THE EVALUATION OF PUBLIC SERVICES IN BAQUBAH CITY

BY USING REMOTE SENSING & GIS TECHNIQUES

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Abstract

Baqubah city has grown extremely rapidly. The rate of growth exceeds the growth of services that must grow side by side with the growth of population. There are natural features that affect the growth of Baqubah city such as Dieyala river, Alssariya river, in addition to agricultural areas .All these natural features affect the growth of Baqubah city in the running form being seen . In this research the remote sensing and geographic information system (GIS) techniques are used for monitoring urban expansion and forecasting the probable axes to the growth of the city, and found that the probability of Baqubah growth to east is preferred due to Baqubah growth to the east would never interfere with natural features. Also in this research the Baqubah public services are evaluated by building data base that attach spatial data with the descriptive data and then compared with the allowed standards for those services.

تقييم الخدمات العامة في مدينة بعقوبة
بأستخدام التحسس النائي وتقانات أنظمة المعلومات الجغرافية
(GIS)

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الخلاصة

توسعت مدينة بعقوبة بشكل غير مدروس أسرع من التوسع في مجال الخدمات الضرورية التي يتطلب نموها بشكل يوازي الزيادة الحاصلة في السكان .هنالك محددات طبيعة أثرت على نمو مدينة بعقوبة مثل نهر ديالى ونهر السارية بالاضافة الى بساتين كل هذة المحددات أثرت على نمو المدينة بالشكل الذي نراه الان .في هذا البحث تم أستخدام تقانات التحسس النائي وأنظمة المعلومات الجغرافية لمراقبة التوسع الحضري والتنبؤ بالمحاور المحتملة لنمو المدينة وقد تبين بأن المحور الشرقي هو الأسهل لنمو المدينة حيث لاتوجد محددات طبيعية تمنع نمو المدينة بهذا المحور .وكذلك تم تقييم الخدمات الأساسيةالمقدمة للمدينة بأستخدام أنظمة المعلومات الجغرافية وذلك من خلال بناء قاعدة معلومات تربط المعلومات المكانية بالمعلومات الوصفية ومقارنة البيانات التي تمثل الخدمات المقدمة للمدينة بالمعايير المحددة لتلك الخدمات .تضمن العمل المنجز في هذا البحث عدة مراحل منها تنفيذ المعالجات الصوريه على الصور الفضائية المتوفرة لمدينة بعقوبة وقد تضمنت هذه الممعالجات اجراء التصحيح الهندسي بأستخدام طريقة نقاط الضبط الاراضي والتي اخذت احداثياتها من خرائط طوبغرافية علاوة على ذلك لقد تم تنفيذ عمليات التحسين الصوري وبعدذلك تم تصنيف استخدام الارض لمدينة بعقوبة بطرقتي التصنيف الموجه وغير الموجه ,كل هذه العمليات ساعدت في انتاج الخرائط التصويرية لغرض استخدامها في انظمة المعلومات الجغرافية وقد تمخض عن هذا البحث بان هنالك قصور في توفير الخدمات الاساسية لمدينة بعقوبة بالاخص الكهرباء والماء حيث تعاني المدينة من عدم توفر هاتين الخدمتين لكل اجزاء المدينة العامة .مدينة بعقوبة مزودة بشبكة جيده من الطرق تربط المدينة بمختلف المدن الاخرى ولاتعاني من نقص في هذه الخدمة اذ ما قورنت بالمدن العراقية الاخرى . هنالك حاجة لمزيد من الاهتمام بالواقع التعليمي في مدينة بعقوبة حيث هنالك نقص

في الملاك التعليمي وكذلك في عدد المدارس ويعود ذلك للزيادة في عدد السكان ,فأغلب المدارس تتحمل فوق طاقتها الاستيعابية .أما بالنسبة للخدمات الصحية فهي تعاني من الاهمال وقلة الكادر الصحي .ففي المدينة عدد الاطباءالاختصاص قليل جداوالعيادات الطبية الشعبية لاتغطي كل اجزاء المدينة وموزعة عشوائيا "في المدينة وهذه المشكلة موجود ايضا" في المراكز الصحية.

1.Introduction

In Baqubah city, land use and urbanization have undergone a fundamental change due to the accelerated expansion since 1960. Urban growth has been speeded up; the random land developing houses, random disposal dumping and other factors create pressure on planning for protecting of urban fringe against urban expansion. This is particularly true in the city where massive agricultural land is disappearing each year, converting to urban or related uses. Evaluating the magnitude and pattern of all Iraq's urban growth is an urgent need. Furthermore, because of the lack of appropriate land use planning and the measures for sustainable development, random urban growth has been creating severe urban consequences. Thus, there is also a need to assess the urban growth impact of the rapid urban expansion in relation to the availability of public services. The integration of remote sensing and geographic information systems (GIS) has been widely applied and been recognized as a powerful and effective tool in detecting urban land use and land cover change [Harris and Ventura 1995].Satellite remote sensing collects multispectral, multiresolution and multitemporal data, and turns them into information valuable for understanding and monitoring urban land processes and for building urban land cover datasets. Geographic information system (GIS) technique provides a flexible analysis for entering, and displaying digital data from various sources necessary for urban feature identification, change detection and database development.

The objectives of this research can be summarized as follows

. • Evaluating of Public Services in Baqubah City
. • Monitoring Urban Expansion
. • Estimation Urban Growth

2. The ISODATA Classification

The ISODATA method is unsupervised classification that uses minimum spectral distance to assign a cluster for each candidate pixel. The process begins with a specified number of arbitrary cluster means or the means of existing signatures, and then it processes repetitively, so that those means shift to the means of the clusters in the data. Because the ISODATA method is iterative, it is not biased to the top of the data file, as are the one -pass clustringalgorithem , see figure 1.

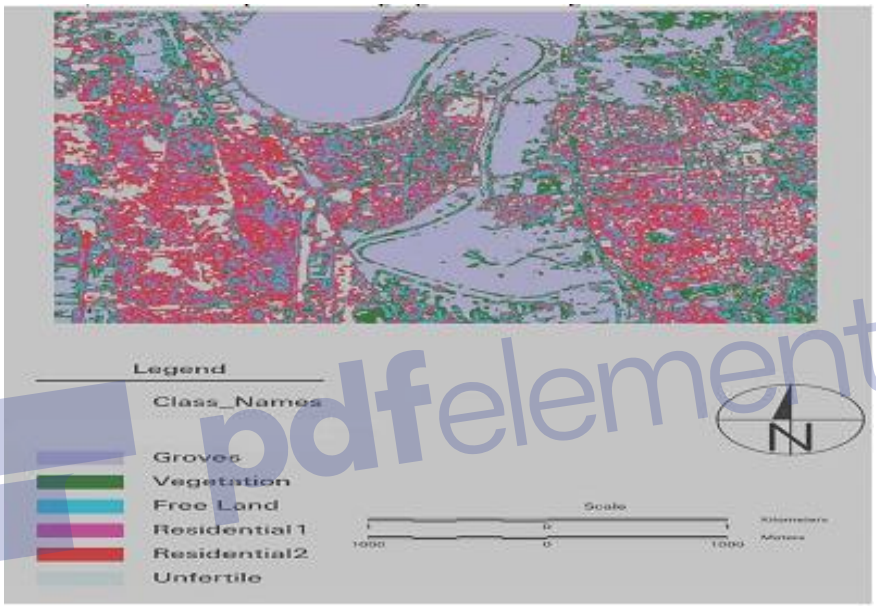


Figure (1) ISODATA Classification (BAQUBAH _20

Table (1) Statistics of ISODATA Classification BAQUBAH_2005

Area (sq kM)	No. of Pixel	Classes
22.483872	156138	Groves
16.196688	112477	Vegetation
14.5044	100725	Residential 1
15.7896	109650	Residential 2
18.655056	129549	Unfertile
19.0427	132241	Free Land

3. Monitoring of Urban Expansion by Using Geographic Information System and Remote Sensing Techniques

In order to detect the change, temporal analyses must be used GIS for analytical purposes. Such analyses are usually done by backdating the information of the reference, the newest year. In such cases the most accurate data are the actual ones and the older years can be less precise. It may be posible to adapt the most accurate vector-data to the less precise older data. In our case the used maps from 1962 to 1990, satellite photographs from 2003 to 2005 the resolution however was partly better than of the reference data (SPOT5 & QUICKBIRD). Overlying Feature Extracted from Maps On Baqubah Satellite Image (SPOT5). This overlying is used to detect Baqubah stages growth as shown in figure2 where geographic information system (GIS) techniques were used to compute urban land area for the years 1962, 1985,1990, 2005.Spatial statistics can highlight the problems and trends. Some trends are already done in the municipality to plan the need of fresh water and others. But by the use of statistical methods also trends can be computed by different mathematical methods, which finally help to estimate the future.

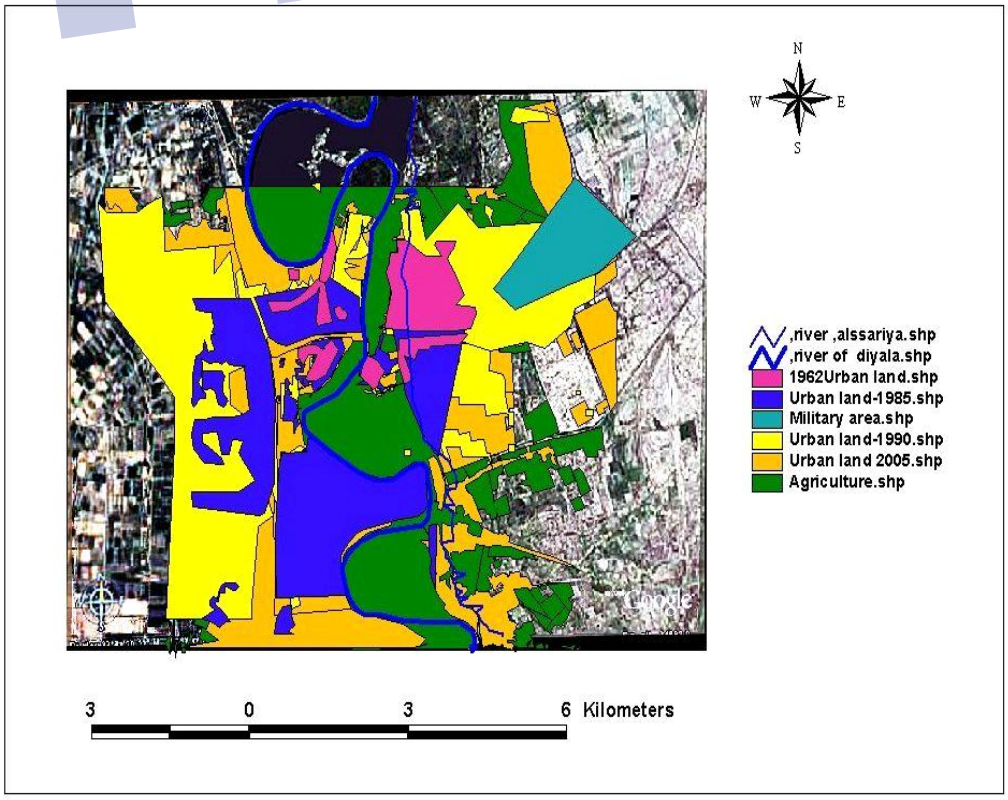


Figure (2) Baqubah growth stages for the years 1962, 1985, 1990, 2005

See the table (2) which is computed using GIS technique.

Table (2) Urban Area Vs Year

YEAR	1962	1985	1990	2005
t	0	23	28	43
Urban Area(ha) A(t)	316	1452	2424	4007.645

In order to obtain an equation relate the year shoud be related as an independent variable with the urban area in hectare and the least squares Regression approximation should be used . By using information computed using GIS technique as shown in fig.(2) the final will be

eq. $F(t) = 54.8752361 + 84.89514953\ t$

Where F(t) is the approximation of urban area in hectare
t is Period of Time .

4. Evaluating School Facilities in Baqubah City by Geographic Information System (GIS)

The City of Baqubah is served by 5 nursery schools, 70 elementary schools, 19 intermediate schools and 22 high secondary schools (15 of them were built at the same time and all of them are situated in the center of the city) that serve the Baqubah area. [Azhaar 2005 in Arabic]. The GIS is a powerful tool that gives the ability to analyze and evaluate the quality and quantity of education services in Baqubah city see figure3 which shows the level of service in Baqubah secondary schools .

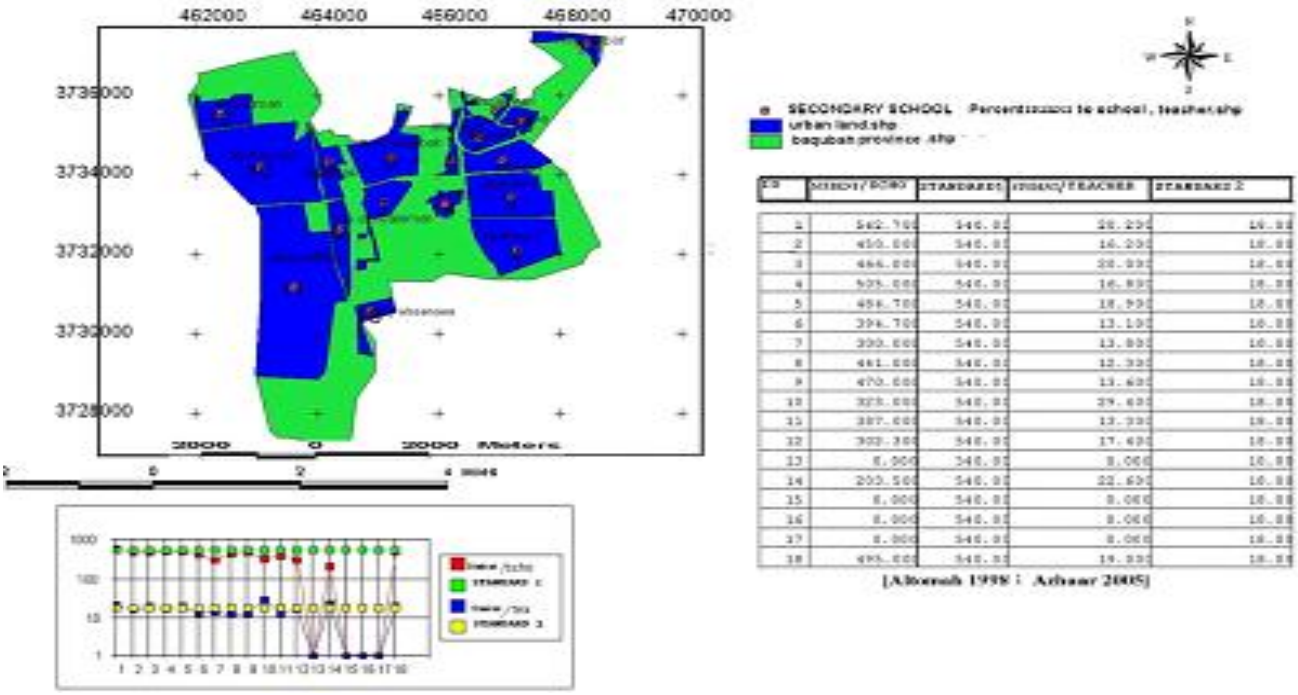


Figure (3)Level of Service in Baqubah Secondary Schools (2004-2005)

5. Public Health in Baqubah

There are (23) institutes of health in Baqubah city for various purposes. There are three governmental hospitals they are: , Public Baqubah hospital, Batool Materity Hospital and Alrazi hospital. These Hospitals cover all Baqubah towns in addition ,there are four respective hospitals as follows: Alrahmah Hospital, Dieyala hospital, Alhayat hospital and Alshifa hospital.There is also a clinic of dentistry, and (13) local institutes of health represented by popular clinics and health centers. GIS technique is a powerful tool that can be used to effectively build data base of public health. It is important for mapping of community health indicators, through our invitational theme to map health inequalities. The total number of doctors in Baqubah popular clinics was (28) doctors in the year 2004. They are distributed in all Baqubah popular clinics. The limited standard in Baqubah popular clinics is one doctor for (10000) persons of population .

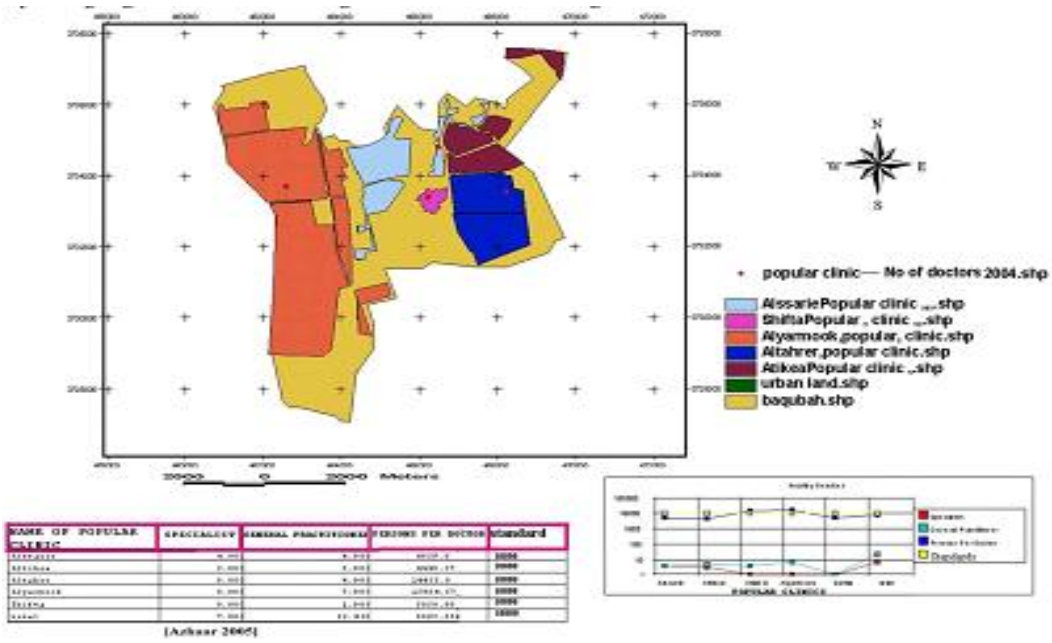


Figure (4) Baqubah Popular Clinics _No. of Doctors Vs Standard (2004)

6. Evaluation and development of Electricity in Baqubah city by Using Geographic Information System (GIS)

Baqubah city has three power stations. The first lies near Dieyala River and generates (116 MW). The second lies to the east Dieyala River and generates (75 MW); the third generates (63 MW). The limited standard is (1.2MW/day) for one person [Mushtaq 1997]. The number of people in the year (2004) was (249011) persons [Azhaar 2005] the forecasted growth of people up to year (2016) is (300631) [Mushtaq 1997] in Baqubah city and the threshold is (1.2MW/day). Using these numbers the electricity facilities can be evaluated in Baqubah city then converted numbers to image to describe the lack in electricity .The Baqubah electricity analysis is as follows

. • The total generation of electricity for the year(2004) in Baqubah city was 254 MW = 254000kW

. • No. of served persons in year (2004) = 254000/1.2
= 211666 persons

. • No. of unserved persons in year (2004)= 249011-211666
=37345 persons

. • The required electricity up to year (2016) = 1.2* 300631

= 360.7572 MW

. • The required electricity in year (2004) =1.2*249011
= 298.8132 MW

. • The total of persons who must be served due to the growth up to year (2016) = (360.7572- 298.8132) *1000/1.2 = 51620 persons

. • The total persons to be served up to year (2016) = 37345+ 51620= 88965 persons

See figure (5)

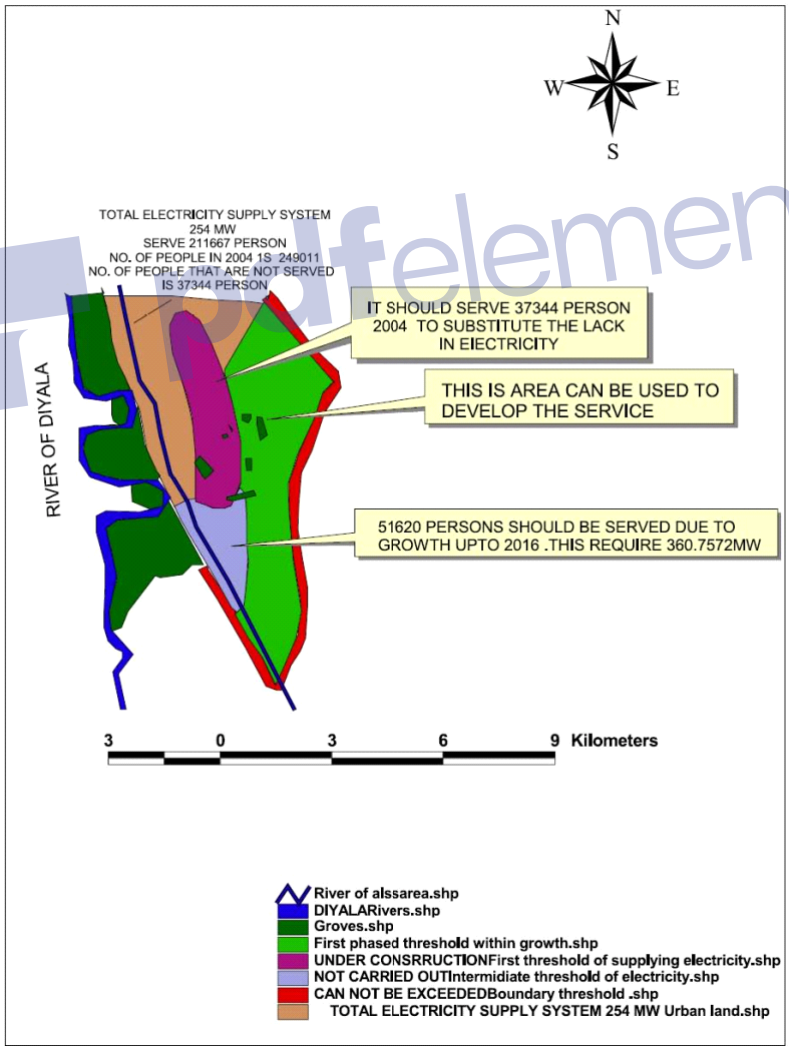


Figure (5) Development of Electricity Supply System in Baqubah City from the year (2004) to (2016)

7. Water Supply System in Baqubah City

Baqubah city has a water project (Baqubah project) which lies to the east of Alssariya river which provides (68184) cubic M/day, with two tanks whose size is about (4546M liter) and there is a tank of about (1136.5 M liter). The Baqubah project serves about (243823 persons). The number of people in the year (2004) was (249011) persons the expected growth of people up to year (2016) is (300631) [Mushtaq 1997 in Arabic] in Baqubah city and the threshold is (0.45 cubic m/day) of water for each person. The Baqubah water supply system analysis is as follows

. • The total no. of served persons(for the year 2004) =243823

. • The total no. of unserved persons(for the year 2004)= (249011-243823)= 5188 persons

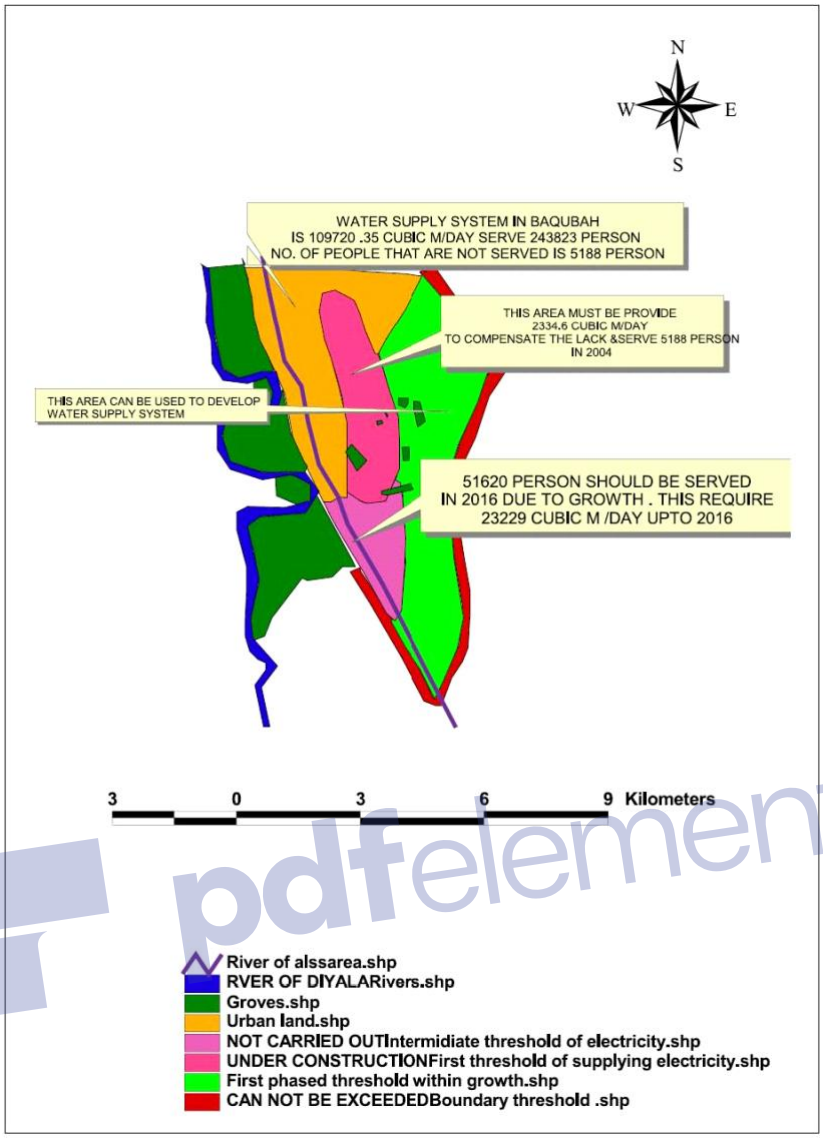
. • Water supply system in Baqubah (for the year 2004)= 243823*0.45 = 109729.35 cubicM/day

. • The lack in water(for the year 2004) =249011 *0.45-109729.35= 2334.6 cubicM/day

. • The total amount of water up to (year 2016) will be = 300631*0.45= 135383.95 cubicM/day

. • No. of persons that should be served due to the growth up to year 2016= (135383.95-112054.95)/0.45 =51620 persons

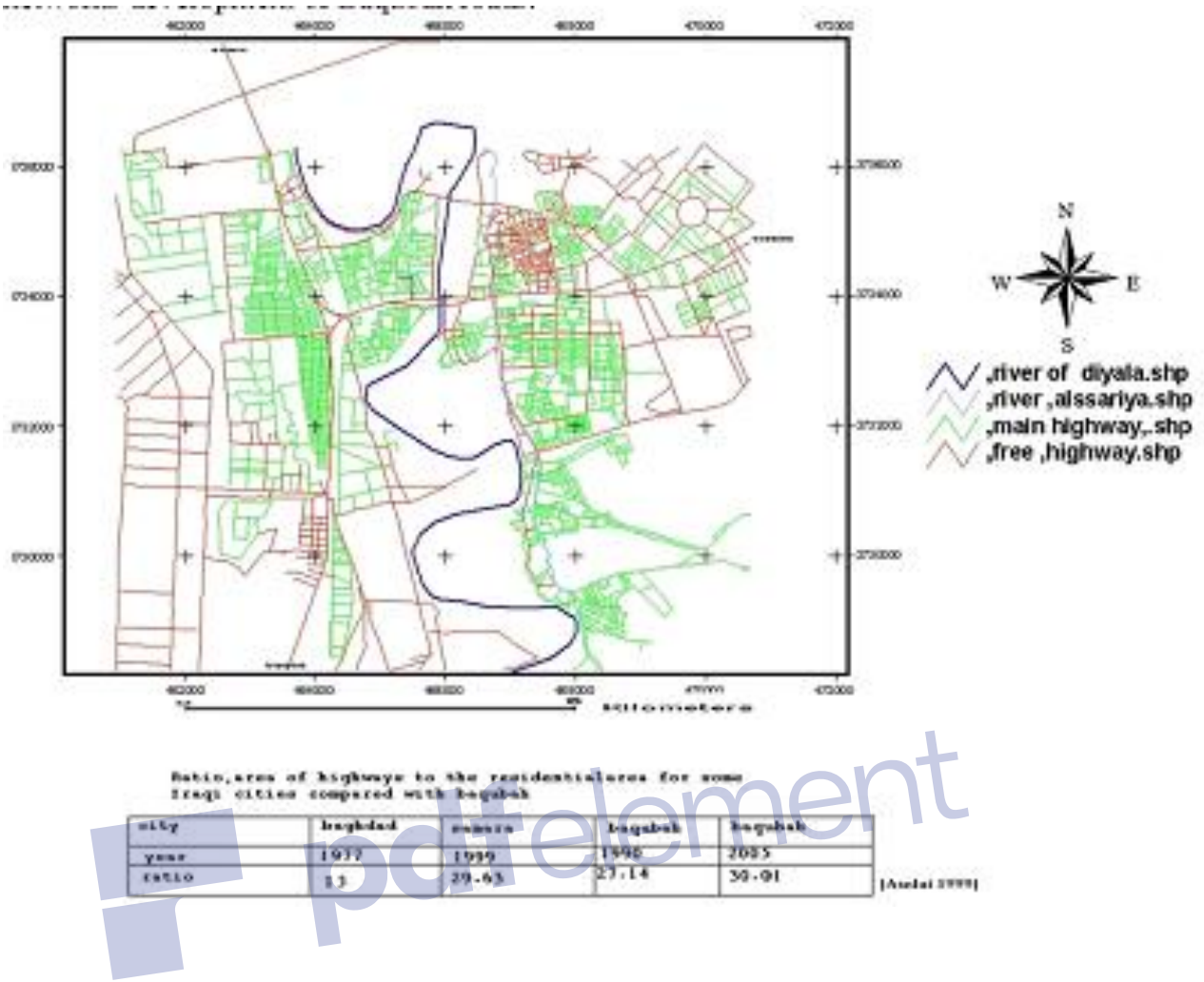
. • The total persons that should be served up to year 2016= 51620+ 5188= 56808 persons. Using these numbers the water facilities can be evaluated in Baqubah city then these numbers are converted to image to describe the lack in water by the use of GIS technique see figure (6)



Figure(6) Development of Water Supply System in Baqubah City from the year (2004) to (2016)

8.Network of Roads in Baqubah City

Baqubah city has been provided with a good free highway to Baghdad and Mandelly cities and there is no lack in this service compared with other Iraqi cities. Fig. 7shows networks development of Baqubah roads .



Ratio,area of highways to the residentialarea for some Iraqi cities compared with baqubah

city	baghdad	samara	baqubah	baqubah
year	1977	1999	1998	2005
ratio	13	29.63	27.14	50.01

(Awlai 1999)

Figure(7)Networks of Baqubah roads in the year 2005

9. Conclusions

1. Future Expansion of Baqubah to the east is easier than its growth to the west. Baqubah growth to the east would never interfere with natural features. The other axes of Baqubah growth are interfered with natural features.
2. There is a need for additional school facilities in Baqubah city where there is a lack in the staff and number of schools due to the growth of population where there are nursery schools only in five towns.
3. There are lacks in health services especially in the staff where the number of specialist doctors in the city is too low about (7) doctors in Baqubah city. The Baqubah popular clinics do not cover all Baqubah city

and they are distributed randomly. This problem is also in health centers. It is obvious there are lacks in medical staff in all Baqubah popular clinics but in Altikea and Shifta popular clinics there is enough medical staff.

4. The electricity in Baqubah city is too low amounted in the year (2004) to (254 MW) where it should be about (298.8132 MW) in the same year to cover the need. In the year (2016) it should be about (360.7572 MW) due to the growth of population. The other important observation about the electrical utilities in Baqubah city indicates that almost all of them suffer from large distribution losses and below-par performance of their supply feeder networks. Therefore, there is an urgent need to reduce these technical losses, which, in turn, will at least partially relieve these utilities from the huge revenue losses they suffer every month. The number of unserved persons in year (2004) was (37345) persons and they represent (0.15%) of Baqubah population.
5. Baqubah city has water project (Baqubah project) which lies to the east of Alssariya river and provides (68184) cubic M/day, with two tanks of (4546M liter) and there is another tank of (1136.5 M liter). The Baqubah project serves about (243823 persons). The number of people in the year (2004) was (249011) persons The total number of unserved persons(for the year 2004) was 5188 persons and they represent (2.08%) of Baqubah population. The total persons that should be served due to the growth of population up to year 2016 is about (56808) persons and this indicates lack in water.
6. Baqubah city has been provided by good free highway to Baghdad and Mandelly cities and there is no lack in this service compared with other Iraqi cities.The ratio of area of Baqubah highways to the residential areas for the years (1990 to2005) is about (27.14), (30.01) respectively.

10. Recommendations

1. Using high spatial resolution images are required for the region of high amount of feature details such as urban area.
2. Availability of up to date digital land use maps for Baqubah city is very important, these maps can be renewed continuously with no need of total changing of the maps.
3. Development of schools facilities in order to cover all Baqubah cities due to growth of population. The number of schools must be increased.
4. Constructing new health centers in Baqubah city to cover the future need to health facilities.

5. Baqubah is in need of two projects one is for water and the other is for electricity to cover the future need.
6. The Baqubah growth must be submitted to urban planning.
7. Encourage growth in areas where it will have the least impact on the environment and develop new opportunities for economic growth at the municipal level.

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