Resettlement the location of water compact unit in Al-Khairat city / Karbala

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Abstract. The location of water compact unites in Al-Khairat city within Karbala government were studied regarding to quality and quantity of water, through a large amount of geo-spatial information such as an electronic field survey, intelligent survey methods, get off the location survey modeling by simulation scenario analysis. It was sent to be educated people to obtain correct and realistic result. The geographic information system (GIS) program is used to be creating a database for the region in the program. Then, the establishment of the water compacts unites added to the GIS program to obtain new sites to resettlement for the construction of new water compacts unites to fill the shortfall in the city. The analysis is done by GIS with eight new locations were obtained and results were matched with reality. It was concluded that there are two out of eight sites that are not suitable for construction a water compact. The lack of location survey model for water compact in Iraq as general and for study area to meet the needs for water which are complex problem related with population health. This study aims to survey the quantity and quality of water for the Al-Khairat city and fill the gap if it exists with the proposal of new sites for new water compacts to get the location survey modeling system to reduce the impact of negative locations.

The research problem: The lack of location survey method model for water compact unites to meet the requirements for water which are complex and spatial problem.

The objective of research: Proposal for predicated resettlement locations for water compact unites to get highly efficient performance.

Keywords: GIS, Al-Khairat, Resettlement, Water compact unit.

1. Introduction
The water is the basis of our life. Otherwise there is no ecosystem or life. The world is witnessing more interest in drinking water because of agricultural, industrial, commercial growth and Increasing in the population cause the huge demand for water [1]. This study deals with compact supply Water in Al-Khairat city.

The research attained to use GIS technique and its facilities to obtain the best water compact location, by resettlement their locations. Population and water consumption estimates are the basis for determining the service demand for water supply and distribution network system. Several analyses should be made to
investigate alternative piping arrangements within the distribution network design system to get modeling with GIS techniques. Flow and pressure demand at any point of the system are determined by hydraulic network analysis of the supply, storage, pumping, and distribution system as a whole [2]. Supply point locations such as storage reservoirs are typically known based a whole, given source of supply or available space for a storage facility. The use of GIS software with other systems are to facilitate access to the result more accurately quickly updating database, integrating, modeling, resettlement and mapping with GIS.

2. Study area
Al-Khairat region is an agricultural area mainly located southeast of the holy Karbala governorate. It is bordered by the governorates of Babel from the east and Najaf from the south as shown in figure 1. It is irrigated directly from the Euphrates River and about 97% of its inhabitants live in rural areas. The path of religious visits, the center of the northern movement south between Karbala and Najaf passes near its western border. Therefore, the region of Al-Khairat is important, because it is a productive agricultural area and is a route for the religiosity visitors on its borders, therefore it should be submitted the accurate location survey model for water supply service in high performance quantity and quality. Al-Khairat is a rural area with a population of 72,194 person at the year 2017, which distribution on the area of 28.5 km² [3]. The forecasting population is expected to increase to double according to the study of the structural plan of Karbala government [4]. Figure 1, shows Karbala location for Iraq and its districts including Al-Khairat. Al-Khairat is a largely agrarian sub-district in the south east of the Governorate. It is bordered by Babel Governorate to the east and Najaf Governorate to the south and is irrigated from the Euphrates River.

![Figure 1. Al-Khairat site for Karbala and neighboring governorate Source: Karbala Governorate/Director of Urban Planning – Karbala.](image-url)
3. The Satellite Images
The satellite image used is from the quick bird with accuracy 0.6m, the quick bird satellite is launched on October 18, 2001, Vandenberg Air Force Base, California. Orbit is 450 km altitude; 93.5-minute orbit time; 10:30 am equator crossing time (descending); inclination 97.2° sun synchronous. Nominal swath width is 16.5 Km at nadir. Resolution: 1-(Panchromatic): Basic: 0.61 meters at nadir, 0.72 meters at 25° off-nadir Standard & Ortho rectified: resampled to 0.6/0.7-meter GSD and the Spectral Bandwidth is 450—900 nanometers. 2-(Multi-spectral): basic: 2.44 meters at nadir, 2.88 meters 25° off- nadir Standard & Ortho rectified: resampled to 2.4/2.8 meter GSD and the Spectral Bandwidth is: blue: 450—520 nanometers- Green: 520 - 600 nanometers- Red: 630 - 690 nanometers- Near-IR: 760 - 900 nanometers, the research used satellite image with accuracy 0.6 m, which is acceptable due to unavailable more accuracy with the condition of the research.

4. Location of water compact
There are 15 water compact units in the study area [5] as shown in figure 2.

![Figure 2. Water compact location and capacity Source: the database of the water Directorate of Karbala 2016.](image)

5. Building geo database for Al-khairat
In this research, a database of buildings, residential complexes and other indicators that affect the use of water in Al Khairat will be updated with the located of 15 water reservoirs feeding the entire city. Geographic data bases consist of two types of data: Spatial Data. These data are in the form of topographic, geographic, administrative and objective maps, city maps, spatial imagery, aerial
photographs, maps, spatial features and other data representing the site. The second type of data is metadata describing the contents or components of spatial data and comes in the form of statistical tables or descriptive data [6]. The researcher studies and treats the data survived in this research according to the nature of this service and the allowable tolerance.

There are three types of features: [7].
1- Point.
2- Line.
3- Polygon.

Use every group of features according to the need and if it points or line or polygon.

6. The location of water compact
In Al-Khairat city there are 15 water compact as shown in table 1. The location of originally water compact is effect directly on the new water compact location cause there is an important condition that the new should far away from the old about (2-3) km.

| No. | District | Project name | Project capacity (m³/hr.) | Feeding river | X(m)    | Y(m)    |
|-----|----------|--------------|---------------------------|---------------|---------|---------|
| 1   | Al- Hindiya | Abu- Rwea New | 100 | Abu Rwea | 426366 | 3591098 |
| 2   | Al- Hindiya | Abu- Rwea Old | 14  | Abu Rwea | 426063 | 3589104 |
| 3   | Al- Hindiya | Abu- Iwejela | 100 | Al zobdia | 425877 | 3593626 |
| 4   | Al- Hindiya | Al- Igatha   | 50  | Abu Rwea | 425052 | 3589115 |
| 5   | Al- Hindiya | Al- Hiyader  | 200 | Euphrates | 433843 | 3581907 |
| 6   | Al- Hindiya | Al-Khairat   | 200 | Euphrates | 429044 | 3597567 |
| 7   | Al- Hindiya | Al-Khairat center | 200 | Jadwel bani Hassan | 430758 | 3592427 |
| 8   | Al- Hindiya | Al-Khairat center | 50  | Shatt Mullah | 426677 | 3593724 |
| 9   | Al- Hindiya | Al- Sijla    | 200 | Euphrates | 432905 | 3585979 |
| 10  | Al- Hindiya | Al- Silaa    | 14  | Al-zobdia | 423386 | 3592789 |
| 11  | Al- Hindiya | Al- Intakia  | 200 | Euphrates | 433614 | 3590634 |
| 12  | Al- Hindiya | Al-faris     | 200 | Euphrates | 429091 | 3597579 |
| 13  | Al- Hindiya | Al- Fiadah   | 200 | Euphrates | 432918 | 356020 |
| 14  | Al- Hindiya | Great Al-Khabaza1 | 50  | Jadwel bani Hassan | 432189 | 3584897 |
| 15  | Al- Hindiya | Great Al-Khabaza 2 | 50  | Jadwel bani Hassan | 432182 | 4584911 |

Source: researcher

7. Digital mapping production
Input of the database for the water impact in (GIS) program led to be starting of production of digital mapping for these data; the researchers produce maps for the database to illustrate it. Product map for water compact, Rates River, water channel and built up area. The map below in figure 3 shows the most important layers in Al-Khairat which effect mainly on the new location that will be obtained.
8. Online questionnaire
Electronic questionnaires, which are often published on a website, are very quick to present information to the citizens and to get answers from it in a short period.

8.1. Questionnaire result:
The usual questioner does by hard copy and distributed to people to make their opinion and their gap system efficient about service [8], but this questioner was done by internet. The cooperation was with youth inhabitants from Al-khairat to complete the questioner as shown in table 2, below.
Table 2. Questioner result

| Water compact          | Water quantity | Water quality |
|------------------------|----------------|--------------|
|                        | weak | average | good | Very good | Weak | average | good | Very good |
| Abu- Rwea- New         | 13   | 4       | 2    | 1         | 11   | 7       | 2    | -         |
| Abu- Rwea- Old         | 14   | 4       | 1    | 1         | 10   | 7       | 3    | -         |
| Abu- Iwejela           | -    | 1       | 11   | 8         | -    | 8       | 9    | 3         |
| Al- Igatha             | 13   | 5       | 3    | -         | 12   | 7       | 1    | -         |
| Al -Hiyader            | 15   | 4       | 1    | -         | 16   | 4       | -    | -         |
| Al-Khairat             | 10   | 8       | 1    | 1         | 14   | 5       | 1    | -         |
| Al-Khairat Al-Makdoni  | 11   | 6       | 2    | 1         | 17   | 2       | 1    | -         |
| Al-Khairat district center | -   | 2       | 9    | 9         | -    | 6       | 10   | 4         |
| Al- Sijla              | 13   | 7       | -    | -         | 14   | 4       | 1    | -         |
| Al- Siliaa             | 6    | 13      | 1    | -         | 8    | 10      | 2    | -         |
| A-l Intakia            | 8    | 7       | 3    | 2         | 12   | 7       | 1    | -         |
| Al- Faris              | 11   | 5       | 2    | 2         | 16   | 2       | 1    | 1         |
| Al- Fiadah             | 9    | 8       | 2    | 1         | 14   | 5       | 1    | -         |
| Greet- Al-Khabaza      | 9    | 9       | 1    | 1         | 11   | 8       | 1    | -         |
| Al- Fiadah             | 9    | 8       | 2    | 1         | 14   | 5       | 1    | -         |
| Greet- Al-Khabaza 1    | 9    | 9       | 1    | 1         | 11   | 8       | 1    | -         |
| Greet- Al-Khabaza 2    | 6    | 8       | 4    | 2         | 13   | 6       | 1    | -         |

Source: researcher

Through the table 2, we note that the highest efficient results for water compact unites were obtained in only two water compacts which are:
1- Abu iwejela.
2- Al-Khairat District center.

9. Tools of spatial analysis
The research used the main tools of spatial analysis as written below [9]:
1 - Map layer.
2 - Spatial question.
3. Analysis tools (clip & buffer).
4. Buffer areas.
5. Clip (extract).
6. Attribute table (sum & count).
7. Final visualization.
8. Selection by location (spatial selection).

9.1. Record the indicators
After the research survey completes, and the database was available, the questioner complete try to use spatial data analyses, to know which compact is good efficiency and which is low efficient to be excluded.

10. Comparison between water compact unites
The comparison is in the table 3, below which shows the water compact efficient indicators:

| Good efficient compact | Bad efficient compact |
|------------------------|-----------------------|
| 1-it is far away from the river canal by 30 m. | 1-far away from river canal more than 30 m. |
| 2-Be located within the perimeter of the urban area at a distance less than 60 m. | 2-Some located in perimeter of the urban area and some not |
| 3-Not far from the paved roads with a distance of 10 m. | 3-far away from paved roads more than 10 m. |
| 4-The elevation (DEM) from 30-32 m. | 4-The elevation (DEM) from 30-32 m. |
| 5-Located within the agricultural area. | 5-Some located on the agricultural area and some not |
| 6-Located in the soil of the river basins buried in the drains. | 6-Located in both type of soil, the soil of the river basins buried in the drains and the soil of the caves of rivers. |
| 7-The shape is rectangular, and the area is between 100-200 m² | 7-The shape is rectangular, and the area is between 100-200 m². |

Source: researcher

11. New resettlement water compact
After identifying the indicators that give the best location of the water compact we enter into the GIS program, where eight new locations were obtained in the area and with better efficiency according to the determinants derived and figure 4 shows the new locations of the new compacts.

12. Matching the new locations with the reality
After getting eight new locations suitable for locating new water compacts in the area as shown in figure 4, we will make sure that the new locations are possible to build or not. So, we went to the area and took the coordinates of each location of those coordinates to see if the area was valid or not. Two of the eight compacted water unites sites were located on built-up area, while the other six are suitable for resettlement in new vacant land.
13. Conclusions and Recommendations

Below we will get off the important conclusion and recommendation from this research:

13.1. Conclusions

The research gets off many phenomena through this research, but will mention here the main conclusions of this:

1- The need to create a complete database of water services in any region, intended to work through GIS program to facilitate the work with data analysis and updating to deal and use this database by specialist and designers which are the most important solution tools for any infrastructure problems.

2- The importance of using GIS program in the analysis because its field work is huge phenomena layers modeling, requires long time, effort and disbursement of funds, made by surveyors.

3- Using a satellite image of a high resolution commensurate with the work required where the use of a satellite image with a resolution of 60 cm accuracy is suitable for such project.

4- Using of a suitable location based on the indicators of that spatial region, which is a new method in the search, giving us a constant model of fixed equations can modify on variables under the circumstances.

5- When matching the results (locations of the new resettlement compacts) with reality, it gives accuracy to work and ensures that the work on the GIS program is accurate and realistic.

6- Two of the eight compacted water unites sites were located on built-up area, while the other six are suitable for resettlement in new vacant land.
13.2. Recommendations
The main recommendations in this research can be summarized as follows:
1- Several analyses should be made to investigate alternative locations system to get modeling with GIS techniques.
2- Using GIS technique and its facilities to obtain the best location, by resettlement their locations.
3- Matching the results with reality as it is a very important step and necessary in such a search where it was used by this step to identify any proposed sites can create and which cannot.
4- Before starting such a project, the population growth in the region should be studied and taken into account to fill the shortfall in the region because water is one of the basics of life.
5- Remains the need and demand are the first and last criterion as there was no need of people for water does not require the work of any water compact.
6- The work of people or units of the water services specialists of GIS program should be working model in the strata affecting the water services to find a better signature of the sites of the complexes and update data regularly.

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