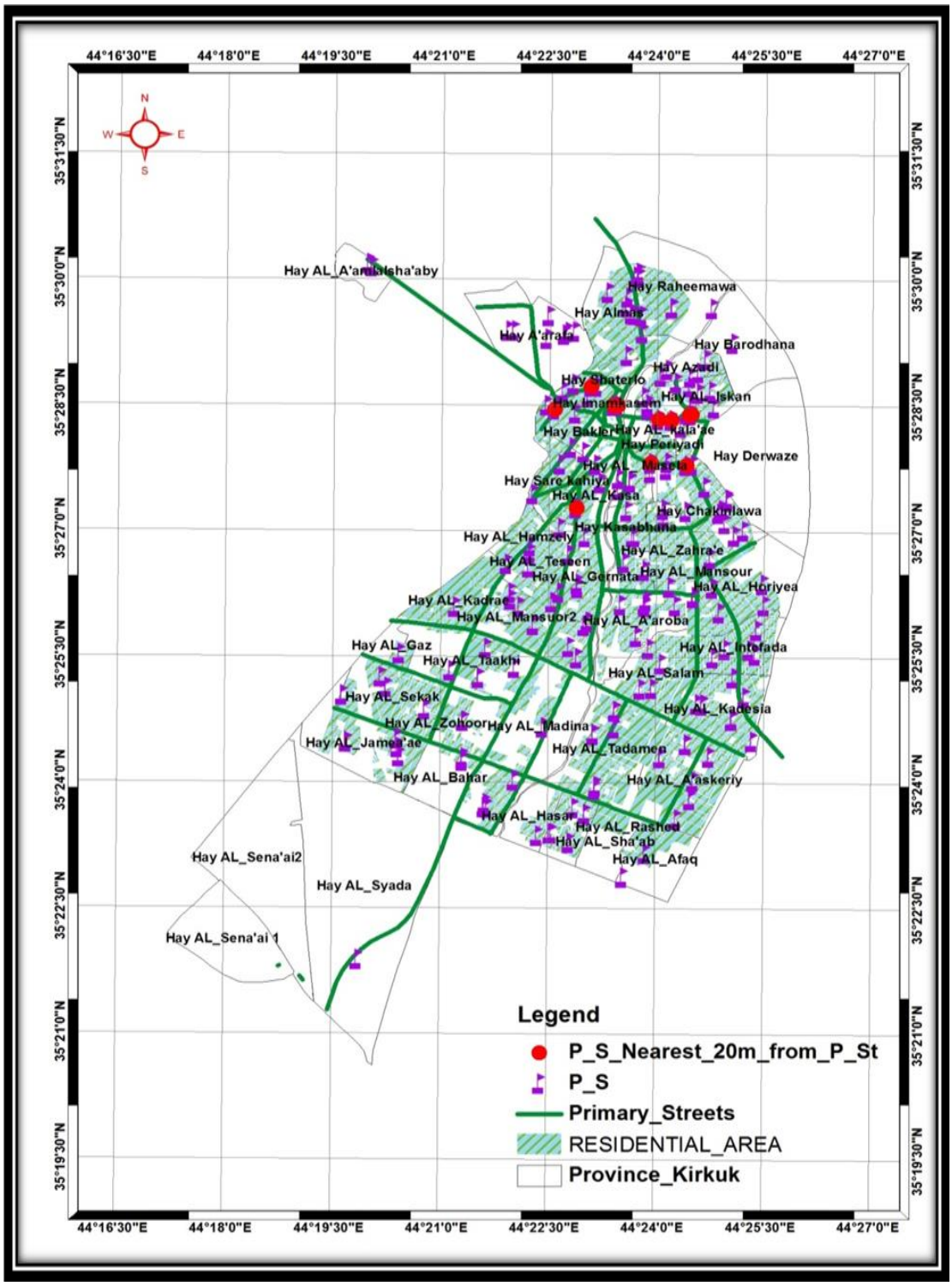
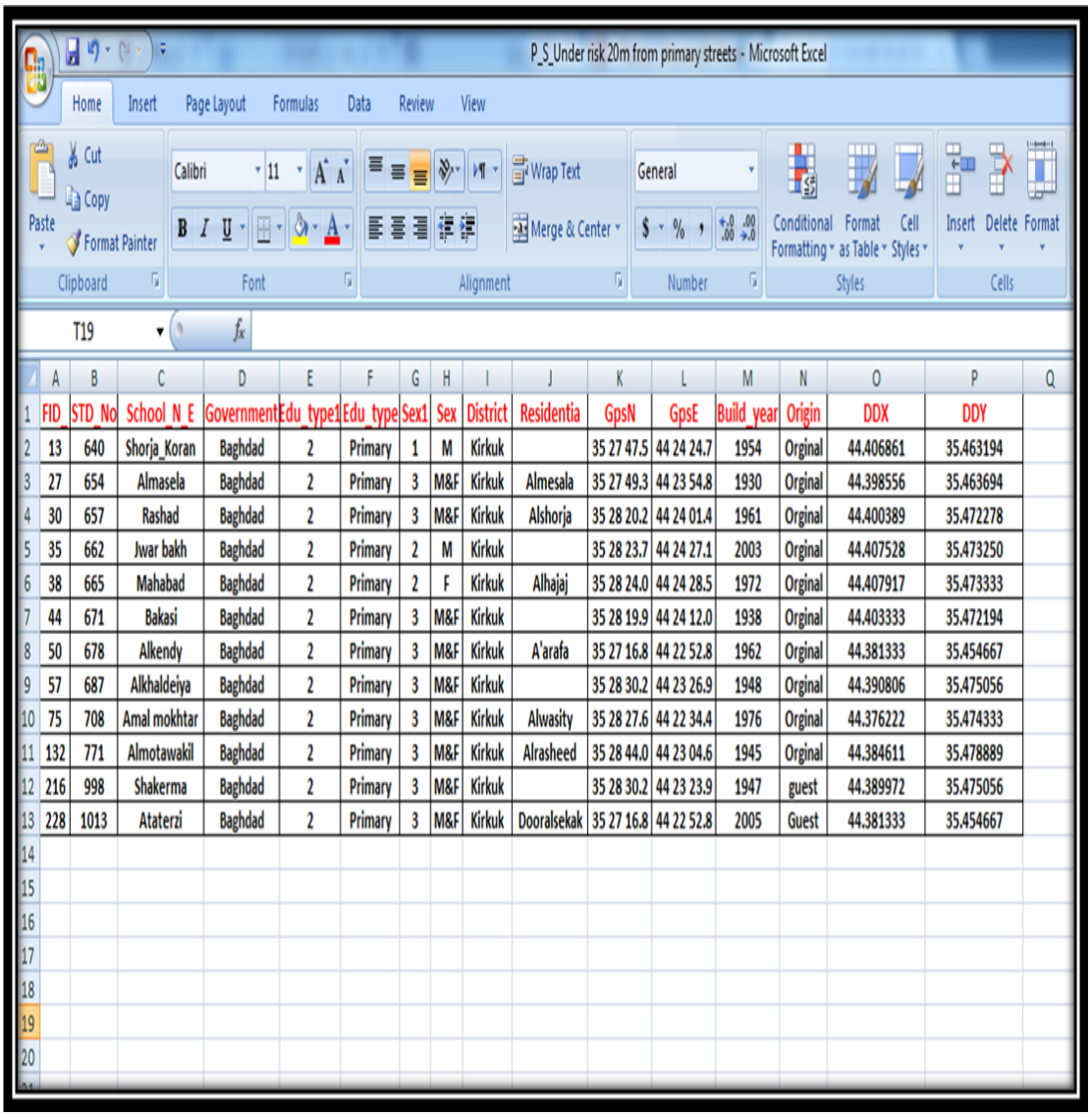


Figure 49: Distance between P_s & primary streets 20m



P_S_Under risk 20m from primary streets - Microsoft Excel

Home | Insert | Page Layout | Formulas | Data | Review | View

T19

FID	STD_No	School_N_E	Government	Edu_type1	Edu_type	Sex1	Sex	District	Residentia	GpsN	GpsE	Build_year	Origin	DDX	DDY
13	640	Shorja_Koran	Baghdad	2	Primary	1	M	Kirkuk		35 27 47.5	44 24 24.7	1954	Orginal	44.406861	35.463194
27	654	Almasela	Baghdad	2	Primary	3	M&F	Kirkuk	Almesala	35 27 49.3	44 23 54.8	1930	Orginal	44.398556	35.463694
30	657	Rashad	Baghdad	2	Primary	3	M&F	Kirkuk	Alshorja	35 28 20.2	44 24 01.4	1961	Orginal	44.400389	35.472278
35	662	Jwar bakh	Baghdad	2	Primary	2	M	Kirkuk		35 28 23.7	44 24 27.1	2003	Orginal	44.407528	35.473250
38	665	Mahabad	Baghdad	2	Primary	2	F	Kirkuk	Alhajaj	35 28 24.0	44 24 28.5	1972	Orginal	44.407917	35.473333
44	671	Bakasi	Baghdad	2	Primary	3	M&F	Kirkuk		35 28 19.9	44 24 12.0	1938	Orginal	44.403333	35.472194
50	678	Alkendy	Baghdad	2	Primary	3	M&F	Kirkuk	A'arafa	35 27 16.8	44 22 52.8	1962	Orginal	44.381333	35.454667
57	687	Alkhaldeiya	Baghdad	2	Primary	3	M&F	Kirkuk		35 28 30.2	44 23 26.9	1948	Orginal	44.390806	35.475056
75	708	Amal mokhtar	Baghdad	2	Primary	3	M&F	Kirkuk	Alwasity	35 28 27.6	44 22 34.4	1976	Orginal	44.376222	35.474333
132	771	Almotawakil	Baghdad	2	Primary	3	M&F	Kirkuk	Alrasheed	35 28 44.0	44 23 04.6	1945	Orginal	44.384611	35.478889
216	998	Shakerma	Baghdad	2	Primary	3	M&F	Kirkuk		35 28 30.2	44 23 23.9	1947	guest	44.389972	35.475056
228	1013	Ataterzi	Baghdad	2	Primary	3	M&F	Kirkuk	Dooralsekak	35 27 16.8	44 22 52.8	2005	Guest	44.381333	35.454667

Figure 50: Primary schools under risk

- Secondary schools

When they applied the buffer on secondary schools according to the universal Standards distance of (1000m) from residential area, as shown in figure 50, we found some of schools they couldn't covered all district such as:

1- Hay kadrae'e
2- Hay Gaz
3- Hay Sekak
4- Hay zohor
5- Hay madina
6- Hay afaq
7- Hay horiyea
8- Hay derwaza
9- Hay barodhana
10- Hay raheemawa
11- Hay almas
12- Hay askarey
13- Hay sayada.

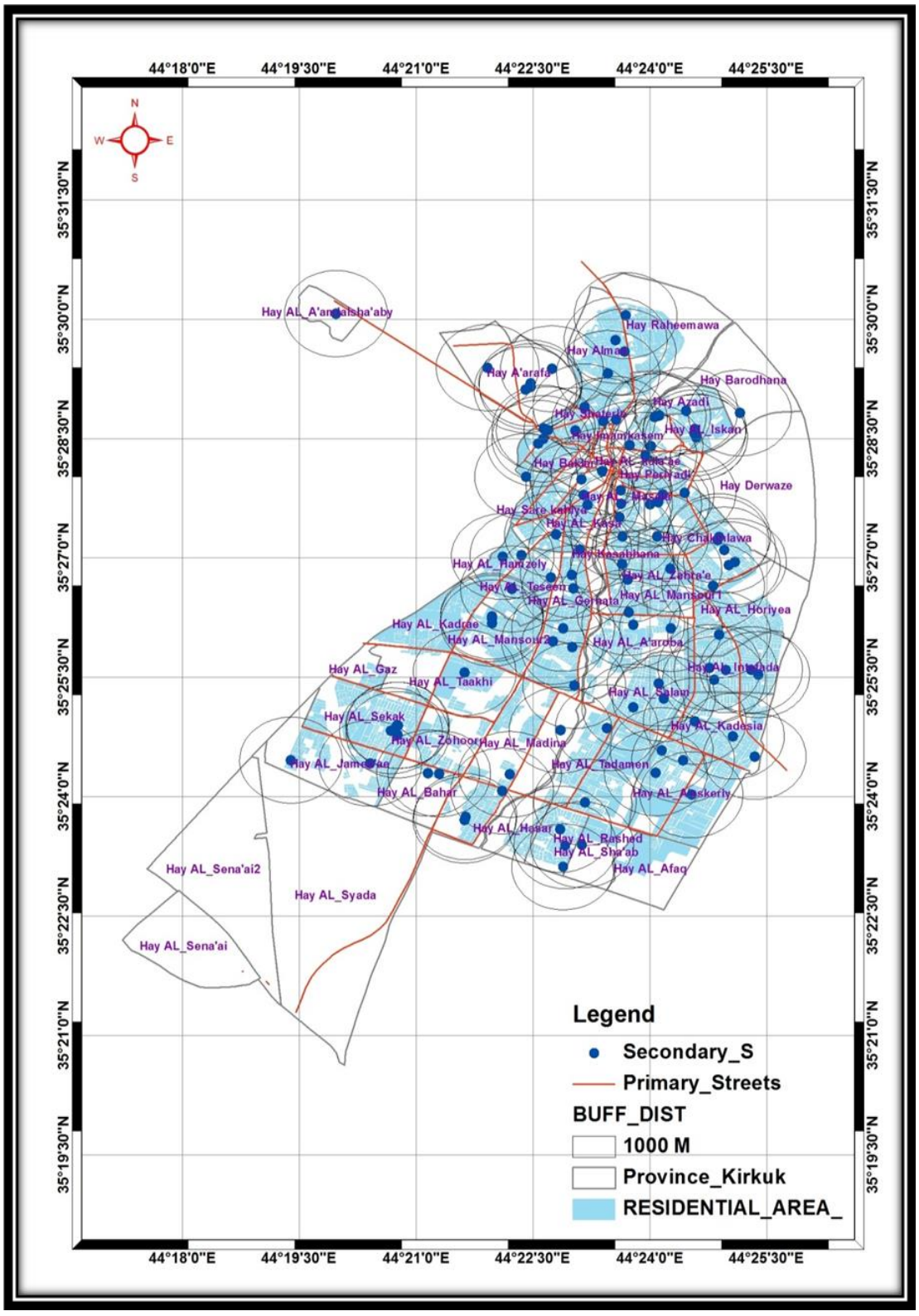


Figure 51: Secondary Schools after buffering with distance 1000m from residential area

4.2.2 Health areas

- Hospitals

In this side of service and after applied the buffer according the universal standards distance of (2500m) depending on the Saudi Arabia Standards, we found that the distributed hospitals in the Kirkuk do not cover all residential area health service, as shown in figure 52.

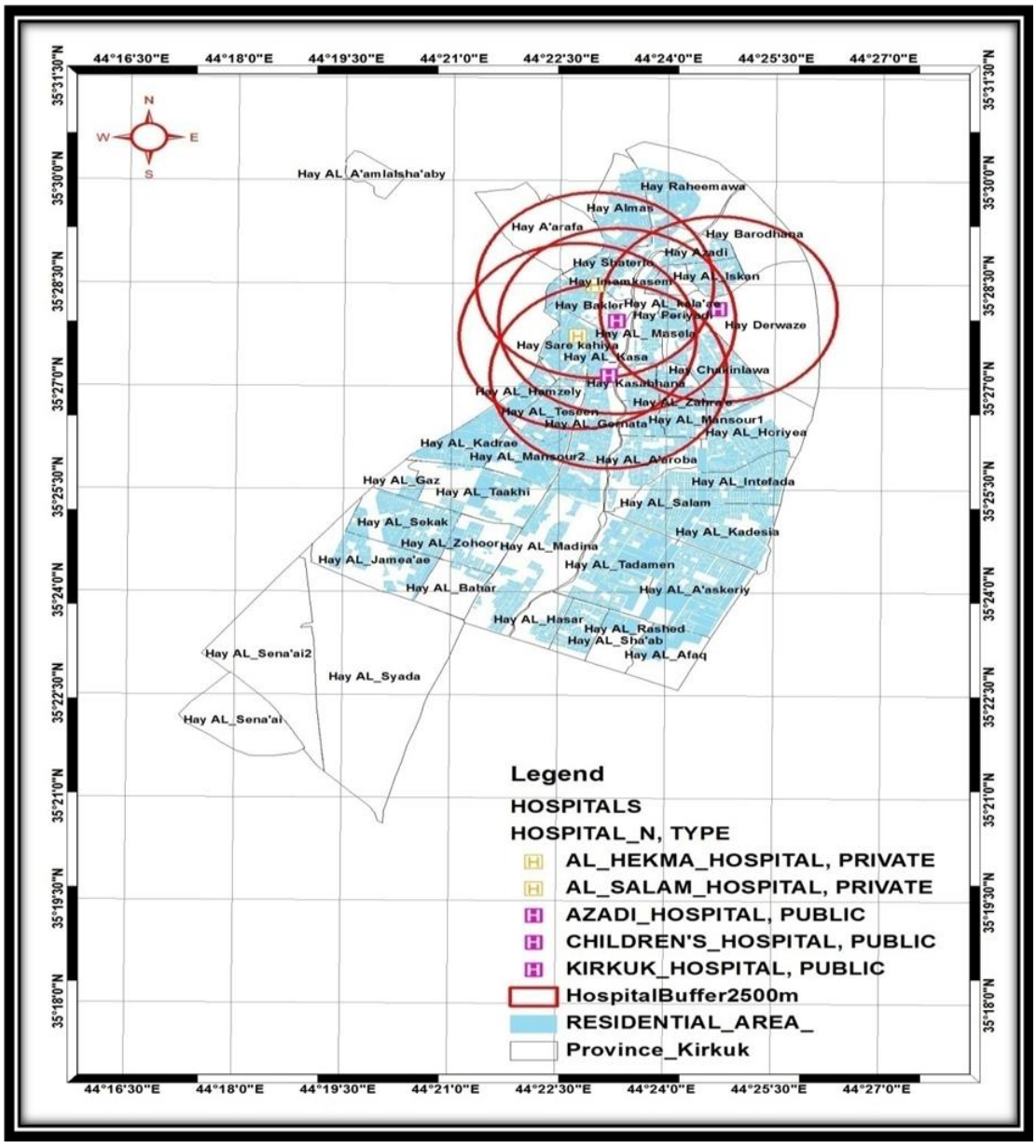


Figure 52: Hospitals buffering 2500m

- Health units

In addition in this after applied the buffer service (800m) depending on the Saudi Arabia Standards, we found lack of distribution in this service they didn't cover all district in Kirkuk province, as shown in figure 53.

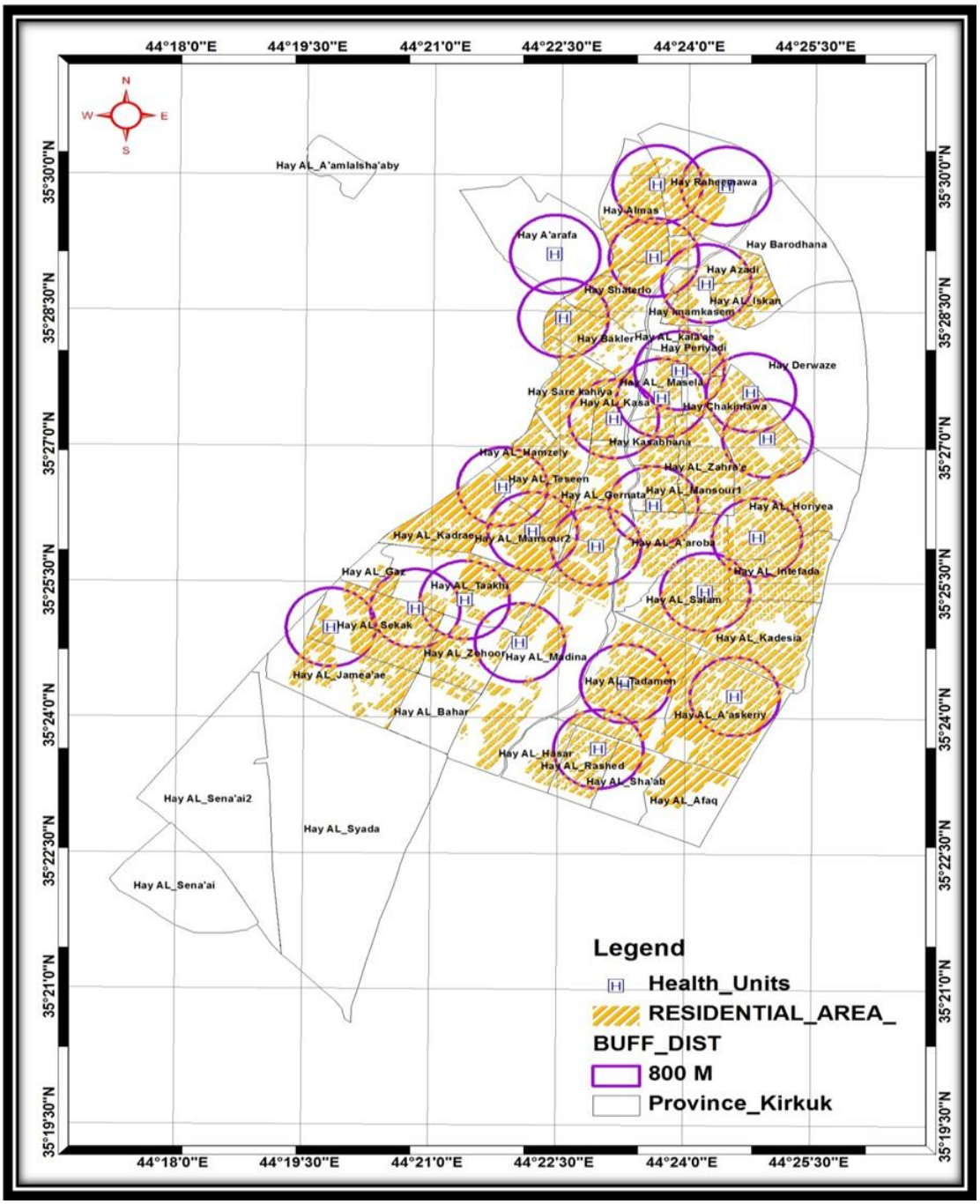


Figure 53: Health units buffering 800m

4.2.3 Police stations

As discussed in Chapter 3 (3.1.2) in figure 33,34, on police stations in the city, there are four police stations causing danger to the citizens because of their proximity to residential area and as we know the current bad situation of Iraq in general and Kirkuk in particular terrorist acts that affect the security side, which always keen to provide and safety to the citizens as the security impact of explosion storm up to (800m) diagonal distance by a personal interview with one a security official in the city, causing physical damage to lead to the loss of life of citizens and lead to the destruction of homes as well as material damage as in Figure 54 and 55.

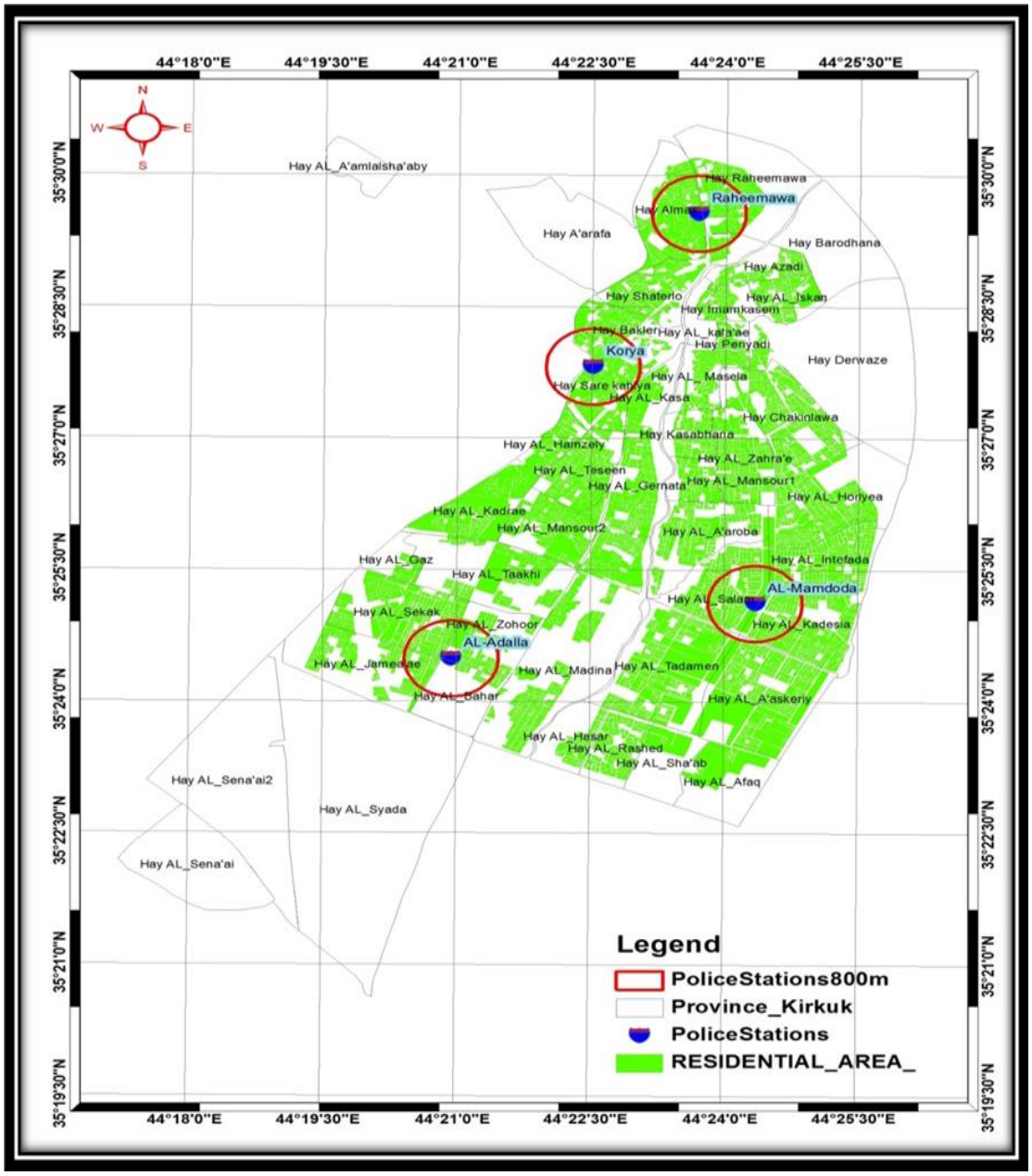


Figure 54: Police stations buffering with 800m

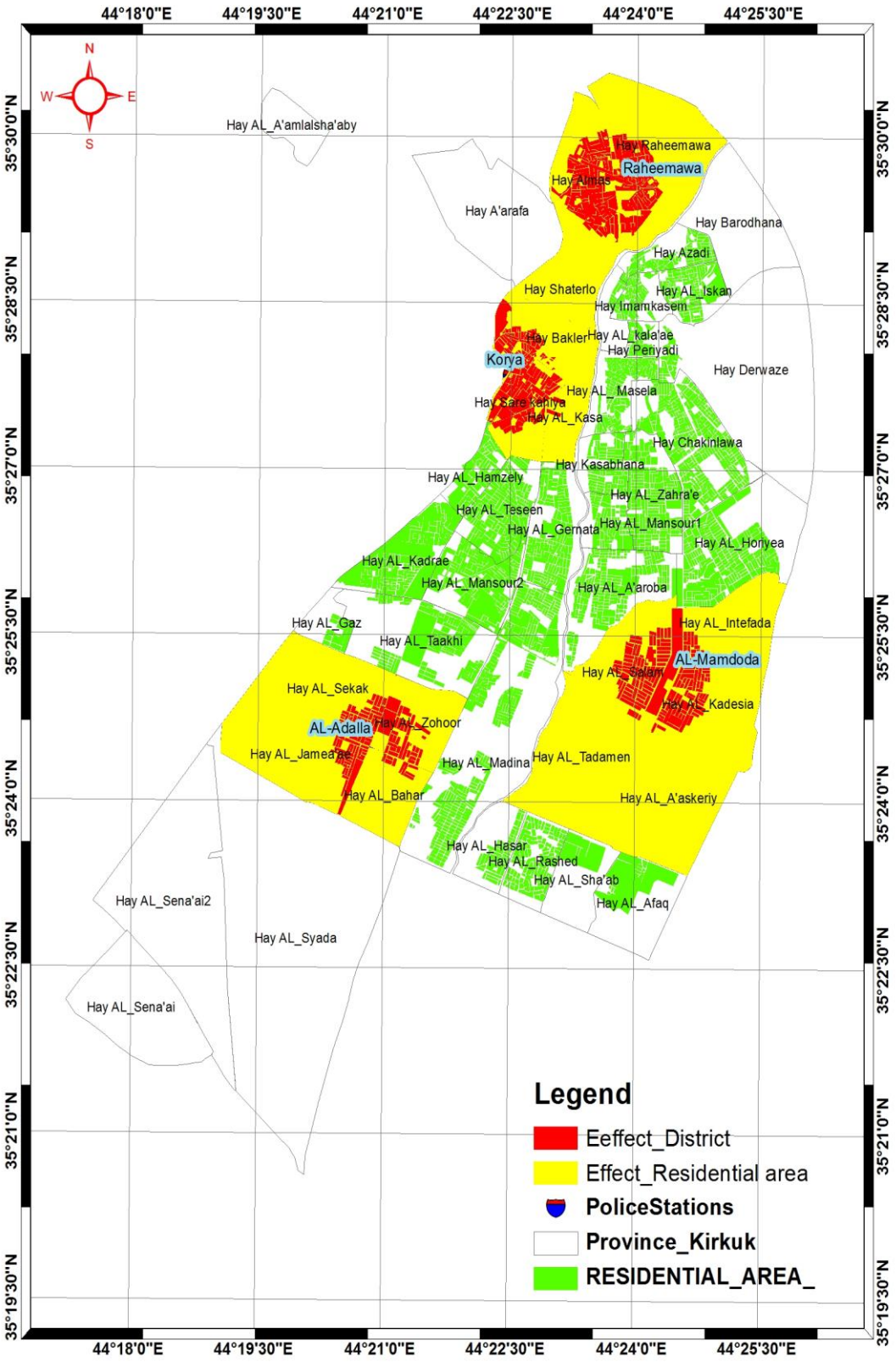


Figure 55: Residential areas under risk from the impact of the explosion

4.3 Bus Stations

As mentioned in the previous chapter about topology system (3.2),(3.2.2) to the building network dataset and create a system that the shortest path (3.3) through the streets of the city were to find bus station and determine its course by taking a point from the city center and moving the buses on the internal transportation network of a way to cover all residential areas to provide more and better service for citizens and take them from their residence to form other residential areas, also commercial area, industrial area, educational area and health area etc. As well as and calculate the distance between each station and another on the length of each line transfer the distance of (500 m) as directed by Prof. Dr. Taner ALTUNOK who is my supervisor, Where we have divided the city into 12 transportations line these lines has two way path. As shown in figure 56.

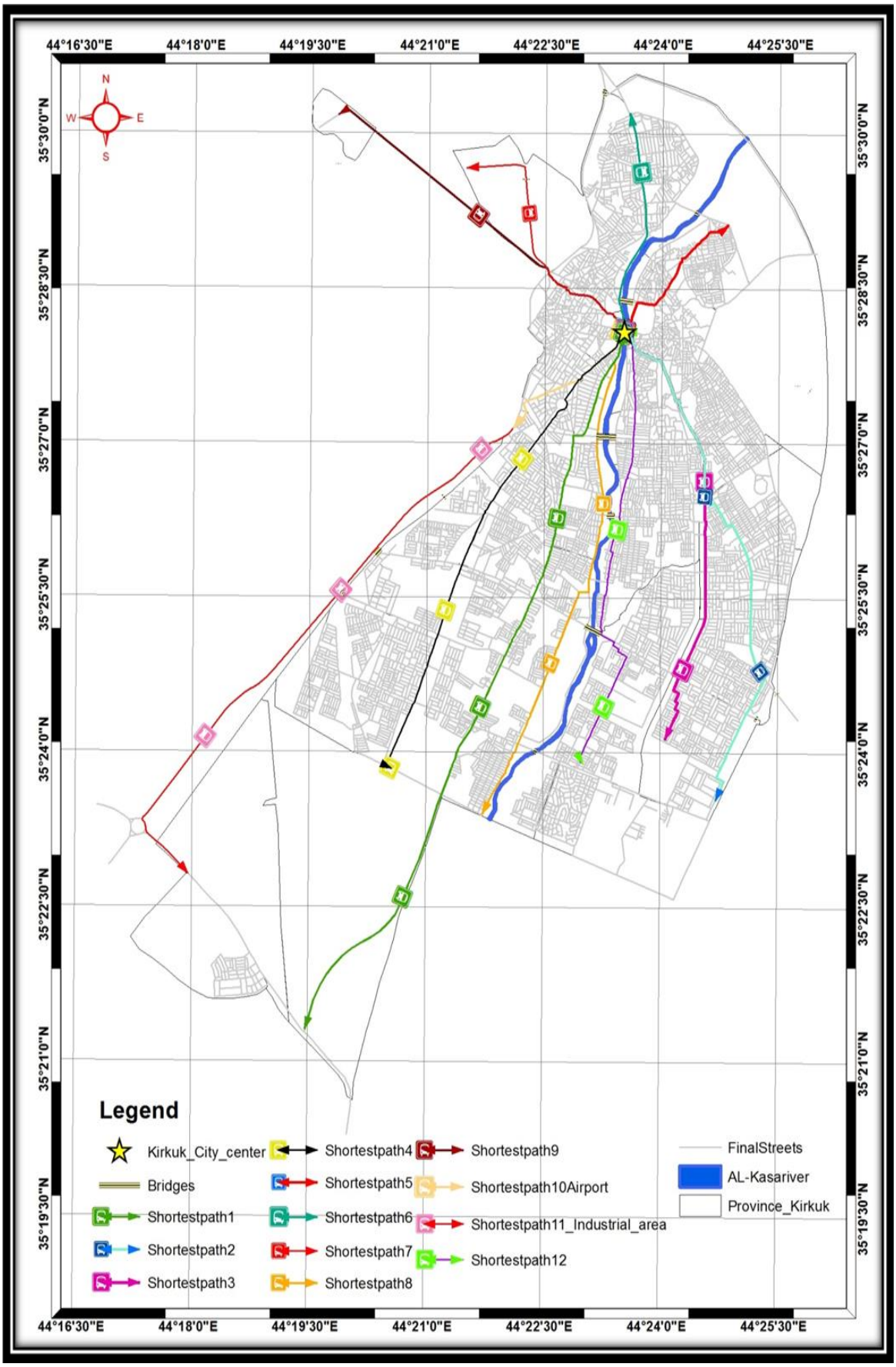


Figure 56: Bus stations

4.4 Optimum Residence For Kirkuk Citizens

After the work that we have done in previous chapters. This chapter specifically been reached to find the best residential areas in Kirkuk residence ideal for citizens in terms of more intensive services to the land of Kirkuk in terms of educational, health and recreational administrator area and commercial area, religious and industrial etc. All of this to enable the citizen to choose the best place to set up . We have been performing these steps and results through using Spatial Join in ARC GIS between each service (Area) and Province map and summarized the counter for this service that covered in each district after finished the join created a thematic map (Symbology) by bar chart to achieved the aim as shown in figure 57.

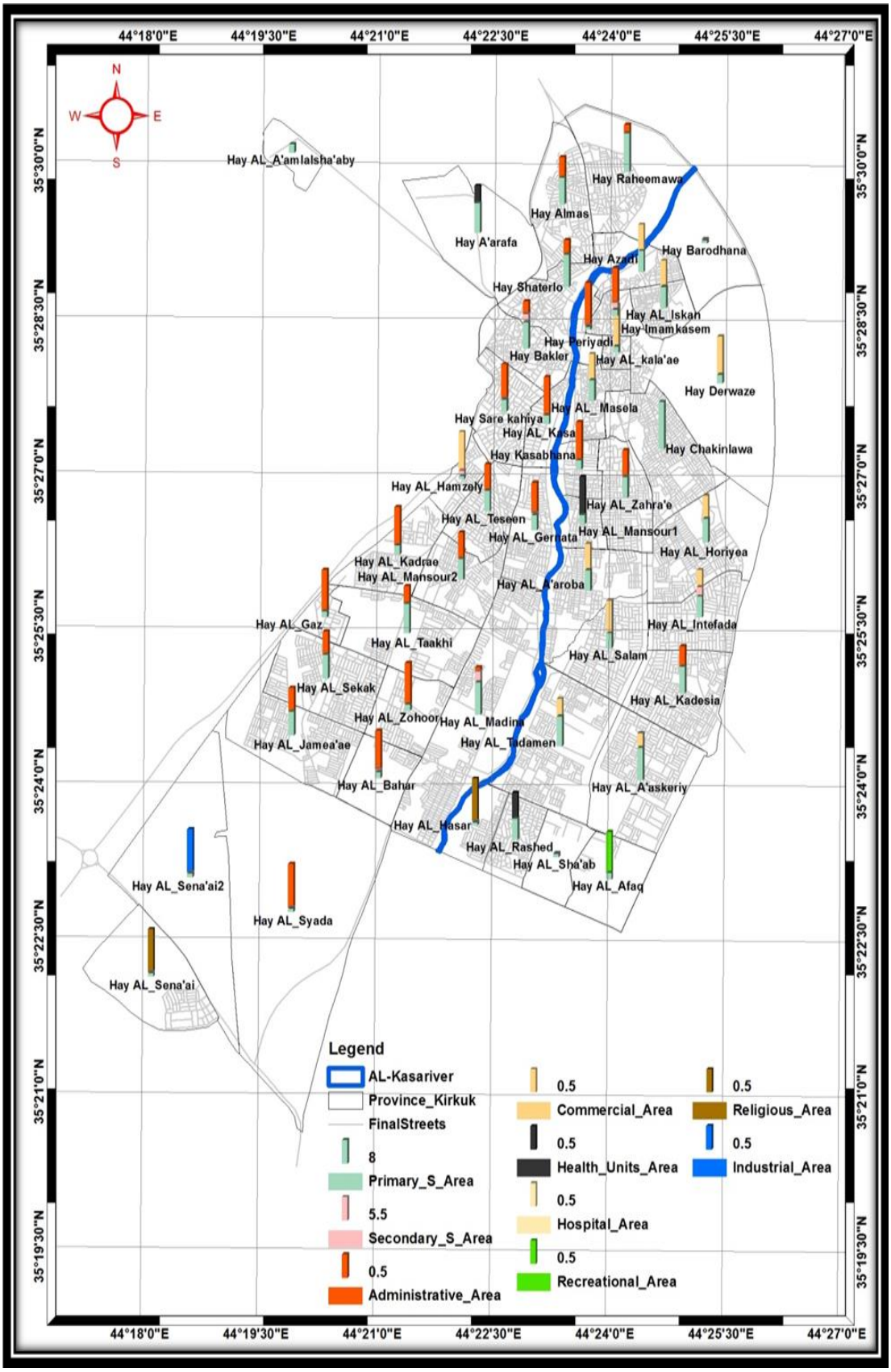


Figure 57: Thematic map for each residential area and each land area

As a result during above figure we found table of land area counter for each residential area as shown in table 6 and figure 58 .This table starts from the optimum district of the residence to low.

No	**Residential Area**	**Administrative Area**	**EDU_Primary_S**	**EDU_Secondary_S**	**Commercial**	**Health**	**Hospitals**	**Industrials**	**Recreationals**	**Religious**
1	Bakler	13	9	8	57	1	1	5	16	9
2	Sare kahiya	9	4	3	8	1	0	1	10	4
3	Shaterlo	8	11	7	18	1	1	2	12	5
4	AL_Mansuor2	7	7	4	4	1	0	1	6	3
5	Raheemawa	4	13	1	2	1	1	1	5	3
6	AL_Taakhi	4	10	2	7	1	0	1	2	1
7	AL_Kasa	4	3	2	11	1	1	2	3	2
8	AL_Madina	2	11	10	7	2	0	1	6	6
9	Chakinlawa	1	16	11	3	2	0	1	6	7
10	Imamkasem	2	2	3	3	1	0	1	5	4
11	AL_kala'ae	3	1	1	4	1	0	1	3	1
12	AL_A'askeriy	1	11	5	5	1	0	1	3	10
13	A'arafa	1	10	6	1	1	0	1	1	1
14	Almas	3	9	6	3	2	0	2	6	3
15	AL_Teseen	1	7	2	3	1	0	1	1	2
16	AL_Zahra'e	2	7	2	2	1	0	1	1	1
17	AL_Rashed	1	7	4	1	1	0	1	8	1
18	AL_Salam	1	5	3	4	1	0	1	1	2
19	AL_Zohoor	3	2	1	1	1	0	1	1	1
20	AL_Jamea'ae	1	8	2	1	1	0	1	1	2
21	AL_Iskan	1	7	5	4	1	0	1	7	3
22	AL_Intefada	1	7	7	1	1	0	1	1	5
23	AL_Horiyea	1	8	1	1	1	0	1	1	2
24	AL_Gernata	2	5	4	1	1	0	1	4	2
25	AL_ Masela	1	7	3	15	2	0	1	5	10
26	AL_Kadrae	3	3	1	2	1	0	1	1	1
27	AL_Kadesia	1	9	3	2	1	0	1	3	5
28	AL_A'aroba	1	7	2	3	1	0	1	1	2

29	Azadi	1	7	2	1	1	0	1	3	1
30	Periyadi	1	2	1	5	1	0	1	1	4
31	Kasabhana	2	3	2	1	1	0	1	2	2
32	AL_Tadamen	1	10	2	3	1	0	1	5	9
33	AL_Sekak	2	8	4	1	2	0	1	1	4
34	Derwaze	1	3	2	3	1	1	5	3	3
35	AL_Mansour	1	3	2	1	1	0	1	1	1
36	A'amlalsha'aby	1	3	2	1	1	0	1	1	1
37	AL_Hamzely	1	1	2	1	1	0	1	4	1
38	AL_Syada	4	1	1	1	1	0	1	1	1
39	AL_Gaz	1	2	1	2	1	0	1	1	1
40	AL_Bahar	1	2	2	1	1	0	1	1	1
41	AL_Afaq	1	2	1	1	1	0	1	1	1
42	Barodhana	1	1	1	1	1	0	1	1	1
43	AL_Sha'ab	1	1	1	1	1	0	1	1	1
44	AL_Sena'ai 1	1	1	1	1	1	0	2	1	1
45	AL_Sena'ai2	1	1	1	1	1	0	2	1	1
46	AL_Hasar	1	1	1	1	1	0	1	1	1

Table 6 : Levels of Each and Area for Each Residential Area

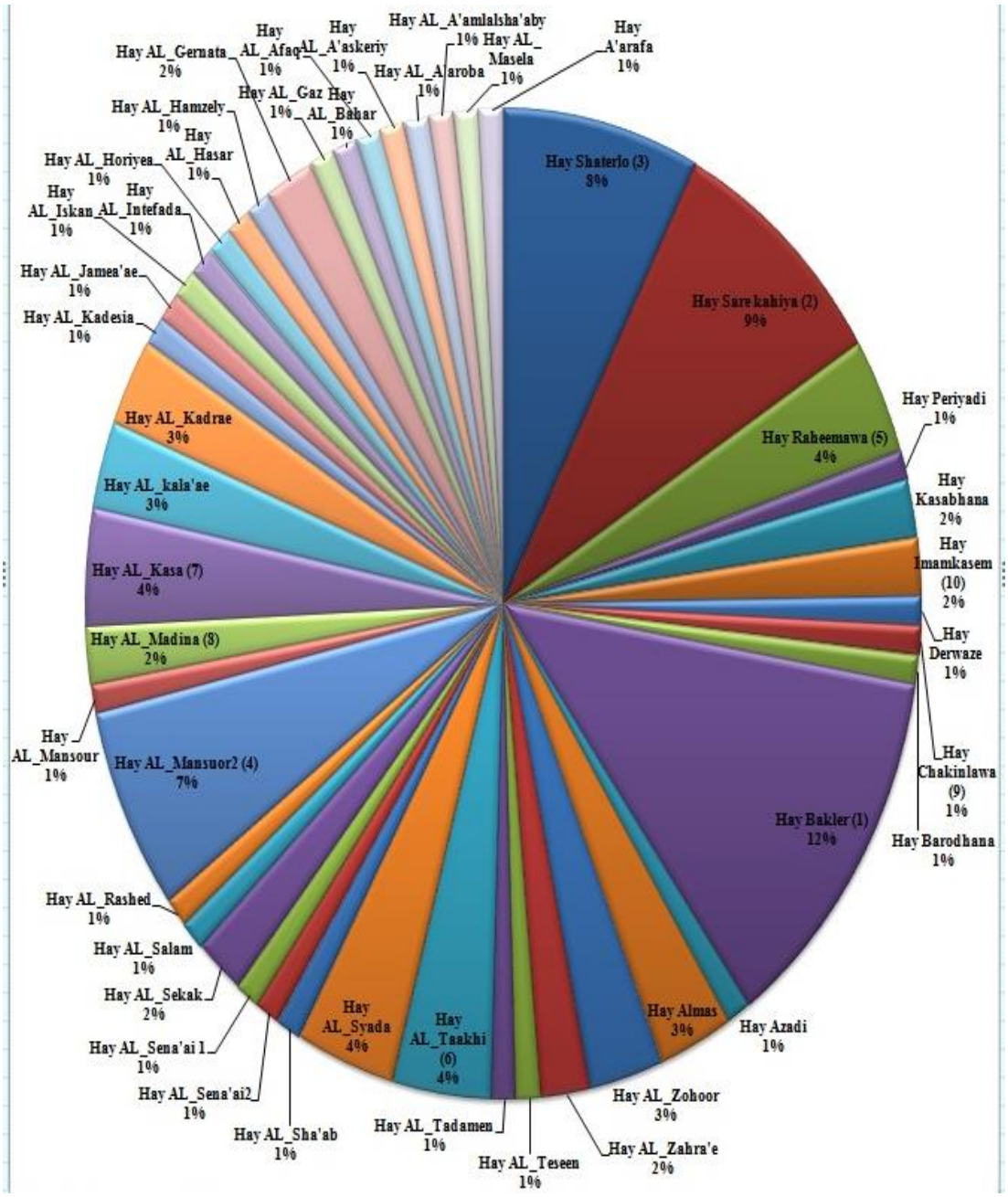


Figure 58: Pie Chart of optimum residence

CHAPTER 5

CONCLUSION

5.1 Conclusion

1. We have 46 districts in Kirkuk and 40 of them are suitable residential areas to residence for the citizens.
2. There are 6 of these residential area lack the infrastructure services such as unpaved streets, lack of water sewers network and the availability of electricity, where the citizen is not favored.
3. Educational areas such as primary schools, complaining of lack of coverage for all residential areas according to the standard 500m buffering.
4. There are 12 Primary schools under risk because of nearest from primary streets with distance 20m.
5. Secondary schools in Province don't covered all residential area after applied buffering 1000m.
6. Health units also they don't covered all residential area according to the 800m buffering.
7. There are 5 Hospital 5 in the Kirkuk are insufficient to meet the needs of the citizens in the city where the ambulance patient with the process very difficult to distance from many areas after the application of the standard in 2000 m.
8. Bakler residential area it's the optimum area for citizens to residence because of the following features:

Administrative Area	EDU_Primary_S_Area	EDU_Secondary_S_Area	Commercial Area	Health Units_Are	Hospitals_Area	Industrials_Area	Recreationals_Area	Religious_Area
13	9	8	57	1	1	5	16	9

9. Sare kahiya residential area comes second level to provide the following characteristics:

Administrative Area	EDU_Primary_S_Area	EDU_Secondary_S_Area	Commercial Area	Health Units_Are	Hospitals_Area	Industrials_Area	Recreationals_Area	Religious_Area
9	4	3	8	1	0	1	10	4

10. Shaterlo residential area comes third level to provide the following characteristics:

Administrative Area	EDU_Primary_S_Are	EDU_Secondary_S_Area	Commercial Area	Health Units_Area	Hospitals_Area	Industrials_Area	Recreationals_Area	Religious_Area
8	11	7	18	1	1	2	12	5

11. AL_Mansuor2 residential area comes fourth level to provide the following characteristics:

Administrative Area	EDU_Primary_S_Area	EDU_Secondary_S_Area	Commercial Area	Health Units_Area	Hospitals_Area	Industrials_Area	Recreationals_Area	Religious_Area
7	7	4	4	1	0	1	6	3

12. Raheemawa residential area comes fifth level to provide the following characteristics:

Administrative Area	EDU_Primary_S_Area	EDU_Secondary_S_Area	Commercial Area	Health Units_Area	Hospitals_Area	Industrials_Area	Recreationals_	Religious_Area
4	13	1	2	1	1	1	5	3

13. There are 15 residential area under risk to their existence within the coverage of police stations, leading to physical and material damage to the citizen who lives in these areas in the event of any terrorist act on these stations.
14. Build transportation network of high-level transport in the Kirkuk city, based on the shortest path system and less time and the distribution of positions in each of these buses stations for each line to cover all residential area in Kirkuk.

5.2 Recommendations

1- Build residential neighborhoods to increase the areal expansion of the city of Kirkuk in the north and south directions to the presence of empty spaces in these two poles of the city because of changes in the population growth increase and reduce the of crowdedness in in the city center, causing high land and residential buildings prices and increase the rent allowance and the concentration of services in these areas.

2- Insert the names of the alleys and re-numbering of these alleys residential areas systematically and urban base and link data in high-resolution with continuous updating of this data.

3- Build infrastructure for the expansion and development of infrastructure of existing networks of water and sewage, electricity and carry transportation network that we have built in this thesis to serve the new residential area.

4- Build extra primary schools according to the standard used in this thesis to cover all residential area in the city.

5- Re-distribution primary school are closed from primary streets with distance 20m, making them outside this distance for the safety of students.

6- Build extra secondary schools according to the standard used in this thesis to cover all residential area in the city.

7- Build extra health units according to the standard used in this thesis to cover all residential area in the city.

8- Build extra hospitals according to the standard used in this thesis to cover all residential area in the city.

9- Re-distribution police stations are close to residential areas, a distance according to standard applied in this thesis to keep safety for the citizens who are living in Kirkuk of explosion effectiveness.

10- Build extra commercial areas and malls and shopping centers and distribution them in a perfect way according to the universal standards, which leads to increased urban development of the city.

11- Internal transportation network linking designed in this thesis linking the villages and districts of the city.

12- Build the subway line (metro) in the city.

13- Build (AMS) ambulance management system and directing duties as GIS standards (Close -Facility).

14- Increase land and recreation (Green space), who was hurt in the comfort of the citizen, which adds aesthetic of the city and reduces environmental pollution.

5.3 Future Work

1- Necessity is generalized in this thesis to all cities in Iraq, just put the province map and insert the database for its and make analyzing via ARC GIS.

2- Insert a new layer beside current layers and defined a new beside current criteria to make a strong system and integrity database.

3- Build a model for the management of residential areas and the inserting of all the layers of lands area and applied the particular criteria for ease of use by any user.

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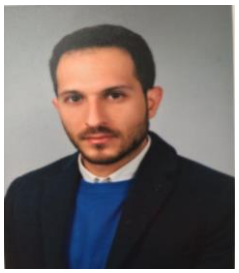
APPENDICES A

CURRICULUM VITAE



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