Mohammed Ali I. Al-Hashimi

Civil Engineering Department
Dijlah University College,
Baghdad, Iraq.
mohashimi2003@yahoo.com

Falah Alnedawy

MSC in Civil Engineering
Ministry of Water Resources
falahjasir@gmail.com

Received on: 29/10/2018
Accepted on: 19/06/2019
Published online: 25/06/2019

Assessment of the Desalination Effect on Shat Al-Arab

Abstract- The resource of the dulcet water decreasing on our plant. Obstacles and problems that face water resources are the pollution and increasing of industrial wastes because of the human activities, lack of water resources in a place is considered dryness on well as unacceptable quality and quantity. The effect of outstretch and tide in estuaries of rivers increase the concentration of the salt in surface water. The city of Basra suffers from the lack of water discharge and high concentration of salt , wastewater, and the salt wedge ascending from downstream of Shat al – Arab river. The water decrease in quantities due to the decrease of water discharge in Shat al –Arab river from 1300 m^3/s to 1000 m^3/s . Now the water discharge reaches less than 40 m^3/s by the end of 2015. Shat al – Arab river suffers from the shortage of incoming water from rivers, which cause increase of salinity. Proposals are made for resolving some of the questions.

Key words: Desalination, Shat al–Arab. Marshes, Saline concentration, Dams, Salt wedge.

How to cite this article: M.A.I. Al-Hashimi and F. Alnedawy, "Assessment of the Desalination Effect on Shat Al-Arab," *Engineering and Technology Journal*, Vol. 3, Part C, No. 3, pp. 385-389, 2019.

1. Introduction

The most important problems and obstacle on the river or water comes are industrial waste and pollution for urban activities, is urban pollution, as well as decreasing water resources and deterioration of their quality [1].

In areas that are considered to be dry areas, the land is characterized by the estuaries of the rivers, which are often known as delta in quantity and quality, They are likely to be affected by the increase of saline concentration in water resources due because to their direct contact with main sources of salinization mainly sea water or Gulf , as in the Arabian Gulf which is due to the impact of these areas of natural conditions represented by waves of water dryness and evaporation n increase in summer time besides to incorrect and unstudied human industries and consequently the effect tides which cause the increase of salinity in surface water [2].

Iraq is considered as one of the arid and semi-arid regions. Iraq was considered a rich country with its water resources and the existence of the Tigris and Euphrates river until the seventies of the last century this country is blessed with four great rivers all of which flow into Shatt al-Arab.

The Tigris River flows from the Taurus Mountains to the south of the Anatolian Plateau in Turkey, heading eastward into Turkish territory, breaking the high-rainfall Anatolia plateau, heading for Syria about 50 km long. The river flows in small rivers that originate from Turkey, Iran and Iraq, which supplies the river with two thirds of its water. And the third comes from sources, and discharge in Shatt al-Arab in amount of 25.7 billion cubic water annually and Euphrates River which flows near the western border of Armenia and discharge in Shatt al –Arab (17.6 billion cubic meters) yearly. Caron River, which flow down near Isfahan city in the middle of Iran and discharge in Shatt al-Arab by 5.8 billion cubic meters yearly in addition to the coming water from marshes (Hawizeh, Hammar, and the Central mashes) as, illustrated in Figure 1.

Figure 1: The main features of the SAR with the location of the monitoring stations

DOI: https://doi.org/10.30684/etj.37.3C.13
2412-0758/University of Technology-Iraq, Baghdad, Iraq

These days the quantities of water (mentioned above) were decreased to a maximum a percent of (3%), The discharge of Tigris river alone (75 cubic meter/second) which equal 2.3 billion cubic meters yearly ,while these discharge approximately completely stopped from karkheh and Caron rivers to Shat al-Arab. In addition to the insignificant of Euphrates incoming water to Shat al-Arab because of the Turkish and Syrian dams that storing water and the climate change which causes the poorly of water quality [1,3, 4].

Basra Governorate (3377446.00 m N, 770379.00 m E) is considered the lung of Iraq along the Arabian Gulf .It is the International border of Iraq with Saudi Arabia, Kuwait and Iran, with total population of more than four million according to 2011 census. Basra area it has (19070 Km^2). It has a vital location that contributed to the development of the city in historical times because of its wealth of agricultural, economic and industrial wealth (Figure 2).

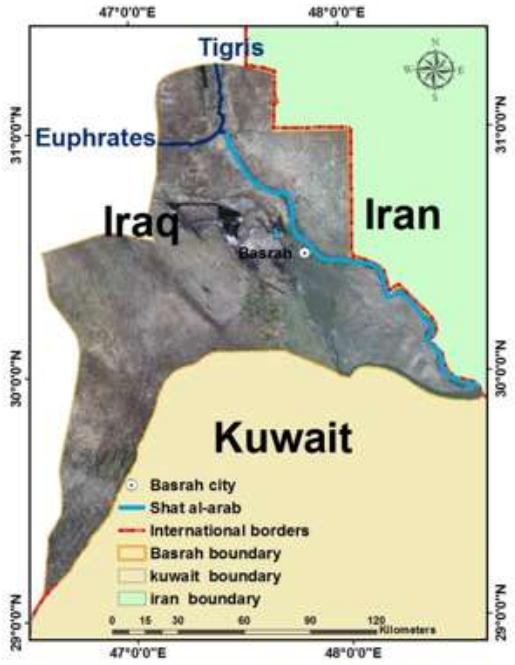

Figure 2: Shat al-Arab river area (by ARC GIS digitizing environment)

Basra city is Suffering from the lack of water discharge and high concentration of salts and high concentration of waste water and the burst of salt tongue, which is a great aid to the population of Basra because of the deterioration of the quality of water reaching and decrease in quantities, due to the decrease of water discharge in Shatt al-Arab river from 1300 m^3/s in seventies of last century to 1000 m^3/s at nineties of same century [4]. Now the water discharge are reaching less than 40 m^3/s by the end of 2015, the total solved salts/salinity) from (750-800) mg/L in the seventies of last century to 3764 mg/l in 2008, [1].

The amounts of the dissolved salts in Tigris river near the Iraq Turkish boundaries are considered as acceptable in the range of 280 mg/l, but they increased widely as going to the south .For river, the amount of dissolved solids near the boundaries of Iraq and Syria are 600 mg/L and increase while going to south to reach 1300 mg/ l near Samawa [5]. When studying the drinking water quality, it is found that it not matching World Health Organization (WHO) limits of drinking water.

It comes worse when the salt wedge ascending from downstream of shat al-arab going to the direction of upstream because of decrease of water discharge which mentioned before that it decreased to less than of 40 m^3/s and sometimes reaches to less than 10 m^3/s until Seba area is away 70 km at north of Faw city. Domestic water uses average was 17000 m^3/year in 1950 .while it decreased gradually for the reasons above to be 7000 m^3/year in 2000. It is expected to continue decreasing of water average to be 5000 m^3/year, (Figure 3).

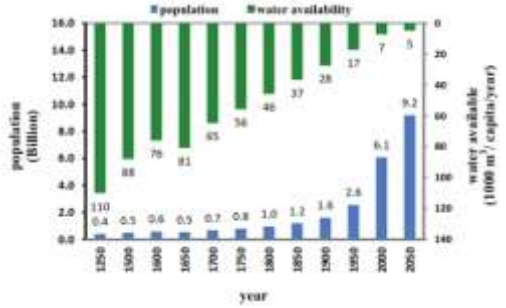

Figure 3: The population number in the world and the volume of water available during different periods [7]

Decreasing of obtaining new clean water is because of increasing of population on earth planet, which encourage the uses to build dams and erection of channels and increase agricultural uses [6]. And we are not forgetting that Changes in land use, seasonal variations in our weather and longer-term changes to climate can all affect surface water, groundwater, the flows between them, and the amounts of salt that they contain [5,7]

Salt wedge is because high salt percent in coming water from Arabian Gulf to north of Shat al-Arab river due to the decrease of coming water. These bad situations affected Basra Population, animals and agriculture. Shat al-Arab in south of Qurna city (75 km) north of Basra city , where (520.000 people) lives is formed from joining of Tigris and

Euphrates rivers which are considered the two main sources and it is considered that Shat al-Arab is the discharge area of Caron and Karkheh rivers [8].

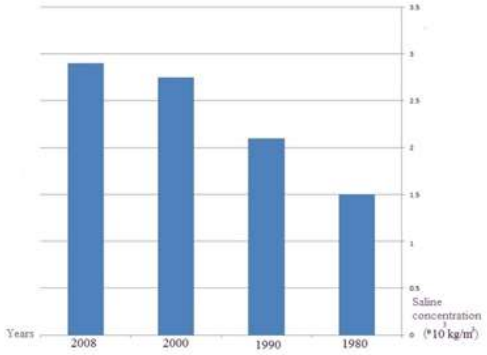

Figure 4: The Saline concentration in Shat al Arab water of years (1980, 1990, 2000, 2008) [9]

Shat al Arab area faced in summer (2018) serious environmental problems and big challenges due to lack of water resources because of high salinity in the water. Local people were exposed to hundreds of poisonous situations, animals death and agricultural products spoil as palms and tomatoes. Ten samples are taken randomly from ten different places from Shat al Arab water, (Figure 5).

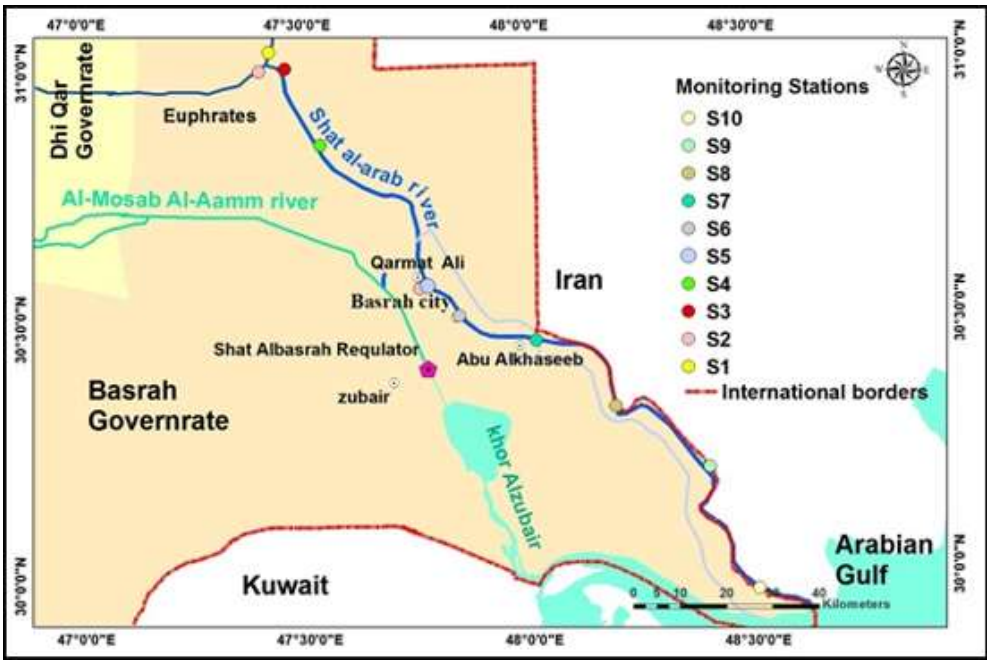

Figure 5: The monitoring station locations along the Shat al-Arab (by ARC GIS digitizing environment)

2. Results and Discussion

The monthly variability appeared to be different at each station and among the monitoring stations. The differences between the reaches were more pronounced than among the stations within a reach. In the case of Tigris (at the most upstream station), the mean monthly salinity was highest in July (1.35 ppt) and lowest in December (0.31 ppt). The salinity levels fluctuated around 1.0 ppt during most of the months, with the exception of November and December (Table 1). The salinity levels and variability of S3 at Sweeb were largely similar to that of S1. Station S2 at Euphrates showed a slightly different dynamic with higher salinity levels compared to the other stations, most notable during February to April .

On average, the salinity levels were in the range of 1.0 to 1.5 ppt during most of the months, with the exception of February to April when salinity varied between 2.0 to 2.5 ppt. In the case at station S10 (Faw) located near the river mouth and the Gulf, the salinity levels and variations were the highest compared to all other reaches.

The mean monthly salinity fluctuated around 28-30 ppt during June to August, whereas it varied around 10-15 ppt in other months. Notable from the Table (1), the salinity levels for monitoring stations(S8,S9) followed a pattern of variations similar to that of (S10), though salinity values at monitoring stations(S8,S9) are much lower compared to (S10), from 0.5 ppt in December to 11.8 ppt in July along (S8,S9). The mean monthly salinity levels in case of monitoring stations (S5, S6 and S7) varied between 1.6 and 4.5 ppt (Table 1), whereby two salinity peaks, during February to March and July to September, could be observed.

Shat Al Arab River suffering from the shortage of incoming water from river (Tigris, Euphrates,

Caron and Karkhah) which cause increase of salinity because of seawater flows with salt wedges which cause unhealthy drinking water for human and animals.

Table 1: The average mean monthly saline concentration for year (2014) for the last ten monitoring stations ($* 10^3 kg/m^3$) (source: previous studies) [10]

Moniter Station	Symbol	Longtude	Latitude	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Des.
Tigris	S1	47° 25.993' E	31° 01.853' N	0.85	0.90	1.26	1.05	1.00	1.28	1.35	1.04	1.05	1.37	0.75	0.31
Euphrates	S2	47° 24.583' E	30° 59.632' N	1.42	1.99	2.25	2.33	1.56	1.53	1.50	1.42	1.07	1.24	1.09	1.10
Sweeb	S3	47° 28.004' E	30° 59.741' N	0.99	1.31	1.47	1.33	1.00	1.23	1.22	1.08	0.84	1.28	0.63	0.53
Shafi	S4	47° 32.647' E	30° 50.876' N	1.07	1.43	1.50	1.51	1.25	1.45	1.69	1.88	1.33	1.38	1.20	1.12
Makel	S5	47° 46.768' E	30° 34.154' N	2.67	4.16	3.56	2.17	1.72	1.60	1.77	2.00	1.85	1.75	1.67	1.67
Basra (City Cetner)	S6	47° 50.960' E	30° 30.630' N	2.59	4.45	3.96	2.25	1.71	1.60	1.99	2.91	3.27	3.12	2.63	2.53
Abu Fluss	S7	48° 01.215' E	30° 27.542' N	2.12	4.47	4.04	2.62	1.94	2.01	3.48	3.75	3.81	2.86	1.83	1.82
Sehan	S8	48° 11.623' E	30° 19.587' N	1.45	2.84	2.28	1.60	1.52	4.91	8.60	5.57	1.39	1.59	1.31	1.24
Dweeb	S9	48° 24.067' E	30° 12.278' N	1.95	3.04	2.66	1.63	0.56	10.45	11.88	3.59	2.60	1.25	1.33	0.49
Faw	S10	48° 30.256' E	29° 57.879' N	8.37	10.26	10.61	8.72	14.71	27.82	31.30	29.66	22.99	12.72	14.77	11.04

3. Recommendations

a) Dams suggested in Basra governorate that illustrated in Figure 6 that shown below:

1) Ras al Bisha area
2) Al Mohamadia island area
3) Abo floos area.
4) Kurna dam by Poland Company (Polyservices).

b) There is another option opposite to the dams building on Shat al Arab idea; this opinion adopted the idea of building a new water channel Similar to Badaa project water.

This pipe channel is closed to overcome the evaporation and infiltration loss of water problem as in existing open channel, and stop the physical pollution due to sediments because in dust and sand storm which common in this area .Finally this channel will stop illegal affairs by withdrawing water from it to feed illegal fish farms.

c) To demand water for different uses and prevent salt wedge upstream from Arabian Gulf to the Shat al Arab for these reasons we must be:

1) Applying the water security concept.
2) Implementation the water Governance Concept.
3) The quest to establish the National Water Policy Council.
4) The cooperation with national organizations in the field of water security and water scarcity.

d) For urgent solutions for this problem, desalination water plants by Reverse Osmosis System, which is suitable for brackish water, must be built directly and as soon as possible, these treatment plants are built along Shat al Arab stream until Seba area. Also saline water treatment plants are built along river streams from Seba to Faw, to provide domestic areas by suitable pure clean drinking water.

e) To provide the clean water, the prices of water were increases and water meters were put in houses and institutes.

f) And finally, increase building of desalination plants on Khor al-Zubair must be considered to ensure good and enough water for important uses in Basra government as in the gulf countries which produce 57% of the universal product of salt water desalination.

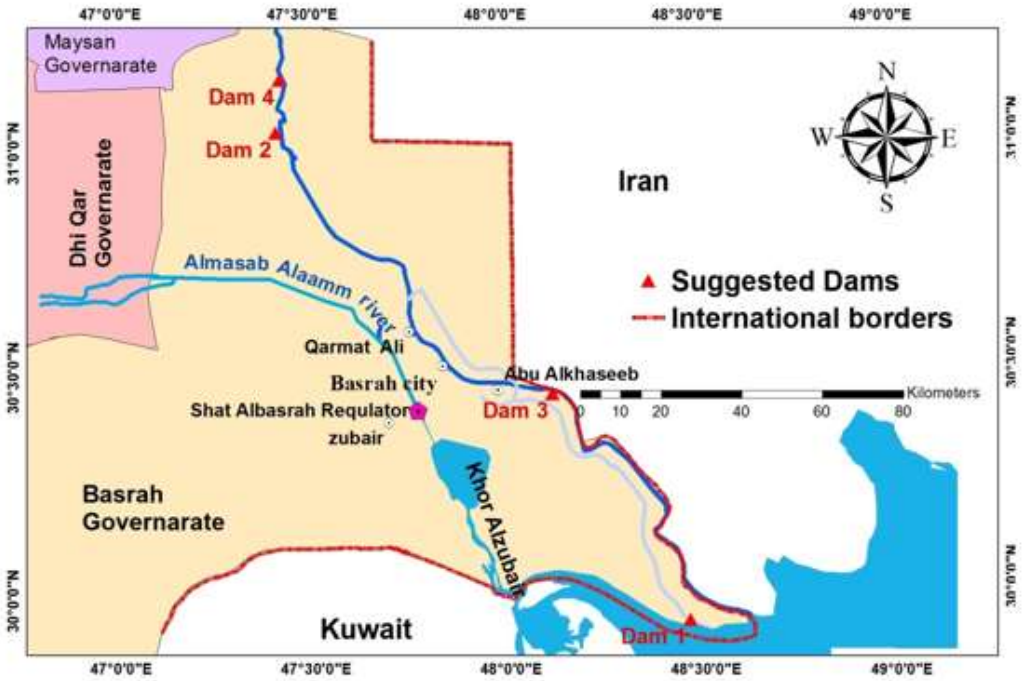

Figure 6: The suggested dam's locations at Shat al Arab River (by ARC GIS digitizing environment)

References

[1] UN. Water, "Status report on the application of integrated approaches to water resources management," United Nations Environment Program: Nairobi, Kenya, 2012.

[2] World Bank, "Iraq: Country Water Resources, Assistance Strategy: Addressing Major Threats to People's Livelihoods," Report No. 36297-IQ, 97, p. 2006.

[3] A.H. Kamel, S.O. Sulaiman, and S. Mustaffa, "Study of the Effects of Water Level Depression in Euphrates River on the Water Quality," J. Civil Engineering and Architecture, 7, 2, p. 238-247, 2013.

[4] K. Shatha, A.Z. Jabar, "Salting water of the Shatt al – Arab Reality and possible treatments," P:8, The Ministry of Environment, Iraq, 2009.

[5] T.R. Reinert, & J.T. Peterson, "Modeling the effects of potential salinity shifts on the recovery of striped bass in the Savannah River Estuary, Georgia–South Carolina, United States," Environmental management, 41(5), 753-765, 2008.

[6] World Health Organization, "Cancer pain relief: with a guide to opioid availability," World Health Organization, 1996.

[7] X.L. Qi, & S.C. Zhang, "Topological insulators and super conductors," Reviews of Modern Physics, 83(4), 1057, 2011.

[8] K.A. Rahi, & T. Halihan, "Changes in the salinity of the Euphrates River system in Iraq," Regional Environmental Change, 10(1), 27-35, 2010.

[9] A.H. Al Bomola, P. & Dahlblom, "The river pollution in Iraq and its effect on drinking water quality, 2011.

[10] Basra Water Board, Ministry of Municipalities, Iraq, unpublished internal reports, Salinity data, 2014.