



Pollution of Water's direct effect in Iraq on the Public Health & Safety

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Abstract

The devastating effects of pollution of Water are significant, affecting human life, animal life and vegetation at the same time. Recently, Iraq has experienced the effects of pollution of Water, destroying an abundance of plants and many animals. Pollution of Water is one of the mostly deadly and severe problems facing humankind currently. This study analysed the effects of heavy metals Pb, like Cr, Zn and Fe in water for drinking. The findings revealed an upsurge in the number of cholesterol, urea, and white blood cells among people in Basra, Baghdad, and other urban areas. It was also found that these individuals were more likely to have fever, diarrhea, kidneys, and respiratory problems. Recent studies have revealed that pollution of Water in Iraq is caused by a variety of factors, i.e., solid pollutants, chemicals, and microorganisms. Unfortunately, due to the current state of war, there is not much concentration on water treatment plants (WTPs) resulting in a decrease in the quality of the supplied water. Due to the lack of wastewater treatment facilities in most Iraqi cities, sewage is simply discharged into the river. In addition, supply of water and sanitation systems in some major cities have been damaged and the two networks are jointly linked.

Keywords: *clean water; Pollution of water; Supply of water; sewer system.*

1. Introduction

Irrigation and agriculture played an essential role in the development of ancient Iraq and remain a major part of life in the country today. The rivers of Tigris and Euphrates were the vital element of Iraqi civilization, i.e., the civilization of Akkad, the civilization of Sumerian, and others, providing the water essential for the growth of cities and peoples. The Iraqi climate is typically dry in central and southern Iraq, of minor precipitation in the North [1]. This arid climate makes irrigation projects even more important for Iraq's population and countries. The hydrological cycle ensures that water derived from other natural resources is constantly replenished; the total amount on the planet remains relatively constant [2]. Over the last two decades, Iraq has experienced a significant decline in its environment as natural, from pollution of air to contaminated land and H₂O. This is mainly due to the many sources

of pollution, as well as the lack of strategies to develop and maintain a clean supply of water for its citizens. Consequently, renewable water resources have been largely ignored and suffered greatly [3]. Recent studies have found that Iraq is facing a decline in water beneficiaries because of multiple sources of pollution of Water, i.e., solid pollutants, chemicals, and microbes. So that created some severe environmental issues [4]. Motivated the issue of urgent pollution of Water that researcher sought to introduce the concept of water and its components, as well as to identify the types and sources of pollution of Water in Iraq. Moreover, they sought to understand the different types of pollutants, their quantities, and dimensions. Finally, the purpose of this research was to propose and implement policies that could be effective in addressing pollution of water in Iraq.

2. Statement of problem

In Iraq, reduced rainfall and drought have reduced the amount of H₂O discharged to poor rivers, wells, dry springs, and irrigation canals. In addition, numerous waterways are transformed into water as shallow reservoirs and are impacted by the organic matter and contaminated solids return from agricultural lands. In addition, many waterways are converted into water as shallow reservoirs and are impacted by the return of organic matter and contaminated solids from farmland. Moreover, Ministry of Water Resources has been greatly affected by the water scarcity Euphrates and Tigris Rivers and their tributaries, along with the drought that Iraq is experiencing. The chief cause of pollution of Water in Iraq is the discharge of contaminated wastewater into the river, including water from industries, sewage, and effluent from institutions i.e., slaughterhouses, hospitals, laundry garages, and lubrication. In addition, pollution from saltwater returning from agricultural areas contributed to the problem. This has had a devastating effect on the environment, destroying plant life and endangering animals. In addition, human activities i.e., industrial and health wastes often exceed the allowable threshold, further polluting the river

3. Study purpose

The sector of Iraqi water has not expected sufficient attention, which has led to pollution of Water and severe sector threats. The workers in such field sought information about questions as follow:

1. Identify key pollution sources in Iraq.
2. Knowing the level of the problem of pollution of water in Iraq.
3. Discovering the effective solutions to lower the polluted water volume in Iraq.

4. Review of literature

Iraqi water resources in are splitted into 2 main types: groundwater and surface H₂O. Most used H₂O in Iraq is water of surface that

covers the Tigris and Euphrates rivers and their branches and tributaries [4]. The amount of H₂O in these two rivers changes with the seasons due to the different levels of snow and rain that fall on each region. Unfortunately, there are a few issues and difficulties related to water resources in Iraq, including the control of shared waters by neighboring countries, as there are no agreements or rules to determine the amount of water that each country should receive [5]. Improper use of water, as well as failure to treat H₂O discharged into H₂O sources, has results in a significant decline in H₂O quality over the years. This, coupled with increased population growth and urbanization, has led to a severe water scarcity crisis in Iraq. To address this, effective water sector management and the revival of Iraq's marshes to stable levels are needed [6].

As Iraq faces water shortages, groundwater is distributed in diverse regions – covering the south and north, the region of Jazira, and the regions of southern and northern Badia. This reliance is expected to increase in the coming years [7]. In recent years, Iraq has had a reduction in the water for drinking quality, which has led to the spread of some waterborne epidemics. In addition, the salinity of Shatt al-Arab water has become so high that it is no longer suitable for drinking by animals or for agricultural use in Basra Governorate [8]. It is needed to revise existing environmental legislation, particularly those relating to environmental factors, to incorporate as many qualitative variables as possible. As of now, there is no adequate system for the conservation of water resources, and there are no limits or laws governing discharged wastewater into swamps, drains, depressions, and open land [9].

Water resources of Iraq consist of the following:

A. Surface water: The Euphrates and Tigris rivers besides their tributaries, along with Shatt al-Arab, are of paramount importance to Iraq's supply of water. The volume of water

of surface changes from season to season, with a higher concentration in flood season of spring and a smaller amount in autumn and summer [10]. The Tigris River has its origins in the eastern and northeastern highlands outside Iraq, and is fed by tributaries i.e., the Khabur, the Little Zab, the Great Zab, the Diyala and Great. These tributaries, along with rain and snow, contribute to the variation in the water amount in the river from year to another. In addition, some of its waters come from Iran and Turkey. In southern Iraq, the Euphrates and Tigris rivers contribute to an interesting natural phenomenon: swamps and wetlands [4]. The size of these wetlands varies depending on the season, being the most extensive in early summer and spring, and the least in late autumn and summer. This phenomenon can be found in the Maysan, Basra, and Dhi Qar governorates [11]. Many projects in Iraq have been developed to create lakes as artificial, control, and water storage, as no lakes as natural are there in the country. Flood water or surplus water can be stored in reservoirs or underground depressions to protect cities and farmland from flooding, as well as supply water to Iraqi rivers during periods of drought. Unfortunately, these large surface lakes are prone to evaporation, which leads to an increase in salt concentration. In the last century, the Habbaniyah lakes, the Tharthar and Razaza reservoirs were created, as well as the Dukan, Mosul, Darbandikhan, Hamrin dams and Haditha, [12].

B. Groundwater: Groundwater investment in Iraq is estimated at about 4 billion m³ per year, which represents about 7.5% of the country's total water resources. Hydrological studies and investigations indicate that renewable and investable groundwater storage is available in most parts of the country, except for the alluvial plain. This is expected to increase in importance as river water scarcity worsens in the western and southern regions of Iraq [8].

4.1 Pollution of water

Pollution of Water is the alteration of water components or condition due to human

activity, making it unsuitable for natural utilizes i.e., agriculture or drinking. Industrial, agricultural and development activities are major contributors to pollution of Water. Key terms for pollution of Water include: [13].

A. The acidic activity Ph is a fundamental measure of how basic or acidic water is, and it is limited to the range (1-4). The acceptable value must be (7); furthermore, anything higher than this number is deemed basic and anything lower is acid. It threatens the environment as aquatic more severely compared to basal environment [14].

B. Biooxygen requirements are a measure of how much the model needs O₂ quantities dissolved in H₂O for meeting the microorganisms needs for the organic matter growth, and is therefore indirect evidence of the content of organic matter in the water model that able to be bio-degradable under the bacteria influence o [15].

C. Chemical O₂ (CoD) requirements are a measure of the amount of O₂ dissolved in H₂O required by the model to oxidize oxidizable chemicals.

D. a type of roots that, when released into rivers, encourage the growth of aquatic plants. Examples of these roots include and NO₃ and PO₄ that are salt that containing P or N in their chemical makeup. Additionally to producing additional specific issues [16].

E. The term "SO₄" refers to a salts set, where some might be occurring naturally due to the makeup of the soil [17].

F- Majority of the chloride salts that generate salinity in water are called chlorides (Cl), and their concentration rises with evaporation.

G. The group of dissolved solids, that are is total salinity expression, resulting from the several salts types' presence that are of natural origin definitely.

H. The term "TSS" refers to a solids group which includes silt, other suspended particles in H₂O, and heavy metals like zinc, iron, copper, and lead. Most of these particles are of natural origin, but few greases and oils which are left over from various unintentional

accidents or industries from activities which utilize oils and metals in their processes of manufacturing may cause an increase in TSS.

4.2 Sources of pollution of Water

Multiple pollution sources are the main cause of pollution of Water. This leads to deteriorating water quality and pollution of water resources. The most prominent sources of pollution of water are:

A. Pollution from industrial utilizes:

Contaminants contained in the water incoming originate from activities of industries, both inorganic and organic. These pollutants can be produced from the production of potash, plant fertilizers, and organo-phosphates, as well as substances released by beverage and food factories, textile and tanning companies and industries of petroleum.

B. Agricultural industries pollution

Nitrate and phosphate salts are known for their high solubility in water, which allows them to flow into water of surface and groundwater, leading to both fertilizing and pollution.

C. Domestic utilize pollution

H₂O used for domestic purposes can be either organic or inorganic and may contain toxic substances i.e., hydrocarbons. On the other hand, organic matter may contain minerals i.e., lead that can be broken down by microorganisms. Oils as natural organic, i.e., uric acid and phosphate-containing proteins, are commonly found in household water.

d. Water fresh pollution

Pollution happens in multiple water types, which also includes fresh H₂O. Fresh H₂O is the H₂O that an individual deals with directly and utilizes in his drink, food, and hygiene. Freshwater might be contaminated from various sources because of lack of sanitary conditions lack and attention [18]. The factors

which caused such a condition might be called:

1. A tank is used for other utilizes, and such tanks are often not periodically clean.

2. Lack of a health system aid to the removal of sewage waste and insufficient sanitation services. Due to the garbage that is dumped into wastewater before being transported to rivers and lakes, it contains various sorts of germs and bacteria. (Sarant, 2013).

3. Liquid factory waste from manufacturing sectors such generation of energy, steel and Fe factories, glass and cement products, chemical and plastic products, paints, and textile manufacture is one of the most common sources that pollutes rivers. [19].

E. Pollution of marine waters

Shipping often leads to pollution of marine waters, with oil and its derivatives being the most common form. This type of pollution can spread rapidly, sometimes up to 700 kilometers from the source. It usually occurs due to oil tanker accidents and breakdowns, oil exploration attempts, and disposal of petroleum residues and waste by the passage of tankers. In addition to oil tankers, seawater is contaminated with other sources i.e., agricultural waste, pesticide residues and factory waste disposed of in rivers [20].

5. Pollution of water in Iraq

Pollution of water in Iraq has been a major problem since the last century, and it is increasingly difficult to detect solutions to combat it and reduce its influences. This is particularly worrying because many village and Iraqi cities are found on the banks of lakes and rivers, essential resources for the population [21]. Prior to discussion the pollution of water sources in Iraq, it is significant to notice that the rivers of Iraq quality is figured out through factors i.e., sewage and the sewage that is dumped into them, leading to pollution [22].

5.1. Polluting agents in Iraq

Iraq's pollution of Water is caused by a variety of sources, which are direct causes, i.e., the following, may be the primary contributors to the emergence of other causes of pollution of Water:

A- The water quality and kind entering Iraq from rivers of Iraq varies in concentrations of salt terms that are often adequate nonetheless have started to grow, especially in the Euphrates River water where Turkey has constructed dam projects being massive on the Euphrates and Tigris rivers.[23].

B- The waste quantity and quality, covering human agricultural and industrial waste, besides discarded rivers and associated treatments [24].

Climate factors affecting, i.e., high or low rainfall, and the degree to what such is related to the quality of river water improvement.

D- Considering the ongoing degradation to which Iraqi rivers have been subject, developing environmental legislation to protect their ecosystem makes sense. [25].

5.2 Pollution in Iraq Sources

These are the historical sources that caused pollution of Water in Iraq, which led to a major environmental issue:

A. Pollution in agriculture:

Irrigation discharge of up to 20% salts, or more than 2 billion m³/year is the primary factor leading to increased salinity of the Tigris and Euphrates rivers (Salah et al., 2012). To reduce the salinity of the two rivers, dams and drainage channels were built to divert contaminated water to Khor Abdullah, which lies downstream [26].

The use of chemical pesticides and fertilizers can have a devastating effect on aquatic life if levels exceed 5-4 mg / l. This is particularly true in Iraq, where 90 slaughterhouses lack treatment systems and dispose of their

untreated waste directly into rivers. This issue needs to be studied further to better understand the extent of pollution caused by slaughterhouses in rivers [18].

B. Pollution of industries

Industry is a major source of H₂O and pollution of air, with disastrous results for all living things, including humans. Companies take water from rivers and lakes to carry out their own manufacturing processes, often contaminated with organic and inorganic substances, as well as toxic lead, mercury, and cadmium, which are discharged back into these water sources. This can lead to the extinction of fisheries and other food chains and increase diseases i.e., E. coli, cholera, and salmonella [12].The industries most responsible for this pollution are listed below.

1. Chemical Industries

Eight out of 9 companies did not have processing units, which caused significant disruption to the ecosystem. It is estimated that the chemical industry produces about 17,797.7 m³ of contaminated H₂O/ h, and other industrial facilities are estimated to yield around 15,455.75 m³ of contaminated H₂O that has elements i.e., base materials, hydrochloric, sulfuric, dissolved dyes, and heavy metals. As a result, this polluted water is released into rivers, making the water unfit for consumption by humans and animals, destroying the natural balance of the ecosystem. [13].

2. Engineering Industries

Approximately 8543.25 m³ of suspended matter and acids are discharged into rivers because of engineering industry, with 5 out of 9 facilities lacking processing units [11].

3. Food industry

Services that dispose of 645 m² of wastewater per hour, which holds sugar-contaminated, suspended carbon, organic matter, and machine-making wastewater containing

leather-containing materials, cheese, and milk residues, are very limited in their processing capabilities. With just 2 treatment units for a sum of 9 food establishments, the river where this waste is dumped acts as a breeding ground for disease germs, making it unfit for consumption of human [29].

4. Industries of textile

The installations dispose of 6156.5 m³ of contaminated water per hour, which has various substances i.e., urea dyes, soap, sulfates, chlorine gas to shorten textiles and base materials. Among the facilities, it is in five treatment units [30].

5. Industries of construction

There are 21 industrial enterprises discharge H₂O from their operations to the River of Tigris, in which half lacks treatment units. These facilities discharge an estimated 5,689 m³ per hour of contaminated water into the river; have about 130 m³/h of oil, powders of cleaning, and other suspended materials or chemicals (Hasab et al., 2020). Approximately 18 plants or facilities dump contaminated H₂O and waste into the wastewater, with a sum of 63.4 m³/h disposed of without treatment. Notably, the industrial wastewater of the Euphrates River is 184.81 m³ h, with more than 13 plants, most of which lack treatment units [28].

7. Various pollution sources

Approximately 25% of Iraq's population is served by 11 primary wastewater treatment plants and 27 secondary plants. Unfortunately, these stations are outdated, and their efficiency is low. As a result, 74 hospitals and 235 other treatment systems lack proper treatment, increasing health risks from contaminated water in the Euphrates and Tigris rivers, main Iraqi water sources. This pollution is caused by high levels of phosphate and microorganisms in residential wastewater. [13]. In addition, Iraq has various cities do not have a sewage system, and those that have been built, i.e., in Baghdad, are

obsolete and polluted. Solid waste is not treated appropriately, which leads to pollution of surface and groundwater, as well as untreated rivers. This is linked to wastewater, often to urban water systems, which could create a severe health crisis, particularly in terms of the spread of infectious diseases [20].

8. Water for drinking environmental impact as service project sites

According to the International Bank for Reconstruction and Development, projects must be placed in category B for avoiding any impacts of the environment on the geographically. The potential environmental negative and location as social impacts of creating every project are defined as reversible and site-specific, so suitable mitigation measures can be easily implemented [23]. The negative potential environmental impacts of the project, i.e., air quality, noise, construction waste, occupational safety and health, disturbances in pedestrian and vehicle traffic, interruptions in supply of water, and the risk of pollution of water in the present system must be considered. According to the World Bank's Environmental Assessment (OP/BP 4.01), this project is categorized as Category B that requires the Environmental and Social Impact Assessment preparation (ESIA) and the formulation of ESMP. [22].

9. Analysis of the extent of pollution of Water in Iraq

There are 1,921 million hectares of water bodies in Iraq, including two major rivers – the Euphrates and Tigris – and their tributaries, i.e., the Little Zab, the Great Zab, and the Diyala River, along with numerous branches and lakes. Unfortunately, the flow of Tigris River water into Iraqi territory has decreased through Turkey's construction of 104 dams and reservoirs, with a sum 138 billion m³ storage capacity of water, and Iran's installation of water utilities reduces flow [27]. Nearly 80% of Iraq's Euphrates River water was lost due to Turkish water

installations, resulting in a rapid decline in the river's flow. Wasit province has 2 other rivers: the Kanjan Jam River that irrigates Zarbatiya, and the Jankilat River. Governorate of Maysan includes 5 rivers: Al-Tayeb, Dwerj, Karkh, Shatt Al-Omar, and Karoun that together have a length of two hundred kilometers and are an important tributary of the Shatt al-Arab. It is estimated that the water available in Iraq in 1990 amounted to 5,531 billion cubic meters, with a projected decline to 2,162 billion cubic meters by 2025. Generally, Iraq has been seeing a decline in quality of water, with the salinity rate in river water increasing 1.5 times from 2002 to 2016 according to Iraqi standards, and sulfur pollution reached 20% in 2017, reaching 1250 PPM. This number is likely to increase again to 1,250 PPM by 2025. Due to Iraq's absence of a concrete policy with its neighbors, especially Turkey, Syria and Iran, and its failure to formulate balanced arrangements to protect Iraq's water resources, per capita water revenues in the Euphrates and Tigris rivers and their tributaries have deteriorated (Dwabel and Saad, 1985).

In the biennium from 2016 to 2017, the amount of water imported from the Euphrates and Tigris rivers was measured at about 56.42%, with 3821 million m³ of groundwater and 4248 million m³ of retractable groundwater from the main aquifers [28].

6. Water production and consumption

According to statistics from the Central Iraqi Bureau of Statistics, net water production in 2018 was assessed at 2327 million cubic meters, increasing to 5817 million cubic meters in 2019 and then declining to 5734 million cubic meters in 2017. However, the amount net water consumed declined from 5031 million m³ in 2017 to 4689 million m³ in 2018, causing per capita consumption to decline from 207.3 m³ in 2017 to 187.6 m³ in 2018. This decline can be seen in Table 1 and Figure 1.

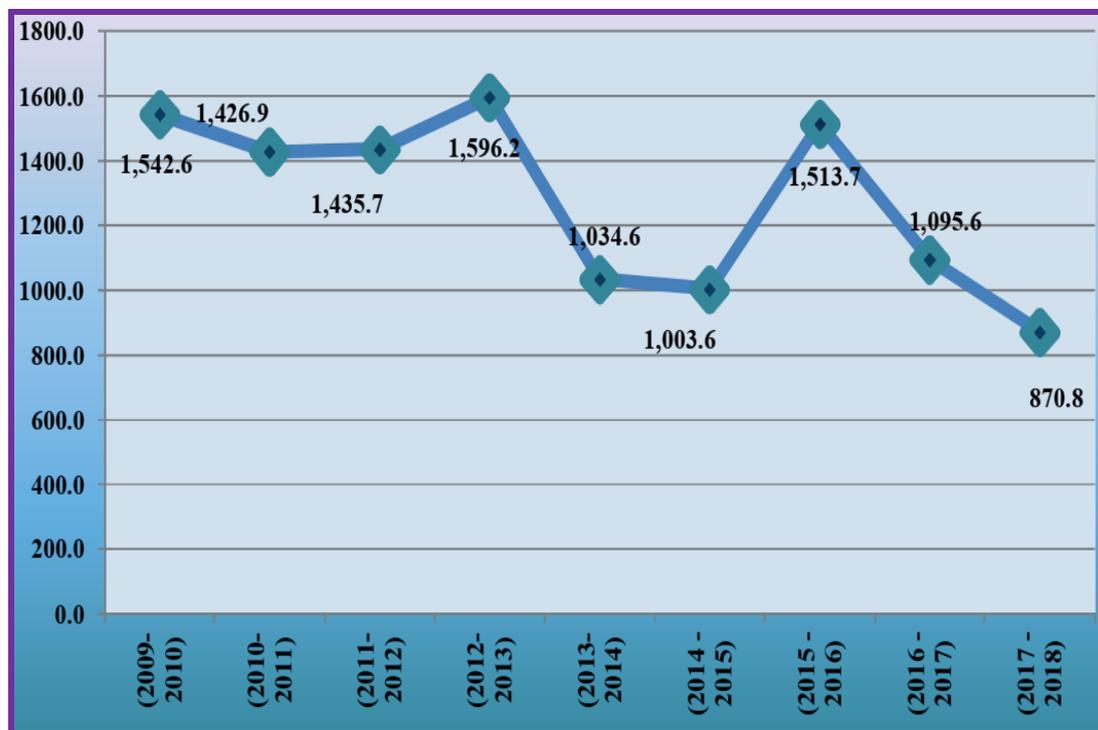


Fig 1. Per capita revenues of the Tigris River, its tributaries and the Euphrates for the water years (2017-2018) (2010-2009) (Ewaid et al., 2018).

Table 1. Total Water Imports and Per Capita 2009-2018 (Ministry of Planning and Development Cooperation 2018, p. 5).

Water Year	Total of water imports (billion cubic m ³ per year)	Population	Per capita imports (month/year m ³)
2009-2010	50.12	32.489.972	1.542.63
2010-2011	47.57	33.338.757	1.426.87
2011-2012	49.11	34.207.248	1.435.66
2012-2013	56.02	35.095.772	1.596.20
2013-2014	37.25	36.004.552	1.034.59
2014-2015	35.34	35.212.600	1.003.62
2015-2016	54.75	36.169.123	1.513.72
2016-2017	40.6	37.139.519	1.095.60
2017-2018	33.20	38.124.182	870.84

The Table 1. above writes down that the decrease in the shares of water from countries neighboring to Iraq that are the rivers sources, has caused a decrease in the water shares of the entire population of Iraq. Table 2 and Figure 2 below provide data from Iraq in 2018 regarding the whole population, the people served number by water for drinking distribution networks, the population % who had access to water for drinking, and the percentage of the population with access to environmentally friendly supply of water.

Table 2. The table signifies the percentage of the working population in urban and rural areas in 2018 (Ministry of Planning and Development Cooperation for 2018, p. 27).

Type of environment	Total of population	Number of people served	Percentage of those who served
urban	22.294.988	20.444.396	91.7
countryside	10.519.602	6.659.232	63.3
Total	32.814.590	27.103.628	82.6

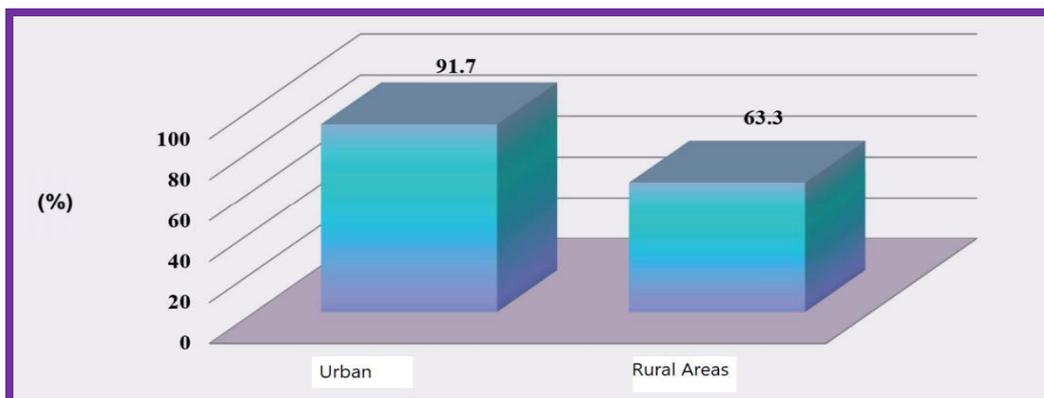


Fig 2. The population proportion served in urban and rural areas in 2018 (Ministry of Planning and Development Cooperation, Water Statistics in Iraq, report sent to ESCWA at the 2019 meetings).

82.6% of the population in Iraq is served through water for drinking distribution networks. The highest % is in the municipality of Baghdad at 100%, and the

second highest percentage in Najaf province at 93.4%. The population proportion in urban areas is 91.7 per cent, while the percentage in rural areas is 63.3 per cent.

7. The facing problems of water sector in Iraq

The water sector in Iraq faces a few difficult issues, the utmost significant that are the old water networks and their inability to produce enough water, as evidenced by statistics from the Ministry of Planning, which indicate that the amount of produced water is not enough to meet the citizen's demands. Moreover, the

shortage of electricity production is another major factor affecting the continuous production of water. The water sector in Iraq faces many problems, i.e., lack of consumer understanding, insufficient rationalization of consumption, and a population growth rate that exceeds the development of water projects. Table 3 illustrates these issues and how they are distributed among the various Iraqi governorates.

Table 3. This table displays the major issues that water sector in each governorate experienced in 2018. (Source: Water Directorates in the governorates, Ministry of Construction, Housing, Municipalities, and Public Works.)

Type of problems	Number of governorates facing this problem	Percentage impact of the problem	Governorate Names
Project of inefficiency	6	37.5	Anbar, Basra, Babil, Dhi Qar, Salahuddin, Maysan,
Water scarcity in the water source	12	75.00	Diyala, Kirkuk, Baghdad Suburbs, Babil, Wasit, Maysan, Basra, Karbala, Salahuddin, Qadisiyah Muthanna, Dhi Qar,
Source of pollution of water	11	67.9	Kirkuk, outskirts of Baghdad, Babil, Karbala, Diyala, Maysan, Dhi Qar, Salah al-Din, Wasit, Muthanna, Basra
Project production does not meet the need for water	9	56.3	Nineveh, Kirkuk, Diyala, Anbar, Karbala, Wasit, Salahuddin, Qadisiya, Muthanna
Poor maintenance procedures	5	31.3	Suburbs of Baghdad, Maysan, Babil, Basra, Qadisiyah,
Lack of technical and administrative personnel	9	56.3	Nineveh, Anbar, Karbala, Salah al-Din, Kirkuk, outskirts of Baghdad, Maysan, Basra, Najaf,
Scarcity of spare parts and raw materials	11	67.8	Diyala, Nineveh, Baghdad Municipality, Babil, Wasit, Qadisiyah, Salah al-Din, Muthanna, Maysan, Dhi Qar, Basra

In addition, there are many things that cannot be accurately assessed or whose estimates are impractical, for example calculating the level of pollution of the water source, corrosion of water delivery channels in the governorates, and insufficient H₂O production to meet governorates requirements. Unsafe and hazardous circumstances make any growth of water production tools impossible. Moreover, there are matters related to cultural people awareness, including the lack of awareness of most people of the necessity of a culture of rationing consumption. Population abuses are seen as one of the main obstacles to the regular flow and distribution of water.

8. Pollution of water activities

The Table 4 below shows that 1689 activities caused pollution of water, of which only 234 (13.8%) were treated and 1455 (86.14%) remained untreated. Such pollution sources are usually discharged into the sewer network. The cause of pollution with the highest percentage of establishments was 763 projects, while sewage networks reached only 40 activities distributed over the governorates and had a very low percentage of pollution of Water.

Table 4. Number of polluted activities by type and number of treated and untreated activities discharged to the sewage network for 2018 Source: Publications of the Ministry of Planning and Development Cooperation for 2016.

Hospital			Industrial Facility			Car Wash & Maintenance		
No	Treated Water Activities	Untreated Water Activities	No	Treated Water Activities	Untreated Water Activities	No	Treated Water Activities	Untreated Water Activities
210	35	185	950	23	927	529	116	413
Maslakh			The Agricultural activities			Other's activities		
27	6	21	0	0	0	630	22	608

The Table 4 above helps to show the scale of environmental destruction in Iraq, as the figures indicate a bleak view of the environment. Most of industrial and agricultural activities lack meaningful treatment. Rate, which paints a picture of the huge amount of pollution in Iraq's water sources, and its potential to cause carcinogenic diseases, diseases, and other long-term consequence.

9. Conclusions

Water contamination in Iraq is a very complicated issue that both civilians and officials must deal with. The main source of this pollution is the Tigris River. Many aquatic animals have become extinct because of increased salinity, pollutants, and pesticides. Other significant sources of pollution include industrial pollution and careless oil use, both of which have been connected to a rise in cancer cases. Furthermore, one of the main causes of environmental catastrophes in the nation is the absence of waste management and environmentally friendly methods in industrial facilities. Iraq is now among the most polluted nations in the world because of the increase in solid and urban garbage.

10. Recommendations

To reduce the risk of pollution of Water in Iraq, the study suggests the following measures. Iraq needs to adopt a new water policy that includes building rainwater collection systems, using water of surface, and hiring specialist foreign firms to build a state-of-the-art sewage system. As one of the

most crucial actions that can stop Iraq's environmental circumstances from getting worse. Work together with international organizations like the UN to create practical strategies for introducing clean water into bodies of water. In order to demonstrate the primary causes of pollution and the decline in the availability of clean water in Iraq, scientific study must apply the scientific method and contemporary techniques. The government should employ respected firms to carry out a thorough analysis of environmental issues based on their locations and identify the types of pollutants they produce. The launch of a brand-new national initiative to create a cutting-edge system for water resource preservation. Replace corroded water-connection networks with new, sewage-and-clean-water-separated networks. Focusing on intensive courses to raise the technical proficiency of employees in the water and sanitation industries and utilizing specialized engineering talents.

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