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Evaluation of Water Quality for Badaa Canal Project South of Iraq

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EVALUATION WATER QUALITY OF BADAA CANAL SOUTH OF IRAQ

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ABSTRACT. Badaa canal is Basic source of fresh water in Basra -However, The canal remained structurally unsafe and many cases of not providing water. In 6th month 2008, the Japanese s Agency of (JICA) agreed a credit to rebuild worth $395 million American Dolars to the Iraq– as an initial amount in a developInte rnational Cooperation ment program.

This research focus on the Al Bada Canal Water quality; it begins in the Al Bada district downstream of the AL Garhaf River at Nassiriya and ends in Basrah governorate that have a problem from water inability for drinking and irrigation water throughout the year. The parameters selected were PH, EC,TDS, Turb, TH,Ca, Na, Mg,SO4,Cl..
Because of few studies on this important canal ,we have to made this study,In this research we applied Baharjava water quality index for evaluating Badaa canal water quality, then we applied GIS Technique to enhance clarity and interest . Some researchers did a study using the qualtitative method, The Canal's overall length is 238.5 KM. It has 196 plants, two of them are pumping stations, and three Syphons rate discharge is 21m^3 m^3/sec of which 6 m^3 and 15m^3 to Nassiriya and Basrah respectively. The design has few activity compared to needs becaue of sundry troubles that effect water quantity and quality.the results for current study showed that the canal water quality is acceptable for both drinking and irrigation uses at stationS1 while it's acceptable for drinking uses and excellent for irrigation uses at station S2, For station S3 it was good for drinking and acceptable for irrigation uses, while for station S4 it was acceptable for drinking and good for irrigation uses, the GIS maps help us to distinguish between four stations within two provinces. the parameters TH, TDS, Turb. Showed high concentrations in all stations that exceed the bahrjava range.

Key words:

Badaa canal, Baharjava WQI, GIS, Basrah, Nasiriya.

1. Introduction

Among Complex politics and sometimes-fatal problems, of southern Iraq. There was a proposal access to clean water for the general population of the cityto bridge the ethnic and sectarian divide. Basra's water supply problem and lack of such renewal efforts has been apparent since the US-led invasion in 2003.When Iraq was occupied, the United States Agency for International Development (USAID) began rehabilitating Al Bidda Canal - Basic source of fresh water in Basra -However, The canal remained structurally unsafe and many cases of not providing water. In 6th month 2008, the

Japanes Agency of International Cooperation (JICA) agreed a credit to rebuild worth US $395 million American Dolars to the Iraq– as an initial amount in a development program.

Called the Great Basra Water design for a better water equipping system in Basra and nearby regions. It has includes the rework of the current distribution grid along with building and refurbishment of treatment of water plants [1].

Whatever, other basic water projects that depend mainly on Basra water supplies, the JICA work stopped, due to depravity and fraud [2]. The lack of a trusted water supply for Basra's citizen and reverses wider Spatial and temporal boundaries of hydrological change. Iraq depends largely on trans boundary inflows from the Tigris and Euphrates rivers, which are both reduced by upstream water control infrastructures and weather change[3]; IOM Iraq, 2020). For fourty years since the beginning 1930s, It is called the "natural ordinary regime flow" for the Tigris and Euphrates [4]. Iraq received an intense emission 'pulse' of water– a spring surge energized activated by melting snow at the headwaters of both rivers. This pulse was the life spirit of the agriculture in Iraq and its renewal. By flooding, and the marshes in the Mesopotamian.

By the late 1980s, after the build-up of hydraulic infrastructure in upstream riparian states (Iran, Syria and Turkey) and inside Iraq, the maximum spring pulse decreases by 89% [5]; and this predates the building of the Turkish m Ilisu Dam (2006–2018), which scientists from Iraqi claim has decrease water levels in the Tigris river[6]. Basra downstream governorate, where the Tigris and Euphrates meeting in Shatt al-Arab, decrease flows and high pollution loads are getting worse in hote seasons by seawater a leak [7]. Water outgoing from the Shatt al-Arab provides 60% of the water for treatment plants in Basra but need purification processes and expensive desalination: it is often blended with supplies from the Badaa Canal to make water quality better since the 1990s, the city's residents were forced to purchase potable water from the private sector due to the failure of the potable water infrastructure. Household tap water is used for cooking, washing, cars, and hose for irrigation. Nomas and HASHIM ,2021 STUDIED Al Bada Canal Water project which starts from Al Bada distric downstream of AL Garhaf river at Nassiriya and end at Basrah province which suffers from water in ability throughout the year. The Canal total length is 238.5 KM. It has 196 construction plants, two pumping stations and three Syphons average discharge is 21m^3/sec of which 6 m3 and 15m3 to Nassiriya andBasrah respectively. The project has low efficiency compared to the demands due to several problems which influence water quality and quantity. almahmood and hamdy,2020 studied Qualitative Characteristics of Raw Liquefaction. Water Based on Al-Badaa Canal in Basra, Their study aims at evaluating the qualitative characteristics of the liquefied water flowing from the Al-Badaa Canal towards Basra areas during the year 2020, as well as comparing the physical and chemical characteristics according to Iraqi specifications for the quality of drinking water .Samples of liquefied water were compared in 4 locations for the distribution of liquefied water based on the project, which receives its water from the Al-Badaa canal within the borders of Basra province, in terms of salinity(electrical conductivity and total dissolved substances) and physical and chemical elements, it was found that the liquefied water in the studied neighborhoods along the province of Basra.The research relied on ten elements to determine the water quality and calculate the water quality guide WQI, was relying on water samples for water projects that receive water from the imam Abbas Water Project(P), which is fed directly from the project of Al-Badaa water, in order to evaluate the water of the liquefaction networks that depend fully or partially on Basra or most of it was higher than the Iraqi standard specifications for drinking water except for hydrogen, and the indicators varied between the stations studied during four seasons of 2020.

1.1 Research aim: This research aims to evaluate water quality of badaa canal, because of its importance for the provinces that suffer from shortage, and there were few studies on it.

2. Study Area

The Al Badaa canal water design begins in the Al Badaa district downstream of Al Gharaf River which is the branch of the Tigris River, at Nasiriya, and ends at Basrah governorate which that have a problem water inability along the seasons. It's overall length is 238.5 km, and it has 196 structure plants. It passes through al Nasiriya, Suq al-Shuyukh, and Basrah governorate that suffer from the shortage of fresh water suitable for human consumption as shown in figures 1 and 2.

Its length is 238.5 km according to the Ministry of Water Resources, it reaches 690.2 km.

For the extension of the canal in the governorates of Dhi Qar and Basra, respectively, and an average width of about (7 m). 144 km is lined with concrete and about 95.5 km lined with clay soil with little sand.

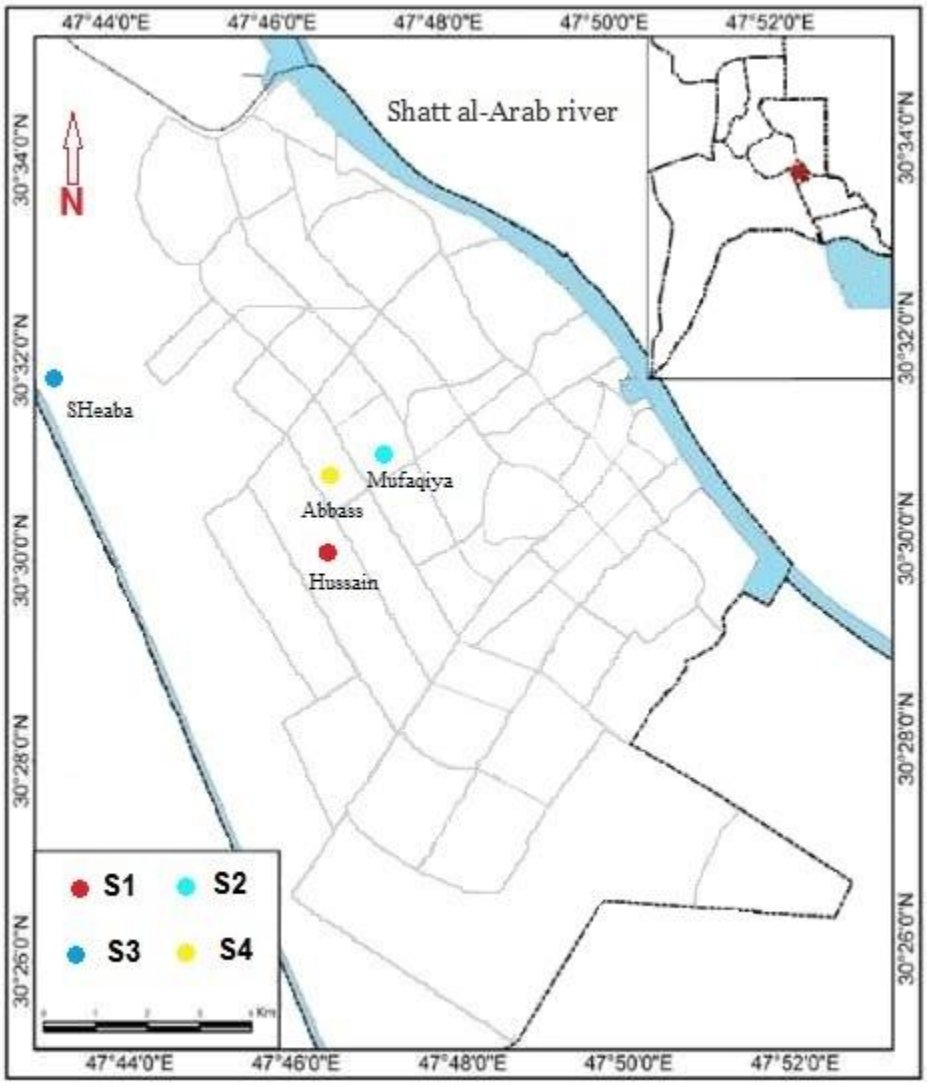

Figure 1: Stations location (researchers work)

Figure 2: Badaa canal which passes through two provinces. (Researchers work)

3. Materials and methods

Data were collected for four stations along Badaa canal which are S1, S2, S3, S 4 for four seasons during the year 2020 (3,4) as shown in figures1 and 2, to calculate the parameters PH, EC, TDS, Turb, TH , Ca, Na, Mg, SO4, Cl, SAR. We used baharjava method because the previous studis didnt use it before this scale consist of set of figures to evaluate water quility for drinking uses and set of figures to evaluate water for irrigation uses then set of figures to evaluate water for industrial uses so it's not possibale to insert sll these figures in our research. We itend to present our research in simple and visual way so reader will interest in reading it

3.1 Stations Names

S1 Imam Hussain water project
S2 AL Mufaqiya water project
S3 AL SHeaba water project
S4 Imam Abbass water project.

3.2 Method used

Baharjava Water quality index

Interested Bhargava (1983) in studying WQI to estimate the water fineness for sundry actions in the Saigon River in Vietnam and the Ganga River in India by applying the sensitivity formula method. He transfers the magnitudes of variables according.

This indicator has been applied to assort rivers into five combinations and to set the water fineness index for each action of several water actions depending on the variables which excited that action. (12)

The geometric average equation is expressed as below:

$$WQI = [\pi^{n}i_{=1} \quad f(pi)\ ]^{1?n} \quad *100\text{……..(1)}$$

Where:

fi (Pi) is the allergy equation for every variable inclusive of the action of variable weight concentration which is pointing to a particular diverse action from (0 – 1). As it appears in [table no. 1].

Table 1: Water fineness classification according to Baharjava (12)

Water quality	Water quality value	Water quality classification
Class one	100 – 90	Excellent
Class tow	65 – 89	Good
Class three	35-64	Acceptable
Class four	11-34	Polluted
Class five	Less than10	Sever polluted

3.3 Geographic information systems GIS

Geographic information systems have been used to interpret and integrate large amounts of geographical data and information to determine the locations of water sources as in [13, 14, 15] and to model areas with potential water resources [16] and provide multiple criteria for decision-making in economic and rapid ways and provides accurate assessment [16, 17, 18, 19]. Providing effective tools for scientific analysis of irrigation and drinking canals [20]. Knowing the amount of water used and the amount of water produced for sewage [21]. ARC Map 10.2 interface was used using 2D GIS to draw canals and determine their locations and lengths [20 and 22]. Extracting data using GIS software [23], where decision making has become clearer and more flexible [24]. Conducting spatial analysis in a clear and quick way for the recipient to understand [25].

4. Results and discussion

In order to evaluate water quality for irrigation uses, we have to determine SAR, which is Sodium Adsorption Ratio as follow:

$$SAR=[Na/(Ca+Mg)/2]^{0.5}\text{----------(2)}$$

[Table 2-5] show the influence of each parameter according to BWQI, then the Baharjava water quality index method [was] applied on these parameters to find the class of water quality for each station, then it was represented by GIS for both drinking and irrigation uses as shown in Figures 3 and 4.

We compare our results with the results obtained by the resercher al mahmood and our results consist with his findings.

Table 2: Shows the influence of each parameter according to BWQI for S1.

Par.	IRR	DR
pH	0.67	0.62
EC	0.23	0.15
TH		
Turb		
TDS		
Na		0.67
Mg		
Ca		0.67
So4	..0.6	0.44
Cl	8.25	0.44
SAR	1.4	
BWQI	55	36

Table 3: Shows the influence of each parameter according to BWQI for S2.

Par.	IRR	DR
pH	0.95	0.67
EC	0.65	
TH		
Turb		
TDS	0.6	045
Na		0.9
Mg	0.49	0.49
Ca	0/73	
So4	0.61	
SAR	2.2	
BWQI	0.91	0.5

Table 4: Shows the influence of each parameter according to BWQ for S3.

Par.	IRR	Dr
pH	0.9	0.68
EC	0.33	
TH		
Turb		
TDS	0.45	
Na		0.9
Mg		
Ca		
.So4	0.49	
SAR	0.717	
BWQI	62%	78%

Table 5: Shows the influence of each parameter according to BWQI for S4.

Par.	IRR	Dr
Ph	0.9	0.67
EC	0.75	0.75
TH		
TDS	0.76	0.69
Na		
Mg		
Ca		0.92
So4	1	0.85
Cl		0.85
SAR		1.14
BWQI	84%	64%

1. The results showed that the canal water quality is acceptable for both drinking and irrigation uses at stationS1 while it's acceptable for drinking uses and excellent for irrigation uses at station S2 and this compatible with the results that achefed by humaidi and almahmood,2020., For station S3 it was good for drinking and acceptable for irrigation uses while for station S4 it was acceptable for irrigation and good for drinking uses these results also accomplish with al mahmood and humaidi findings,2020, from fig 3 we found that Badaa canal length is 439m in Naserya city while its length is 282m in Basrah city.
2. The Figure 5 showing seasonal variation of Ph, the canal water acidity was natural and it has light alkalinity, while fig 7 indicated that canal water has moderat esalinity , fig 8 showed high total hardness .
3. Fig 9 showed high turbidity that exceed baharjava limits, respectively during 2020. The parameters TH, TDS, Turb. Showed high concentrations in all stations that exceed the baharjava range.

Figure 3: Represents WQI

For Badaa canal for drinking uses using GIS

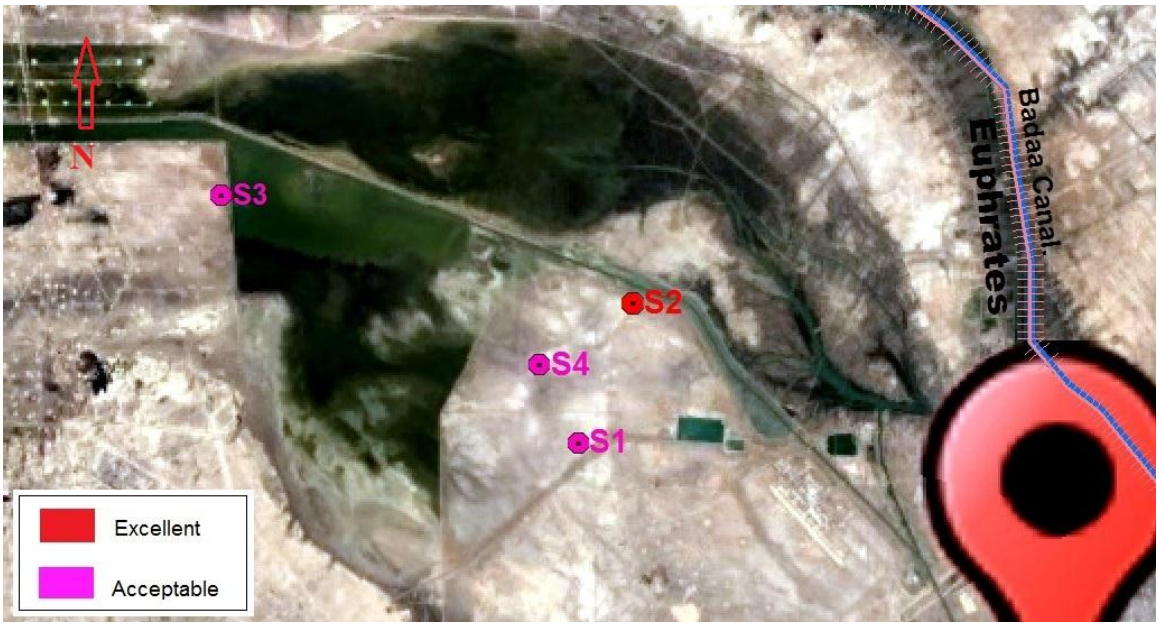

Figure 4: Represents WQI

For Badaa Canal for irrigation uses using GIS.

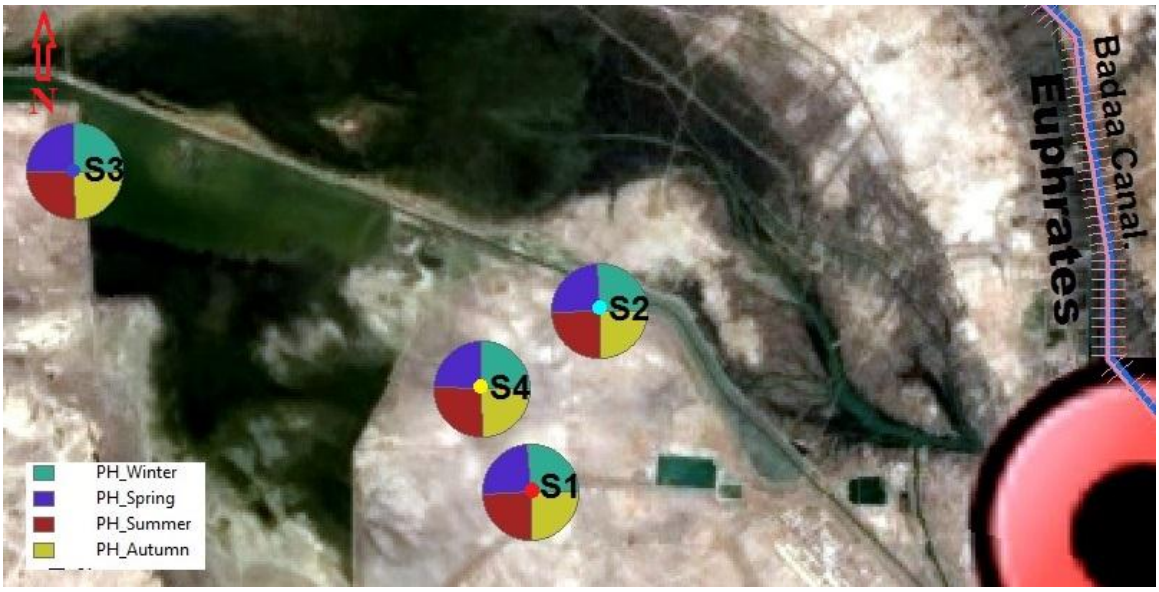

Figure 5: Variation of ph during 2020.

Figure 6: Variation of EC during 2020.

Figure 7: Variation of TH during 2020.

Figure 8: Variation of Turb during 2020.

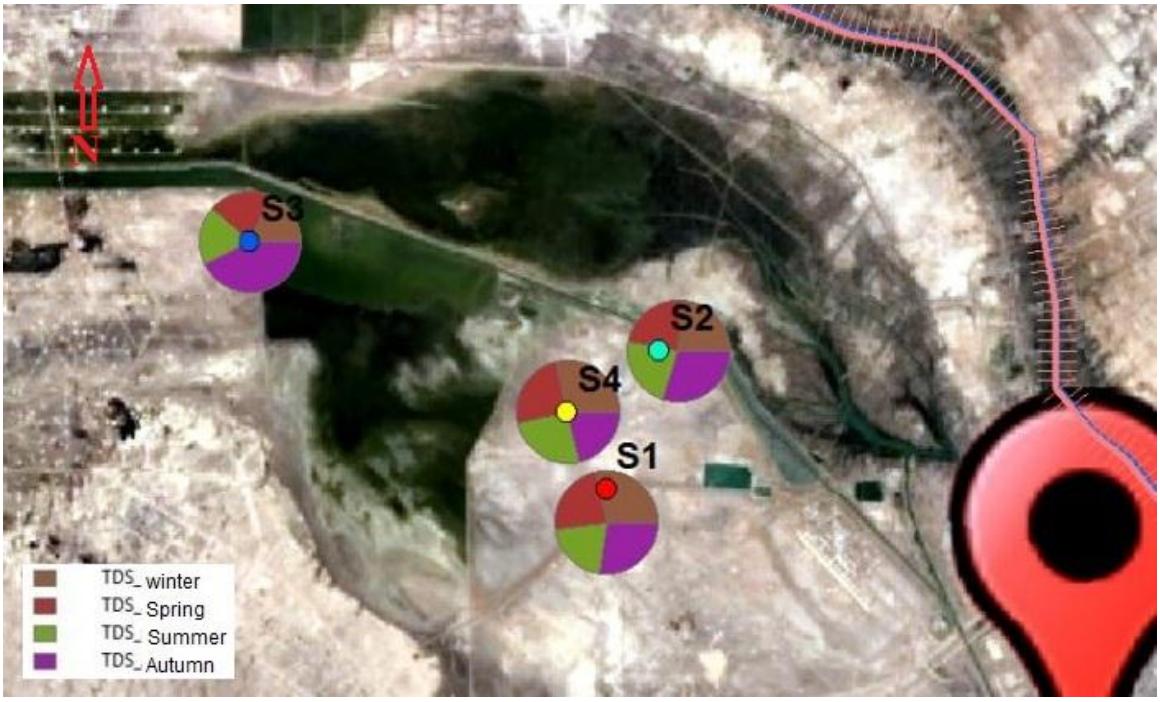

Figure 9: Variation of TDS during 2020.

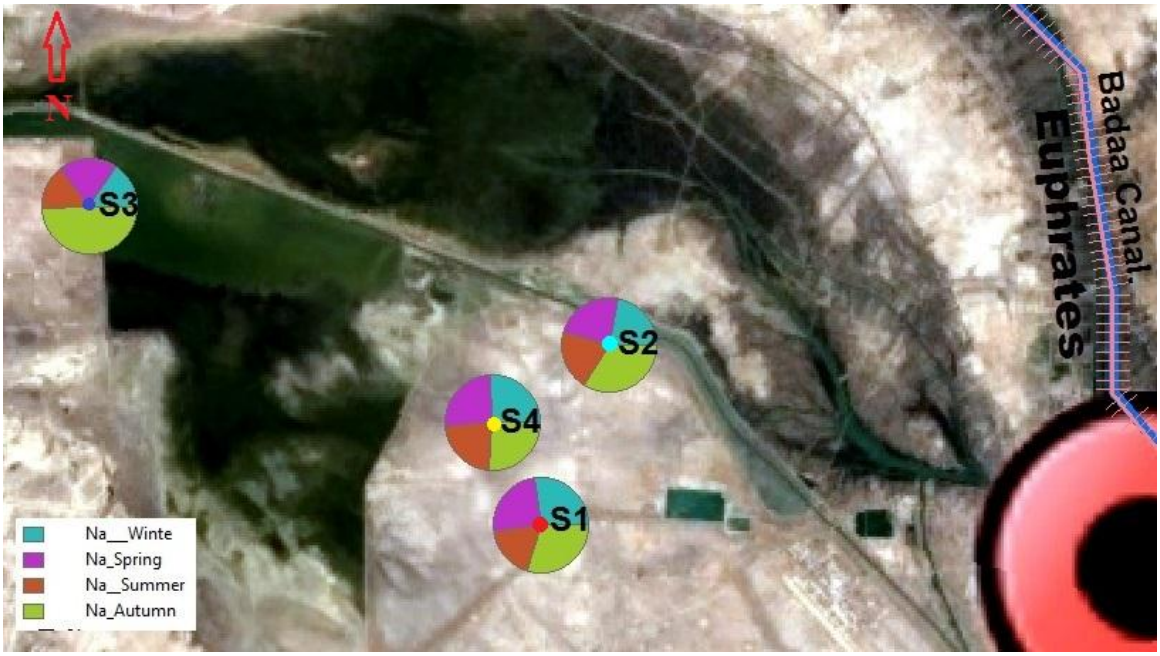

Figure10: Variation of Na during 2020.

Figure 11: Variation of Mg during 2020.

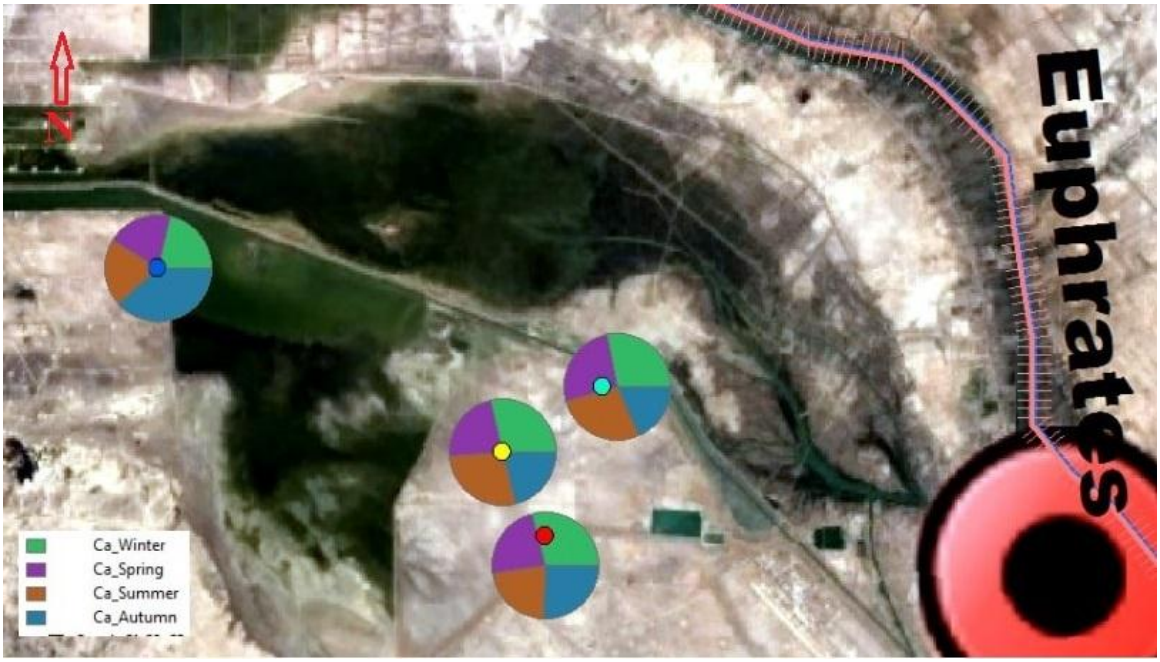

Figure 12: Variation of Ca during 2020.

Figure 13: Variation of SO4 during 2020.

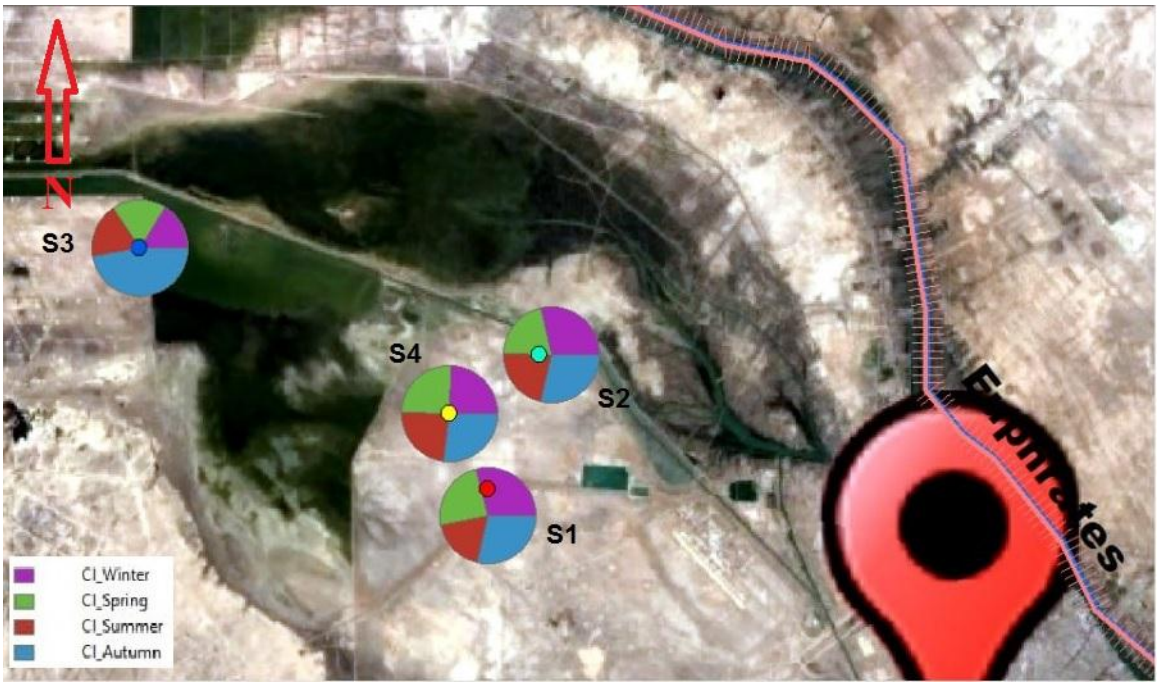

Figure 14: Variation of CL during 2020.

4. The figures 10,11,12,13,14 represented the parametersNa, Mg,Ca, So4,Cl respectevely, showd that their concentrations are within the accceptable limits according to Iraqi specifications 2009 and WHO, 2011.

5. CONCLUSION.

From the above work, we conclude that

1. Badaa canal is a suitable source of fresh water, especially for provinces that suffer from shortages like Naseria and Basrsh south of Iraq.
2. Its water is acceptable for drinking uses and good to excellent for irrigation uses.
3. It needs simple treatment and disinfection before drinking uses.
4. The parametersNa, Mg,Ca, So4,Cl respectevely, showd that their concentrations are within the accceptable limits according to Iraqi specifications 2009 and WHO,2011.
5. We can't apply the Bahrjava scale on the parameters TH, Turb, because their concentrations are out of range.

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