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Efficiency of Infrastructure Services in Khor Al-Zubair City (Iraq)

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Abstract

The aim of the research is to demonstrate the concept, characteristics, efficiency and adequacy of infrastructure in Khor Al-Zubair, as it represents an important benchmark for judging the development of the city. The researchers thus aim to measure the efficiency, adequacy and personal impression of each service in Khor Al-Zubair city and its residential neighborhoods. To meet this objective, the researchers used the descriptive and analytical approach that involves randomly distributing a questionnaire with specific questions to the neighbors of the city. The study has reached a set of results and recommendations that contribute to addressing the problems to the sector of infrastructure services in the city, such as: the per capita share of liquid water in Khor Al-Zubair has reached 100 liters/day, which is less than the quota specified, 450 liters/day by the Iraqi standard. This results in a deficit of 77.2% of the total amount of water that must be provided per person. In addition to the deficiency there is also a decrease in the quality of liquefied water in Khor Al-Zubair city due to its high level of salinity in it, which reached 916 TDS in 2020. Further, there is a deficit of electrical power of 10 megawatts, leading the city to be exposed to regular interruption of electrical current of about six hours per day, where the hours of interruption increase in the hot season of the year.

Keywords: Efficiency of Services, Infrastructure, Iraq, Khor Al-Zubair

كفاءة خدمات البنية التحتية في مدينة خور الزبير (العراق)

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المستخلص

يهدف البحث الى بيان مفهوم وخصائص البنى التحتية ومدى كفاءتها وكفايتها في مدينة خور الزبير. واستعمل الباحثان المنهج الوصفي والتحليلي في الدراسة الذي تضمن توزيع استمارة استبانة تضمنت اسئلة محددة وزعت عشوائيا على احياء المدينة. وتوصلت الدراسة لجملة من النتائج والتوصيات التي تسهم في معالجة المشاكل التي يعاني منها قطاع خدمات البنى التحتية في المدينة. فقد بلغت حصة الفرد من مياه الاسالة في مدينة خور الزبير ١٠٠ لتر/يوم، وهي أقل من الحصة التي حددها المعيار العراقي والبالغة ٤٥٠ لتر/يوم، الأمر الذي ينتج عنه عجزا مقداره ٧٧,٢% من إجمالي كمية المياه الواجب توافرها للفرد الواحد حسب المعيار العراقي. فضلا عن هذا العجز فهناك انخفاض جودة مياه الاسالة في مدينة خور الزبير بسبب ارتفاع نسبة الملوحة فيها حيث تعد المياه غير صالحة للشرب عندما تبلغ ملوحتها (٥٠٠ TDS)، وقد بلغت نسبة ملوحة المياه الواصلة الى مدينة خور الزبير في نهاية عام ٢٠٢٠ ٩١٦ TDS. كما تعاني المدينة من عجز في الطاقة الكهربائية مقداره ١٠ ميكاواط؛ الأمر الذي يؤدي الى تعرض المدينة الى القطع المنتظم للتيار الكهربائي الذي يصل في معدل العام الى حوالي ست ساعات يوميا، وتزداد ساعات القطع في الفصل الحار من السنة.

الكلمات المفتاحية:- البنية التحتية، خور الزبير، العراق، كفاءة الخدمات



1. Introduction

Khor Al-Zubair city is one of the new prominent cities in Basra Governorate. It was built in Al-Zubair district in order to settle the families of workers in the major industrial facilities in that region. It was planned and implemented with a great level of interest until it became a focus of attraction for many families who settled in that city. It was planned to construct its infrastructure in a way that helps receive the attention of those in charge of that during the mid-seventies of the last century. However, the long series of wars that Iraq has witnessed in the eighties, nineties of the last century until 2003, and after this date, and the increase of the population, have a great impact on the system of the infrastructure work of the city, resulting to have many shortcomings.

The problem with this city is that there is no one to one correspondence between the significant and strategic importance of this city and its current infrastructure services it offers and the needs and requirements of its population. Accordingly, the study aims to examine the performative efficiency of the infrastructure services in Khor Al-Zubair city, represented by drinking water, sewage and the fixed-line services, the electricity services, and the solid waste disposal services. It also aims to investigate the personal impression of household heads about the efficiency of these services. The study thus hypothesizes that the performance of infrastructure services in Khor Al-Zubair city does not correspond to the basic needs of its residents.

The significance of the study comes from the direct connection between the infrastructure of the city with its residents' life needs, and other urban activities and events in the city. In addition, the paucity of research as far as this city is concerned has urged the researchers to research it for the purpose of providing the authorities and institutions concerned with the diagnostic findings of the study. Diagnosing the

problems is a forward step towards facilitating finding many solutions, and developing city.

2. Theoretical Background

2.1 Previous Studies

In a study titled "*The impact of solid waste in the environment of the city of Baghdad*", Othman & Tokan (2018) examined the concepts, types and components of solid wastes according to land uses, as well as the effects of solid wastes on the spatial environment, and the factors affecting the quantity and type of solid wastes. The study revolved around Baghdad city, shedding light on its location and the population. To meet the objectives of the study, the researchers designed a population questionnaire to obtain an integrated view of its effects on its both axes (service and environment). Results showed that there were no places designated for throwing solid wastes inside residential quarters. Besides, there was a lack of a sufficient number of solid waste collection vehicles (closed type) that helps reduce pollution and avoid volatilizing the wastes while transporting them to their specific stations.

Abduljalil (2019) conducted a study entitled, "*The spatial analysis of infrastructure services (electricity, water, sewage, telecommunications) in Al-Rifai city and its impact on the population*". This research was conducted using a spatial analysis of the infrastructure services in selected locations in Al-Rifai city. The study involved examining the impact of several factors, such as the lagging development projects. The study found that there were variations in the services provided to these locations due to several variables, including the infrastructure obsolescence and the failure to implement development projects. Such variations highly affected the life of the population, their public health, and the inhabitants of the city.

Mohamed's study (2019) examined the assessment of (24) raw water, and drinking water projects of Diyala Governorate in 2017, together with the quality of water in the drinking water network area, and the per capita share of water. The study concluded that the treatment units in



these projects did not show efficiency in properly removing the pollutants.

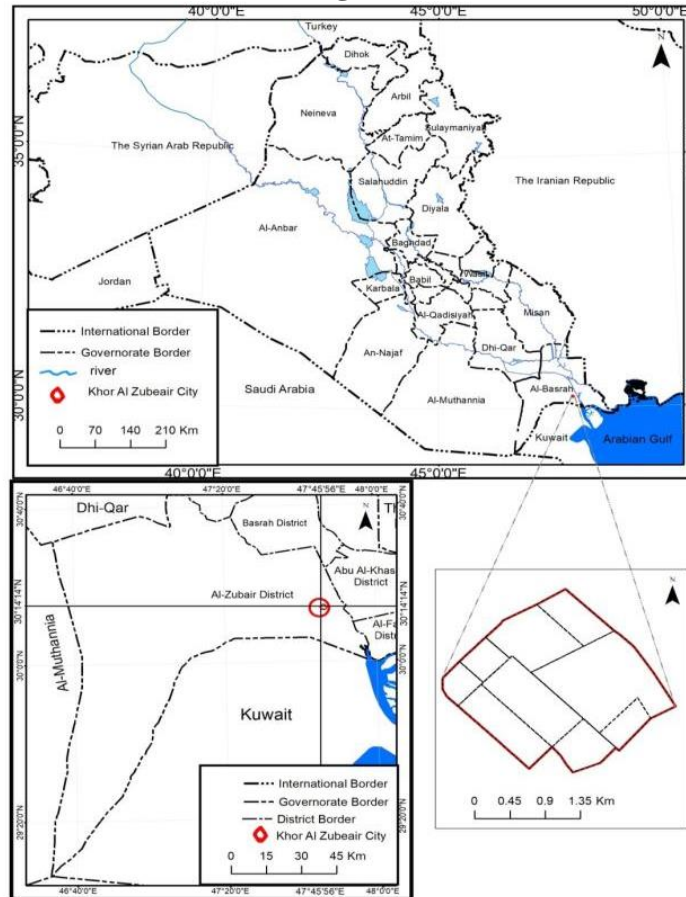
3. Analytical Part

3.1 Methodology of the Study

The study relies on the descriptive, analytical and inductive approach in studying and analyzing the characteristics of the infrastructure services in Al-Zubair city. The spatial boundaries of the research coincide with

the municipal boundaries of Khor Al-Zubair city for the year 2021. The city is located at the intersection of the longitude arc $47^{\circ}, 45',$ and $56'$ east and the latitude $30^{\circ} 14' 14''$ north (Fig.1). It occupies an area of 455.02 hectares, equivalent to 4.55 Km², and includes nine residential neighborhoods (Fig. 2) with 7.641 housing units (Fig. 3), which occupy 35.550 people (Fig. 4).

Figure 1



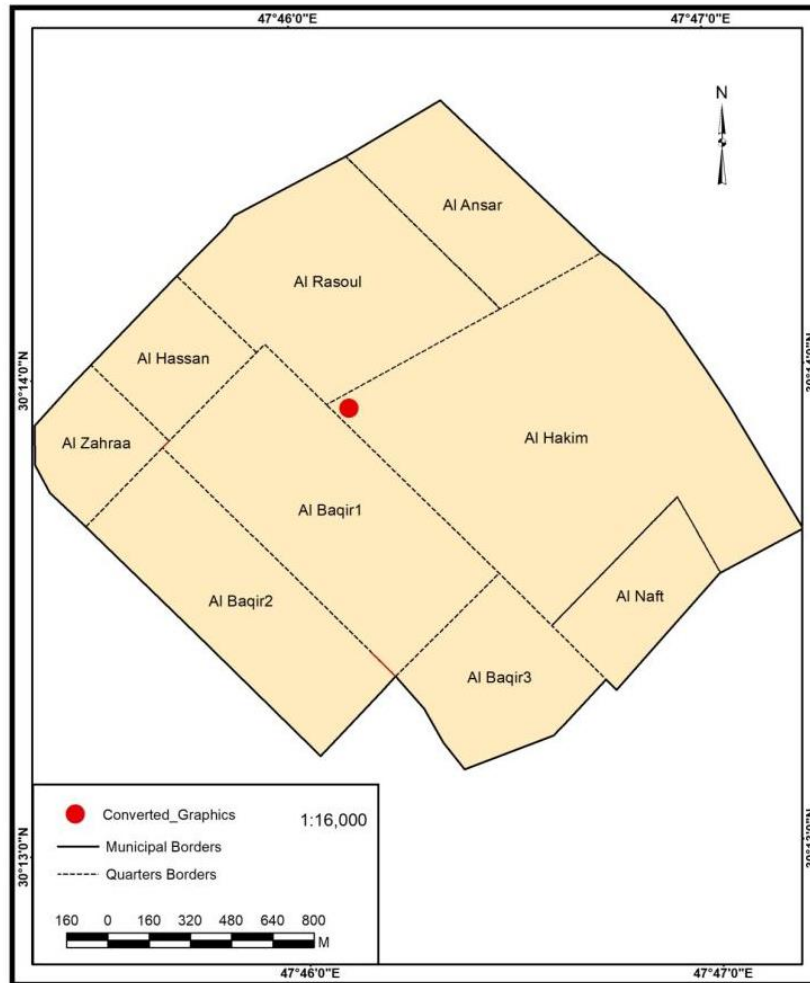
The Geographical Location of Khor Al-Zubair City in Relation to Iraq, Basra Governorate, and Al-Zubair District, 2020

Source: From the researchers' work, depending on:

1. Ministry of Water Resources. (December, 2007). *Map of Iraq and Basra Governorate 1: 500000*. The Republic of Iraq: General Directorate of Survey.
2. The Ministry of Housing, Reconstruction and Municipalities. (2020). *Geographic Information Systems Unit, Satellite Image, Accuracy Scale 0.5 m Basra Municipalities Directorate*. Basra: Planning and Follow-up Division, unpublished data.



Figure 2

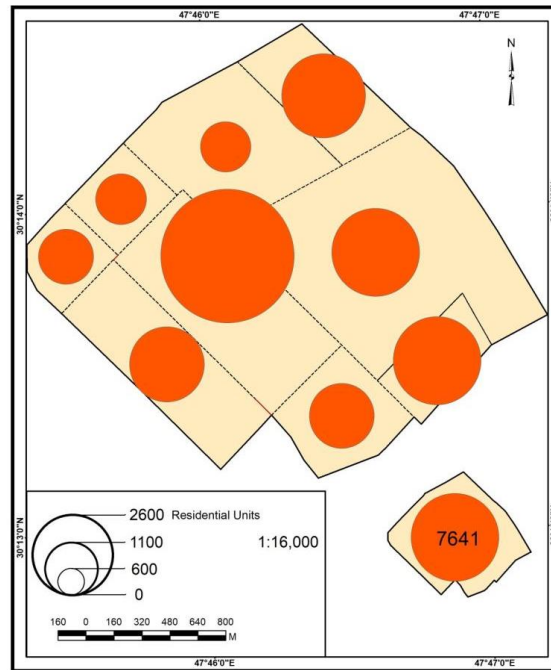


The Residential Neighborhoods of Khor Al-Zubair 2020

Source: The work of researchers, depending on: the Ministry of Housing, Construction and Municipalities, Basra Municipalities Directorate, Planning and Follow-up Division, Geographic Information Systems Unit, satellite image, precision scale 0.5 m, 2020, unpublished data.



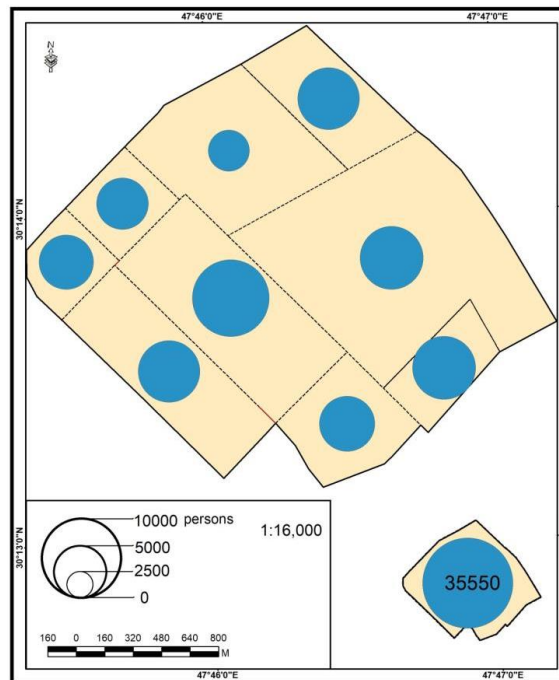
Figure 3



Population Distribution according to Residential Neighborhoods in Khor Al-Zubair City, 2020

Source: The work of the researchers, based on: Fig. 2, the records of the chosen ones in Khor Al-Zubair, September 2020.

Figure 4



Population Distribution according to Residential Districts in Khor Al-Zubair City, 2020

Source: The researchers' work based on Fig. 2 and the records of the selected in Khor Al-Zubair City, September, 2020.



The data of the study have been collected from the following sources:

- Sources and periodicals, such as books, theses, published scientific research related to the infrastructure services in journals, and the satellite image of the city.
- Government publications and published and unpublished official statistics and data related to the basic infrastructure services, whether at the level of Iraq, Basra Governorate, and Khor Al-Zubair city.
- The comprehensive field study that has been conducted by the researchers of the present work on all the neighborhoods of the city.
- The personal interview with administrative figures in the service institutions in question.
- The questionnaire form which has been formed to approximately cover (6%) of the total housing units in the city, which is totaled to 7,641 housing units. A number of 436 forms have then been randomly distributed to nine residential quarters of the city, following the municipal numbering system in the city, and the individual system was chosen to be a comprehensive sample. The forms were distributed at the beginning, middle and end of the residential neighborhood, depending on the application of the above system in the distribution.

3.2 Data Analysis

3.2.1 Drinking Water Services

Providing safe drinking water is an essential structure for the population settlement. Its quality reflects the extent of the civilization, economy, society, and health development experienced by the population. In Iraq, the water sector has continued to suffer from decline and neglect, particularly after 1991. The second Gulf War and the economic embargo have adversely affected the infrastructure of this sector and have resulted in a clear decline in the level of delivery of services to the population (Ministry of Planning, 2010). In addition, this sector lacks an integrated system for managing and regulating the mechanisms for production, maintenance, liquidation, distribution and recognition. Such a

system helps ensure the optimal performance of the systems, and serve to improve the performance efficiency of workers in keeping with contemporary developments regarding the technique of implementing water projects (Ministry of Planning, 2018).

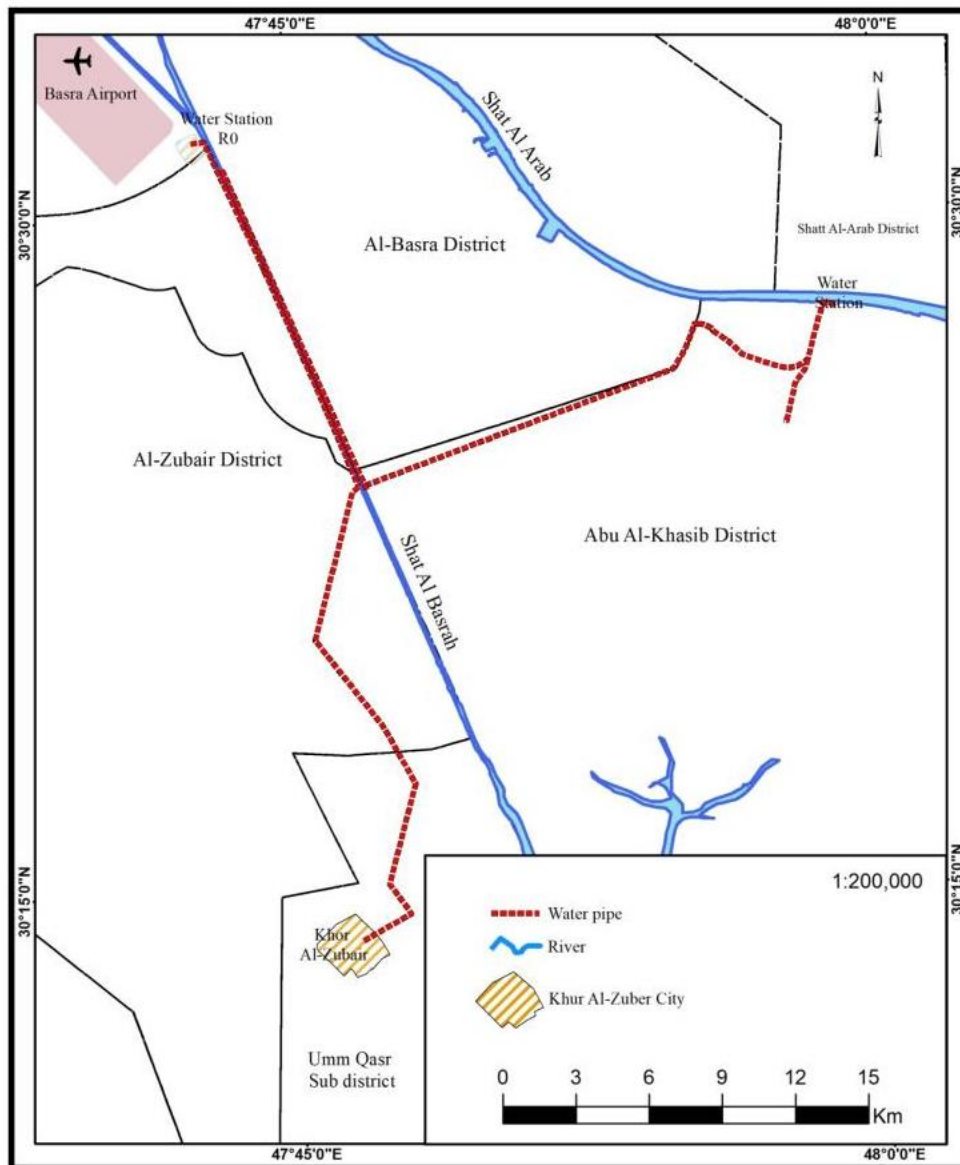
The amount of water scarcity reached 2.6 million cubic meters per day in 2008 (Ministry of Planning, 2010), and the percentage of the population served by safe drinking water is 78% in the governorates except in Baghdad. The percentage of the latter is close to 100% in 2014, and it further rises in urban areas to 86%, and decreases in the countryside to 66 %. This percentage was affected by the conditions produced by terrorist operations, especially after 2014. Moreover, these percentages did not change in 2016 (Ministry of Planning, 2018, Republic of Iraq, First Report on the Sustainable Development Goals 2019). In Basra Governorate, the amount of water produced in 2016 in all water projects reached 700 812 m³/day, and the total need of water in the governorate is 951434 m³/day. This means that Basra Governorate suffers from a water deficit of 250,622 m³/day, i.e., a proportion of 26% of the amount of water currently produced to cover the deficit (Ministry of Planning, 2018).

The length of the drinking water network is 107 km, and it was rehabilitated in 2006. The city of Khor Al-Zubair depends on two main sources for its drinking water supply: The first source is from Mahaila water project, which is located in Shatt al-Arab waterway in Abu Al-Khasib district. The second source is from Al-Abbas station that is situated in the city of Basra. It gets water through Al-Badaa water channel that supplies Al-Abbas station with water from Dhi Qar governorate through two pipes of 80 mm in diameter. The two transmission lines meet at Nazem east of Basra, which in turn, transmit the water to the station water purification in the city of Khor Al-Zubair. Then, the latter will be responsible for supplying water through the drinking water network to all its residential units. It also feeds through the pipelines the cities of



Safwan, Umm Qasr, and the residential complexes surrounding those cities as well (Fig. 5).

Figure 5



Water Sources Supplying the Drinking Water Network in Khor Al-Zubair 2020

Source: From the researchers' work, depending on:

1. Ministry of Housing, Reconstruction and Municipalities. (2020). *Satellite image, accuracy scale 0.5m*. Basra Municipalities Directorate: Planning and Follow-up Division, Geographic Information Systems Unit, unpublished data.
2. R.M. (Expert) Gouda, S. J. Basra. (09-28-2020 at 12:00 noon). *A personal interview*. Basra: Water Directorate, Head of the Districts and Sub-Districts Division.
3. Ali, A. H. (09-28-2020 at 12:00 p.m.). *A personal interview*. Basra: Basra Water Directorate, Technical Director of Khor Al-Zubair Project. (The two were interviewed together at the same time).

This station was allocated to accommodate the water needs of Khor Al-Zubair's residents only. This is because the water purification station in Umm Qasr has been out of work since

2002. Besides, the elimination of Safwan's reliance on the water purification station in Al-Shuaiba in 1995 has led those cities to depend on the water purification station. Reflecting



negatively on Khor Al-Zubair city's residents, the station capacity was not able to meet the needs of the residents of the three cities combined. That is why, it was required to adopt the principle of quotas, called locally (marashanah) in the distribution of water. This is because Khor Al-Zubair city was supplied on a specific day and on the second day. The second day was dedicated to the city of Safwan, and the third day was for the city of Umm Qasr. Therefore, Khor Al-Zubair city got its water every three days, taking into account that the pumping water was for a period of time ranged between 8-12 hours. All of these cities know the dates of their obtaining water according to an announced schedule. Moreover, Khor Al-Zubair city suffers from a scarcity of water that is subjected to the principle of sharing. It also suffered from a decline in the quality of that water, and a high degree of salinity due to the exposure to Shatt al-Arab, the main resource on which the Muhailah project depends. It is one of the continuous water pollution sources in Khor Al-Zubair city together with a continuous escalation of human discharges of heavy domestic, municipal and industrial water streams. Other pollution sources include the agricultural runoff, as well as the incursion of salty tidal waves coming from the Arabian Gulf due to the low levels of Shatt al-Arab water after Turkey has reduced the water quotas of Tigris and Euphrates rivers, and Iran has closed the mouth of Al-Karun River to the coast of Al-Arab (Al-Hassan & Hamzah, 2016). The laboratory analysis of the past three years indicates a remarkable increase in water salinity, as it reaches 4000 TDS in 2018, 2000 TDS in 2019, and 916 TDS (Total Dissolved Solid) at the end of the last year 2020. The reason for this decrease in salinity is due to the increase of water pumping from Al-Bidaa project (in which the salinity percentage is low) with a large percentage at the expense of the water pumped from the water station in Muhaylah in Abi Al-Khasib district. Despite the low salinity of that water, it is still considered salty and not suitable

for drinking; water is considered safe to drink when its salinity reaches 500 TDS (Z. Abdul Amir, personal communication, 10, 2020). In addition, the increased water rate of turbidity reaches the population of Khor Al-Zubair city; its average reaches 122 while the maximum permissible average is only 5 (Z. Abdul Amir, personal communication, 10, 2020).

Another problem that accompanies the use of Muhasasa system (Marashna) is the process of supplying Khor Al-Zubair city with water exposed to stagnation in the pipes for a period of time more than 24 hours, and it may even last for three consecutive days. This leads to the pipes to get contaminated with germs and harmful bacteria, together with the growth of some types of harmful algae such as Spirogyra. This requires those in charge of providing this service to increase the amount of chlorine by (5 mg / liter) to an unusual percentage ranging between (3-3.5 mg / liter) to avoid water get contaminated with harmful bacteria and germs (Z. Abdul Amir, personal communication, 10, 2020).

Statistics for the year 2016 indicated that the percentage of households connected to the public water network reached 89.8%. This means that 10.2% of families across Iraq are suffering from deprivation. However, this indicator records a positive progress compared to that of the year 2012, when the percentage of the deprived families reached 13.8%. In Basra Governorate, the percentage of families using water from the public network is more than 90%. This percentage is considered with respect to the per capita share of drinking water, which ranges between 110-460 liters/day in Iraq, and to the standards used in Iraq. The share that should be provided per person per day is 450 liters per day (Ministry of Planning, 2018). The average per capita share in Basra Governorate for the year 2016 was consistent with what was determined by the Iraqi standard of potable water, reaching 450 liters/day (S. J. Judeh, personal communication, 9-2020).

In Khor Al-Zubair city, the per capita share of the water reaching the housing unit reaches



300 liters per day, which is less than the Iraqi standard- 450 liters/day per person. With the application of the coexistence principle imposed on the cities of Khor Al-Zubair, Safwan and Umm Qasr, this amount becomes 100 liters/day. It is considered a very small amount, estimated at 22.2% of the total Iraqi standard. However, this amount does not reach to the city with this limited percentage due to the abuse of water pipelines by farmers and unlicensed local housing units, which exacerbate the size of the problem and increase the suffering of the population in Khor Al-Zubair city.

In this aspect, the field study sheds light on the opinions of families' heads in Khor Al-Zubair city regarding their satisfaction with the efficiency of the water service provided in terms of the quality of the water delivered, or the maintenance procedures that are carried out by the concerned institutions. All residents

expressed their dissatisfaction with the performance of this service at a rate of (100%), and agreed that the liquefied water is not used for drinking at all, and that 55.4% of them attributed the inefficacy of the service to being salty. This percentage has risen to more than the general average in Medina in the neighborhoods of Zahra and Al-Rasool, Al-Baqer 2 and Al-Baqer 3, with the percentages of (63.6%, 63.4%, 62.5%, and 57.9%), respectively; consider (Table 1) and (Fig. 6). This does not mean that the neighborhoods' water is less salty; it is so in comparison to the general average when it was previously reached their homes. Interviewing the heads of the families in those neighborhoods, they mentioned that previously, especially in 2018, it was difficult to use the liquefied water at home, and even for shower because of its high salinity. They now think that the salinity in the water is much less than it was in those years.

Table 1
The Status of the Water Delivered to Residential Units according to Khor Al-Zubair' Residential Neighborhoods in 2020

No.	Residential Neighborhood's Name	Sample's Number of Housing Units	Containing a smell	%	Containing Impurities	%	Containing Salts	%	containing nothing of the aforementioned	%
1	Al-Zahraa	22	0	0	2	9.1	14	63.6	6	27.3
2	Al Hassan	18	0	0	0	0	7	38.9	11	61.1
3	Al-Baqer 1	127	5	4	0	0	68	53.5	54	42.5
4	Al-Baqer 2	40	5	12.5	5	12.5	25	62.5	5	12.5
5	Al-Baqer 3	38	0	0	0	0	22	57.9	16	42.1
6	Al-Hakem	55	0	0	0	0	33	60	22	40
7	Oil (shakes)	35	5	14.3	0	0	16	45.7	14	40
8	Al-Ansar	50	12	24	9	18	25	50	4	8
9	Al-Raswl	41	0	0	0	0	26	63.4	15	36.6
	Total	426	27	6.3	16	3.8	236	55.4	147	34.5

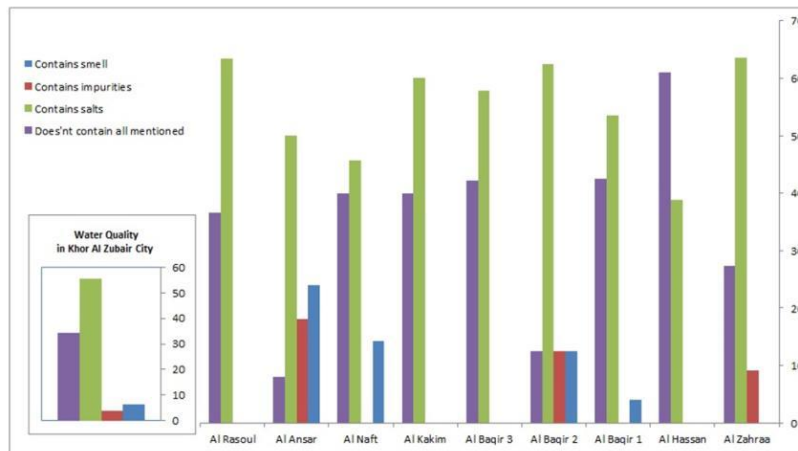
Source: Field Study.

As for the extent to which the liquefied water network is exposed to breakages, the percentage of heads of the households who suffer from this problem reached 78.4% of the total housing units in the sample; consider Table 2. This percentage increases to more than the general average problem in the neighborhoods of Al-Baqer 2, Al-Baqer 1, Ansar, Al-Rasool and Zahra at the rates (95%, 90.6%, 88%, 87.8%, and 86.4%), respectively. Besides, the percentage of

those, who do not believe that there is a breakages problem in the liquefaction network, reached (21.6%) of the total housing units in the city. Most of these housing units are from oil districts. The percentages of Al-Hassan, Al-Hakim, and Al-Baqer 3 are higher than the general average, reaching (31.4%, 27.8%, 25% and 23.7%), respectively.



Figure 6



The Status of the Water Delivered to Residential Units according to Khor Al-Zubair's Residential Neighborhoods in 2020

Table 2

The Relative Distribution of Household Heads' Opinions about the Water Network being Exposed to Fractures according to Khor Al-Zubair's Residential Neighborhoods in 2020

No.	Residential Neighborhood's Name	Sample's Housing Units Number	Network being Exposed to Fractures	%	network being not Exposed to Fractures	%	Total
1.	Al-Zahraa	22	19	86.4	1	13.6	100
2.	Al Hassan	18	13	72.2	5	27.8	100
3.	Al-Baqer 1	127	115	90.6	4	9.4	100
4.	Al-Baqer 2	40	38	95	2	5	100
5.	Al-Baqer 3	38	29	76.3	9	23.7	100
6.	Al-Hakem	55	41	75	14	25	100
7.	Oil (shakes)	35	24	68.6	11	31.4	100
8.	Al-Ansar	50	44	88	6	12	100
9.	Al-Raswl	41	36	87.8	5	12.2	100
Total		426	334	78.4	92	21.6	100

Source: Field Study

The impressions of the household heads clearly show that the maintenance procedures in this sector within the city do not take place in a single pace, (Table 3) and (Fig. 7). This is because 67.8% of the total heads of the housing units of the sample took place within a week, and not on the same day. The highest percentage of this impression was in the neighborhoods of Al-Rasool, Al-Hakim, Al-Hassan, and Al-Ansar with 87.8%, 76.4%, 72.2%, and 70%, respectively. The other neighborhoods recorded lower rates below the general average of the city. As for their opinions regarding the maintenance procedures taking place at the same day, they accounted for 17.6% of the total housing units in the city, whereas Al-Naft neighborhoods, Al-

Baqer 3, Al-Baqer 2, Al-Ansar and Al-Hakim recorded the top percentages with (31.4, 26.3%, 25%, 24%, and 21.8%), respectively. The percentage of the heads who believed that the maintenance of the services provided in this sector took a month was 2.1% of the total housing units in the sample. On the other hand, the percentage of those who found that the maintenance procedures were not carried out and neglected by those in charge of this sector was 12.5% of the total housing units in the sample. However, this percentage rose significantly, exceeding the general average. In the neighborhoods of Zahraa and Al-Hassan, the percentages obtained were (36.4% and 27.8%), respectively, followed by Al-Baqer 1, Al-Baqer 2



and Al-Baqer 3 neighborhoods with (17.5%, 17.3%, and 13.2%) of the total housing units in the sample. With regard to the responses of the heads of families about the extent of their

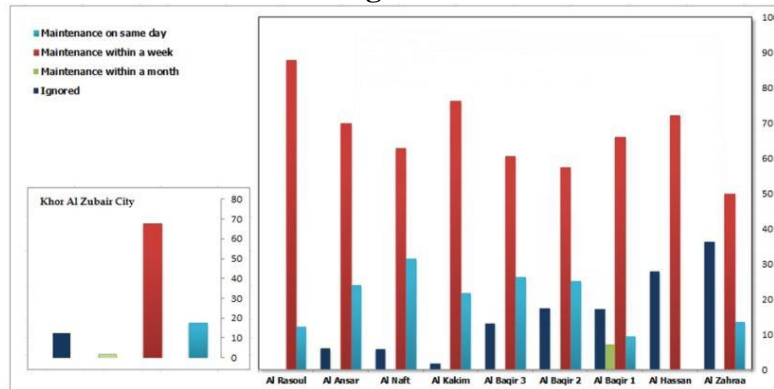
satisfaction with the drinking water service in the city, all the heads of households showed their dissatisfaction with the services of this sector at a rate of 100%.

Table 3
Maintenance Procedures for the Drinking Water Network when Exposed to Fractures, according to the Residential Neighborhoods' Opinions in Khor Al-Zubair City in 2020

No.	Neighborhood's Name	Sample's Housing Units Number	Maintenance done at the same day	%	Maintenance done within a week	%	Maintenance done within a month	%	Neglect	%
1	Al-Zahraa	22	3	13.6	11	50	0	0	8	36.4
2	Al Hassan	18	0	0	13	72.2	0	0	5	27.8
3	Al-Baqer 1	127	12	9.5	84	66.1	9	7.1	22	17.3
4	Al-Baqer 2	40	10	25	23	57.5	0	0	7	17.5
5	Al-Baqer 3	38	10	26.3	23	60.5	0	0	5	13.2
6	Al-Hakem	55	12	21.8	42	76.4	0	0	1	1.8
7	Oil (shakes)	35	11	31.4	22	62.9	0	0	2	5.7
8	Al-Ansar	50	12	24	35	70	0	0	3	6
9	Al-Raswl	41	5	12.2	36	87.8	0	0	0	0
Total		426	75	17.6	289	67.8	9	2.1	53	12.5

Source: Field Study

Figure 7



Household Heads' Opinions about the Period of Maintenance Procedures for the Liquefied Water Network when Exposed to Fractures in Khor Al-Zubair City in 2020

Source: Field Study

3.2.2 Sanitation Services

This service represents one of the vital services that deal with the most negative outputs in different urban communities, in addition to rainwater drainage, the high cost of sanitation services in urban communities, and the great variance in the levels of services.

The sanitation of waste is one of the most important processes necessary to ensure the provision of a suitable environment. To achieve such an environment, it must be done according to high technical and technological foundations.

This is because such a service leads to an increase in the level of health among the population.

The sources of liquid waste result from the multiple uses of pure water, whether domestic or industrial uses, in addition to garages, car washing stations, and other waste. There are many types of sanitation systems; among which are the separate, and the combined systems. A separate sewage system uses two networks: the first is for collecting and transporting household wastes, shops and factories. The second, on the



other hand, is for disposing the surface water and rain water. A combined or shared sewage system is used for draining rainwater directly into the sewage network, where the same pipe carries the household and shop wastes in addition to rainwater (Al-Dulaimi, 2008).

In Khor Al-Zubair city, the sewage network follows a separate system, as there is a 60 km long network in the city that concerned with receiving heavy liquid wastes from the residential buildings and other various activities. Besides, there is another network of 30km long dedicated to the drainage of rainwater and other waters that flood the streets of the city (Sewage Directorate of Khor Al-Zubair City, 2021).

The sewage network for heavy water in Khor Al-Zubair city consists of pipes of different sizes and diameter. A pipe that is 250mm wide comes out of the housing to be connected to another pipe of 500mm that connects the housing unit and the manhole room (street cesspool), whose pipe extends over. The length of the secondary street of the housing units is 800 mm to the main street pipe. It is 1000mm wide, and ends up with the water treatment station.

The heavy water network in Khor Al-Zubair city is one of the distinctive networks at the present time. It was built when the city was constructed in 1975. In the same year, a water treatment plant was established and the work was entrusted to the Korean company Hyundai. The station consists of three stations with three basins that pump water from the first station to the second station, and then to the third station. The capacity of the pump in the first station is 200

m³/hour while the pumping capacity in the second station is 250 m³/hour; in the third station it has a capacity of 500 m³/hour. The cycled water is used for irrigation and planting. This station was completed in 1986, and continued to operate until 1989. However, it stopped working due to lack of maintenance, and then it went out of work in 1991 due to war conditions (A. Khalaf, personal communication, 9-2020).

As for the rain network, the diameter of its pipes is 1000 mm, equipped with three pumps. Each pipe is 3000 m³/hour, and each pipe pumps water into basins of 20 meters long, 10 meters wide, and 12 meters deep (A. Khalaf, , personal communication, 9-2020).

Currently, the sewage network of Khor Al-Zubair is being maintained by the Rowad Al-Arab Company, a private company that the local government has made a contract with since 2013 in order to drain the sewage pipes. An estimated 80% of the sewage network has been wired, but it stopped working in 2015 due to war circumstances against terrorism. Failing to provide financial allocations and completing the wiring work, the network has been negatively affected. Consequently, exposing the covers of the sewers in the city streets to theft has led much dirt and dust entered into the network, and increased the burdens of those in charge. The effect of this problem was evident; approximately 70% of the total number of the housing units in Khor Al-Zubair city was suffering from sewage overflow (Table 4 and Fig. 8).

Table 4
Relative Distribution of Household Heads' Answers regarding the Heavy Water Network being Exposed to Sewage Overflow due to Blockages in Khor Al-Zubair City in 2020

No.	Residential Neighborhood's Name	Number of the sample of Housing Units	Yes, Sewage Rash occurs	%	Sewer Rash does not occur	%
1.	Al-Zahraa	22	17	77.3	5	22.7
2.	Al Hassan	18	7	38.9	11	61.1
3.	Al-Baqer 1	127	107	84.3	20	15.7
4.	Al-Baqer 2	40	26	65	14	35
5.	Al-Baqer 3	38	26	68.4	12	31.6
6.	Al-Hakem	55	44	80	11	20
7.	Oil (shakes)	35	16	45.7	19	54.3

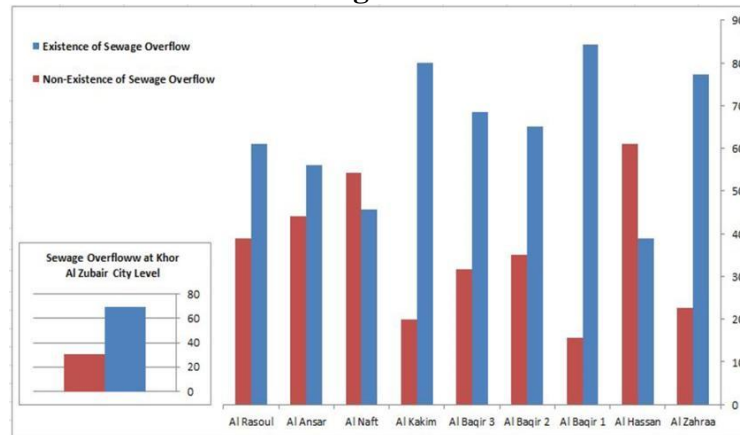


Table 4 Continued

No.	Residential Neighborhood's Name	Number of the sample of Housing Units	Yes, Sewage Rash occurs	%	Sewer Rash does not occur	%
8.	Al-Ansar	50	28	56	22	44
9.	Al-Raswl	41	25	61	16	39
Total		426	296	69.5	130	30.5

Source: field study.

Figure 8



Relative Distribution of Household Heads' Answers regarding the heavy Water Network being Exposed to Sewage Overflow due to Blockages in Khor Al-Zubair City in 2020

Source: Table (4).

This high percentage appeared in the neighborhoods of Al-Hakim, Al-Baqer 1 and Al-Zahraa at a rate of (84%, 80%, and 77%, respectively). The percentage increased to 50% in the Al-Baqir 3, Al-Baqir 2, Al-Rasool and Ansar neighborhoods as indicated in the following

percentages: 68.4%, 65%, 61%, and 56%, respectively. Most of the heads of families, (i.e., 86.2%), expressed their dissatisfaction with the performance of heavy water services; consider Table 5 and Fig. 9.

Table 5

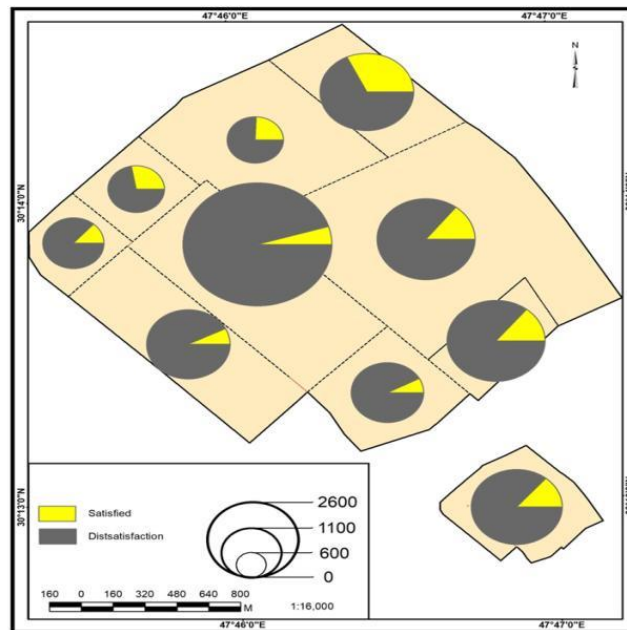
Heads of Households' Opinion about the Efficiency of Heavy Water Network Service Performance in Khor Al-Zubair City in 2020

No.	Residential Neighborhood's Name	Number of the Sample of Housing Units	Satisfied	%	Somewhat Satisfied	%	Not satisfied	%
1.	Al-Zahraa	22	3	13.6	0	0	19	86.4
2.	Al Hassan	18	5	27.8	0	0	13	72.2
3.	Al-Baqer 1	127	6	4.7	0	0	121	95.3
4.	Al-Baqer 2	40	3	7.5	0	0	37	95.5
5.	Al-Baqer 3	38	3	7.9	0	0	35	92.1
6.	Al-Hakem	55	8	14.5	0	0	47	85.5
7.	Oil (shakes)	35	5	14.3	0	0	30	85.7
8.	Al-Ansar	50	16	32	0	0	34	68
9.	Al-Raswl	41	10	24.4	0	0	31	75.6
Total		426	59	13.8	0	0	367	86.2

Source: Field Study.



Figure 9



Household Heads' Opinions about the Efficiency of Heavy Water Service Performance according in Khor Al-Zubair City in 2020

Source: Fig.2 and (Table 5).

Moreover, their opinions did not differ much with respect to the efficiency of the rainwater network service. A percentage of 91.3% of the total number of the housing units in Khor Al-

Zubair city were also dissatisfied with this service; consider Table 6 and Fig. 10.

Table 6

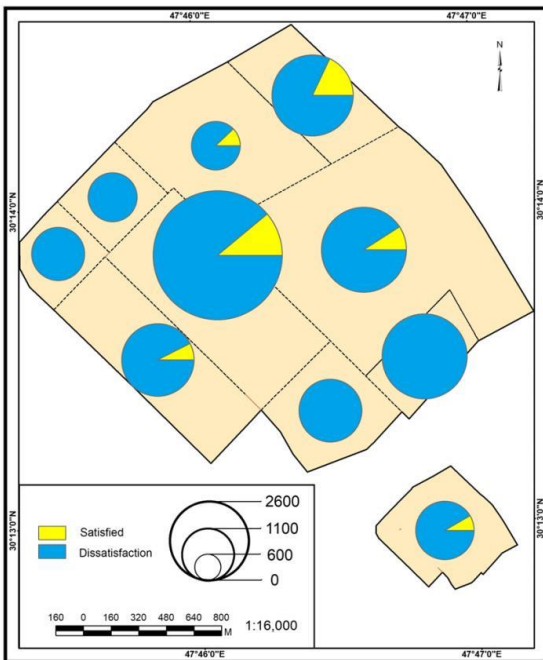
Household Heads' Opinions about the Efficiency of the Rainwater Network Service Performance in Khor Al-Zubair City in 2020

No.	Residential Neighborhood's Name	Number of the Sample of Housing Units	Good	%	Not good	%
1.	Al-Zahraa	22	0	0	22	100
2.	Al Hassan	18	0	0	18	100
3.	Al-Baqer 1	127	15	11.8	112	88.2
4.	Al-Baqer 2	40	3	7.5	37	92.5
5.	Al-Baqer 3	38	0	0	38	100
6.	Al-Hakem	55	5	9.1	50	90.9
7.	Oil (shakes)	35	0	0	35	100
8.	Al-Ansar	50	9	18	41	82
9.	Al-Raswl	41	5	12.2	36	87.8
Total		426	37	8.7	389	91.3

Source: Field Study.



Figure 10



Household Heads' Opinions about the Efficiency of the Rainwater Network Service Performance in Khor Al-Zubair City in 2020

Source: Fig. 2 & Table 6.

3.2.3 Solid Waste Services

The World Health Organization indicates that the term solid waste refers to garbage, dirt, or remnants that their owners are not in need of them at some point of time, so they become of no value (Al-Dughairy, n.d.). Solid waste is described as one of the problems that contributes to polluting the elements of the environment, soil, water and air, and distorts the general appearance of the environment due to the accumulation of waste overlooking the appropriate methods in the process of collecting, transporting, storing and treating these wastes.

The interest in collecting waste and dealing with it is not something new. The Greeks were the first to consider that since the fifth century BC. They established sites for dumping wastes, and they also issued laws to regulate their collection and transportation outside the built-up areas by a distance of not less than a mile. They further punished anyone who throws wastes in the streets, or violates the laws. The Romans also established a special administration for public

health and waste collection and disposal during the reign of Caesar Augustus in the fourteenth century BC. (Al-Dughairy, n.d.).

Municipal solid waste MSW is one of the most important waste streams, and one of the most studied wastes. Solid waste collection, treatment and disposal are important services of politicians and local government. Municipal solid waste (hence MSW) is described as the waste which includes household wastes, non-hazardous solid materials from industrial, commercial, institutional and the non-pathogenic hospital wastes collected by city authorities. Municipal solid wastes reflect the lifestyles and habits of the people producing them. They can also have a negative impact on the well-being of the public and the environment if they are not managed properly (Amasuomo & Baird, 2016).

The disposal of municipal solid wastes in Iraq is carried out by the municipal institutions as well as the private companies that help transport them to open landfills where they are often incinerated. The percentage of the urban population served by the waste collection service reached 88.7% in 2019, and the average amount of wastes that is disposed by a person per day 1.4 kg in 2019 (Central Bureau of Statistics, 2019).

Khor Al-Zubair city was peculiar in the mechanism of collecting solid wastes in the early beginnings. Wastes were removed at that time through mechanisms provided to the city by institutions, such as: the Oil Products Distribution Company, and the General Fertilizer Company and others. Khor Al-Zubair city currently relies on the collection of the municipal solid wastes at the municipal section of the city. The station was established in 2006 and is administratively subordinated to the Directorate of the Municipality of Al-Zubair City. The city of Khor Al-Zubair disposes an amount of 82,825kg per day, as follows (Al-Zubair Municipality Directorate, 2021): -

1. Industrial Solid Waste: It is a waste produced as a result of processing raw materials to produce new products (Amasuomo & Baird, 2016). In the city of Khor Al-Zubair, most of



the industrial solid wastes are remnants of small industrial workshops, such as blacksmithing, plumbing, sewing, and some small food industries and others. The number of those industrial establishments is 50, disposing an amount of 350kg of solid wastes, including quantities of aluminum, copper, iron and other metallic materials.

2. Commercial solid wastes: Such wastes are generated by the markets and shops in the city of Khor Al-Zubair. They include cardboard boxes, plastic boxes, glass bottles and other wastes. The number of those markets and commercial establishments is 800 commercial establishments, producing 2,400kg per day of solid wastes in Khor Al-Zubair.
3. Medical solid wastes are usually produced in Khor Al-Zubair city from the wastes of clinics, medical complexes and pharmacies. There are 15 medical institutions, disposing an amount of 75kg per day.
4. Residential solid wastes are the residues discarded by the individuals of housing units. They vary in terms of their quality as well as their quantity from one country to another, and from one neighborhood to another within the same city as well as from one person to another according to the difference in purchasing power, lifestyle and environmental awareness. Food wastes range between one and three kilograms per person per day. They consist of combustible materials, such as cardboards, woods, textiles, rubber, garden and street wastes, and non-combustible ones such as tin cans, metal, glass and other residential wastes (Khatib & Arafat, 2010;

Darjal, 2014). The solid wastes discarded by the residential units in Khor Al-Zubair city are estimated by 80,000kg per day (Al-Zubair Municipality Directorate, 2021) with a rate of 1.93kg/person per day. The service of collecting wastes is provided to all residential neighborhoods, including even the residential units that are not licensed by the municipality overriding the public property.

Khor Al-Zubair city suffers from a significant shortage in the number of waste containers of various sizes. According to the data of the municipal department in the city, the number of available containers of 1100 liters is 60. All of which are in a medium condition while the city needs 250 containers to meet the shortage. The housing units there suffer from the unavailability of household containers with a capacity of 100 liters (Fig. 11). Four compressor vehicles are available in the city to collect wastes of various sizes. This number is insufficient, forcing Al-Zubair Municipality Directorate responsible for the municipal department in the city of Khor Al-Zubair to rent four compressor vehicles with a capacity of 20 tons to collect the wastes (Al-Zubair Municipality Directorate, 2021). In spite of this; however, there are many residential neighborhoods and main streets in the city that suffer from the accumulation of solid wastes. This in turn has negative effects on the residents' health in addition to the visual and environmental pollution of the city. Most of the containers that are of 1100 liters are in a poor condition, worn out, and in many cases, they are not available in many city streets and neighborhoods (Fig. 12).

Figure 11



100 liters Household Waste Container



1100 liters waste container

Categories of Solid Waste Containers in Khor Al-Zubair in 2021

Source: Al-Zubair Municipality Directorate, Technical Division. (Jan., 2021).



Extrapolating the household heads' personal impression Khor Al-Zubair city regarding their satisfaction with the services of removing solid wastes, it has appeared that most of the heads of households (i.e., 77.5%) were dissatisfied with this service. This percentage is higher than that of the cities in the neighborhoods, such as: Al-Hakim, Al-Hassan, Ansar, and Al-Baqer 1, whose rates were 85.5%, 83.3%, 82%, and 81.1%, respectively. However, the percentage of

those who expressed their satisfaction with the performance of this service was only 22.5% of the total heads of households in Khor Al-Zubair (Table 7 & Fig. 13). It seems that most of them are those who live in some of the main streets of a commercial nature. Such streets have some important government institutions distributed here and there, and so they receive more attention than other areas.

Figure 12



Accumulation of Residential Solid Wastes, Worn Out or Missing Containers, in the Streets and Neighborhoods of Khor Al-Zubair in 2020

Source: Photos taken by the researchers 11:00 AM 12-26-2020.

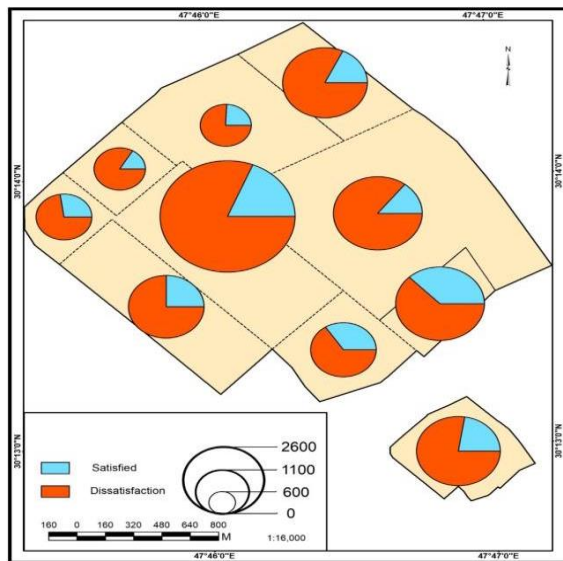


Table 7
Household Heads' Opinions regarding their Satisfaction with the Solid Waste Removal Service in Khor Al-Zubair City in 2020

No.	Neighborhood	No. of Sample's Residential Units	Satisfied	%	Unsatisfied	%
1.	Zahraa	22	6	27.3	16	72.7
2.	Al Hassan	18	3	16.7	15	83.3
3.	Al-Baqer 1	127	24	18.9	103	81.1
4.	Al-Baqer 2	40	10	25	30	75
5.	Al-Baqer 3	38	13	34.2	25	65.8
6.	Al-Hakim	55	8	14.5	47	85.5
7.	Oil (flats)	35	13	37.1	22	62.9
8.	The supporters	50	9	18	41	82
9.	Prophet	41	10	24.4	31	75.6
Total		426	96	22.5	330	77.5

Source: Field Study.

Figure 13



Household Heads' Viewpoints about their Satisfaction with the Solid Waste Removal Service in Khor Al-Zubair City in 2020

Source: Table 7

3.2.4 Fixed Phone Service

The fixed telephone network represents one of the oldest telecommunication networks. It has been known for 125 years, and it has been the focus on statistics communications for many years. The extent of the penetration of the fixed telephone service vis-à-vis the global national

product was drawn in 1963. The International Telecommunication Union referred to a number of fixed telephone network indicators in 1963 and 1972. It also indicated in 1985 that fixed telephone service must be available in all parts of the world in the beginning of the twenty-first century (International Telecommunication Union, 2012).

The landline telephone service was built in Khor Al-Zubair city during the construction period of the city in 1975. All the housing units built during that period contained fixed phone service, but due to the war conditions, that service declined and became out of work, especially after the second Gulf War in 2003 until now. The field study have shown that all housing units in Khor Al-Zubair city lack this fixed-line service due to the failure of exchange in the post office and communications of the city. Such a problem includes all the cities of Basra Governorate, not only Khor Al-Zubair city due to the lack of restoration maintenance of this service after being damaged in the last war in 2003.

The absence of the fixed phone service made the mobile phone service a basic necessity that has no substitute for communicating with others. However, despite the great importance of this service, as it is a prepaid service now, the field study has shown that people are not



satisfied with it in Khor Al-Zubair city. Results have further revealed that all housing units in the city suffer from the deterioration of that service, especially the internet communication service. The percentage of their dissatisfaction is 100%. The heads of the families expressed their resentment at the weakness of the internet service in mobile phones, especially after making education online. Such a step requires the provision of good and efficient internet service.

3.2.5 Electricity Service

The city of Khor Al-Zubair is supplied by three secondary substations (Ministry of Electricity, 2020):

1. Al-Bakr station, which is located near the administrative borders of Khor Al-Zubair;
2. The industrial port terminal, located at Khor Al-Zubair port; and
3. Al Khor Station.

The production of these stations reaches 20 megawatts in their best conditions when the weather is moderate. However, the city's real need of electrical energy is 30 megawatts. This means that Khor Al-Zubair suffers from a deficit in electrical energy of about 10 megawatts. That is why, it is exposed to regular interruption of electrical current, reaching a general rate of about six hours per day. Besides, the hours of interruption increase in the hot season of the year, and when the transmission transformers are disabled due to a large burden on them. All these issues affect the efficiency of their quality. The field study has further revealed that there are somehow a good number of transformers in a semi-average condition (Fig. 14). Besides, all the heads of households have confirmed that the network suffers from electrical transformers' malfunctions, which increase in summer season.

This deficit in electric power is negatively reflected on the citizens of Khor Al-Zubair economically and environmentally. Accordingly, the residents resorted to buying electricity from the owners of large electrical generators that are distributed in some squares and streets of the city's neighborhoods. This has further led to overburden the individual's income, and cause

different types of environmental pollution, acoustical, visual, and air pollution. All these weak points altogether have a profound effect on the personal impression of the heads of the families regarding the efficiency of the performance of this service. Thus, all of them unanimously were dissatisfied with this service.

Figure 14



Poor Performance Transformers and a Part of the Maintenance Work in the City in 2021

Source: Photos taken by researchers, 10:00 AM 12-26-2020

4. Conclusions

1. Khor Al-Zubair city does not get daily liquefied water. It receives a specific amount of water every three days. It is called the sharing system in the Water Directorate in Basra Governorate.
2. The per capita share of liquid water in Khor Al-Zubair is 100 liters/day, which is less than the quota specified, 450 liters/day, by the Iraqi standard. This results in a deficit of 77.2% of the total amount of water that must be provided per person.
3. The water network pipelines in the city are exposed to pollution due to the use of the sharing system, and the growth of some harmful algae, such as Spirogyra.
4. The decrease of the quality of liquid water in Khor Al-Zubair city due to the high level of salinity has led to consider it unsuitable for drinking because its salinity reached 500



- TDS. However, the level of salinity reached 4000 TDS in 2018, 2000 TDS in 2019, and 916 TDS at the end of 2020.
5. The rate of turbidity in the liquid water network in Khor Al-Zubair is very high, reaching 122 while the maximum permissible limit is only 5.
 6. All residents in the city of Khor Al-Zubair have expressed their dissatisfaction with the water service provided, and have agreed that the liquid water cannot definitely not used for drinking.
 7. The percentage of heads of households who have been exposed to drinking water network breakage amounted to 78.4% of the total housing units in the sample.
 8. The study showed that 67.8% of the total heads of households in the housing units of the sample have the impression that the maintenance procedures in the drinking water services sector do not take place at the same day; they rather take place within a week.
 9. The sewage network in Khor Al-Zubair follows the separate system, as there is a network in the city concerned in receiving heavy liquid wastes from the residential buildings. Besides, there are various activities with a length of 60km, and a network that is dedicated to rainwater drainage, and other waters that flood the city's streets, with a length of 30km.
 10. The diameter of the heavy water drainage pipes varies in size, ranging between 250mm, 500mm, 800mm, and 1000mm. They are connected underground from the lowest to the top of the residential unit, and to the street. Then, they are connected to the secondary street and the main street until they end in the water treatment plant.
 11. The company in charge of maintaining and wiring the sewage network in Khor Al-Zubair was reluctant due to lack of financial allocations.
 12. The sewage treatment plant in the city of Khor Al-Zubair has stopped working and been out of work for more than 32 years.
 13. The study revealed that approximately 70% of the total number of the housing units in Khor Al-Zubair city suffers from a sewage overflow problem.
 14. The study has more shown that most of the heads of families in Khor Al-Zubair city are dissatisfied with the performance of the heavy water services. Their percentage reached (86.2%) of the total housing units in Khor Al-Zubair city. The percentage of dissatisfaction with the performance of the rainwater network reached 91.3% of the total number of the housing units in the city.
 15. The city of Khor Al-Zubair suffers also from a great shortage in the number of waste containers of various sizes. The number of the available containers of 1100 liters is 60, which are of a medium condition. However, the city needs 250 containers to meet the shortage that the city suffers from, and all housing units suffer from the lack of 100 liters household containers.
 16. The city of Khor Al-Zubair suffers from a significant shortage in the number of vehicles specialized in compacting solid wastes and transporting them to sanitary landfill places near Safwan. There are many residential neighborhoods and main streets in the city that suffer from the accumulation of solid wastes and their visual pollutions that have negative effects on the health and environment.
 17. The study have stated that most of the household heads, (i.e., 77.5%) expressed their dissatisfaction with the performance of solid waste removal services.
 18. All fixed telephone lines in the city of Khor Al-Zubair are not operating and out of service due to the war conditions since 2003.
 19. The absence of the fixed phone service has made the mobile phone service a basic necessity that has no alternative. Despite the great importance of this service, as it is a



prepaid service now, the field study, has revealed that this service did not gain the desired satisfaction. This is because all housing units in the city suffer from the deterioration of that service, especially the internet communication service, which accounts for 100% of the total housing units in the city.

20. Khor Al-Zubair suffers from a deficit of electrical power of 10 megawatts, which leads the city to experience regular interruption of electrical current. Generally, the multiple-hour power outages reach six hours per day, however, they are susceptible to increase in the hot season of the year.

5. Recommendations

The study ends up with a set of recommendations, as shown below:-

- 1- Rehabilitating and periodically maintaining the water treatment plant in Khor Al-Zubair.
- 2- Increasing the population's share in the city of Khor Al-Zubair by increasing the quantities of water pumped into the city according to the population's needs, in a manner that ensures the continuity of its arrival without any interruption.
- 3- Improving the quality of water reaching the residential neighborhoods by adopting modern methods of filtering, treatment, and a quality in distributing it to the neighborhoods of the study area.
- 4- Regularly maintaining the pipelines carrying water, and repairing those exposed to breakage on a daily basis, in order to reduce wasted water.
- 5- Repairing the fixed telephone network, and reactivating the telephone lines for all residential units in Khor Al-Zubair city.
- 6- Working to improve the mobile network service by increasing the number of communication towers in Khor Al-Zubair area in order to provide a high-quality service.
- 7- Increasing the amount of electric power provided to Khor Al-Zubair city to fulfill the deficit that the city suffers from, and to ensure no interruptions occur to this service.

- 8- Increasing the number of compressor vehicles concerned with removing solid wastes, and distributing them in a balanced manner.
- 9- Sorting wastes before transporting them to the designated areas in an attempt to benefit from the waste recycling process to ensure their use in the city's industrial projects.

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Appendix
The Ministry of Higher Education & Scientific Research
The University of Basra/College of Arts
The Department of Geography & Geographical Information Systems
Questionnaire Form

Dear Citizen,
Best Greetings,
The information contained in this questionnaire has been put for scientific research purposes, and is prepared to bridge the theoretical information gap required by the research project titled (*The Efficiency of Infrastructure Services in Khor Zubair City-Iraq*). Therefore, You are kindly requested to give an objective and accurate answer that serves the development of the city.

Your cooperation is highly appreciated!

Note: Tick (✓) the appropriate location.

The Researchers

What is the name of the residential neighborhood at which you are living?

Information about the infrastructure of Khor Zubair city

i) Tap Water Service:

1. Do you use tap water for drinking purposes?
Yes _____ No _____
2. Do you use tap water for household purposes?
Yes _____ No _____
3. Do you use a pump (water motor) to withdraw water and send it to the house tank?
Yes _____ No _____
4. The status of the water arriving home is full of:
Odors _____ Impurities _____ Salts _____
5. Does the network suffer breakdowns?
Yes _____ No _____
6. If yes, has such a breakdown in pipes been repaired within:
The same day _____ Within a week _____
A month _____ N/A _____
7. What is your level of satisfaction regarding the tap water service being delivered to you?
Satisfied _____ Somehow satisfied _____
Unsatisfied _____

ii) Sewage Services

1. Do you believe that the storm water network in your city is good?
Yes _____ No _____
2. How long does it usually take to get rid of accumulated storm water in your residential neighborhood?



Immediately (in the same time) _____

A day _____ A week _____

The network is nonoperational and neglected _____

3. Is the neighborhood at which you are living served by a sewage (drainage) network?

Yes _____ No _____

4. If no, how is sewage being disposed?

5. Does sewers overflow due to clogs in the heavy water network of your residential neighborhood?

Yes _____ No _____

6. What is your level of satisfaction of sewage services in your residential neighborhood?

Satisfied _____ Somehow satisfied _____

Unsatisfied _____

iii) Power Service

1. Are electric power services regularly supplied without interruption or prone to daily outages?

Yes _____ No _____

2. If no, what is the average daily number of hours of power outages?

Less than 5 hours _____ 5-9 hours _____

10-14 hours _____ More than 15 hours _____

3. What is the daily average number of hours of power outages in the winter?

Less than 5 hours _____ 5-9 hours _____

10-14 hours _____ More than 15 hours _____

4. Does a fault occur in the power transformers in charge of your power home supply?

Yes _____ No _____

5. If yes, how long does it take to repair the fault?

Immediately at the same time _____

Day _____ Week _____ Month _____ N/A _____

6. What is the level of your satisfaction of power services in your residential neighborhood?

Satisfied _____ Somehow satisfied _____

Unsatisfied _____

iv) Landline Phone Services

1. Is your home equipped with a landline phone service?

Yes _____ No _____

2. In case the landline phone service at your home sustains a fault, how long does it take to repair that fault?

One day _____ A week _____

A month _____ The fault is neglected _____

3. What is your level of satisfaction of landline phone service performance in your home?

Satisfied _____ Somehow satisfied _____

Unsatisfied _____

4. Do you have a mobile phone?

Yes _____ No _____

5. If yes, what is your level of satisfaction regarding the performance of the mobile phone service?

Satisfied _____ Somehow satisfied _____

Unsatisfied _____

v) Solid Waste Disposal Services

1. Does the residential unit have a small container for the disposal of solid waste?

Yes _____ No _____

2. How many times are the home wastes being taken out (please write your answer in the adjacent box)? _____

3. Are solid wastes being taken by the municipality regularly every day?

Yes _____ No _____

4. Are the main streets surrounding your residential neighborhood being cleaned?

Yes _____ No _____

5. If yes, is this being done regularly (daily or weekly) by the municipality?

Yes _____ No _____

6. What is your level of satisfaction of the performance of municipal services regarding the disposal of solid household wastes?

Satisfied _____ Somehow satisfied _____

Unsatisfied _____