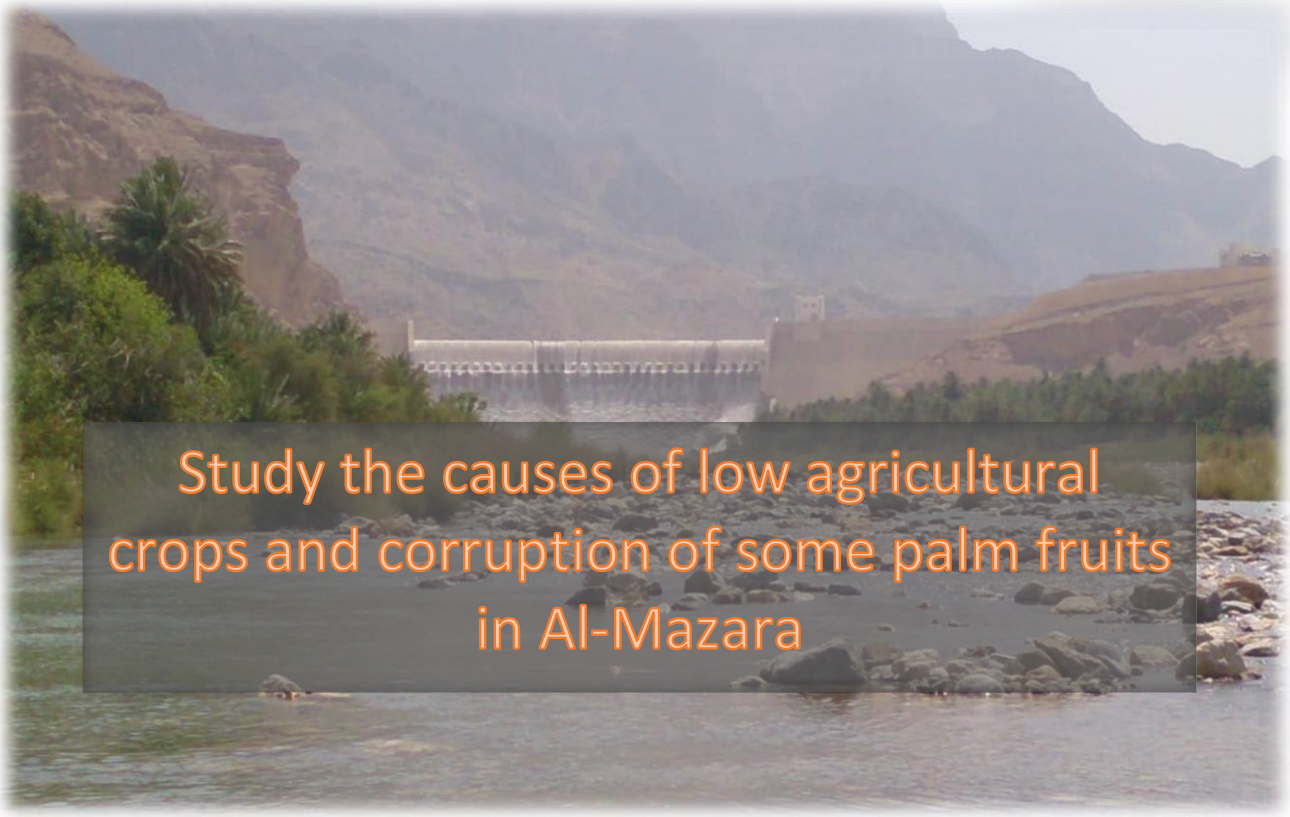
Sultanate of Oman

Ministry of Education

Umm Al Hakam Bint Al Zubair

Pasic Education School (1-10)



Prepared by Students \\

Naqa bint Hassan bin Salim Al- Battashi

Jumana bint Ahmed bin Hammoud Al-Suleimani

Umm Al Hakam Bint Al Zubair Pasic Education School (1-10)

The supervisor teacher//

Rahma bint Salim bin Amur Al-Talbi

March 20 21

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❖ Summary:

The idea for this research came from the observation and complaining of the farmers in Al-Sieh and Al-jazeer. Their farms has low agricultural crops and there is corruption of some of the fruits of palm trees; so we decided to come up with a timeline plan to do some field research on those sites and record all the surrounding factors that may could cause the problem. The main focus was on the water characteristics that feed those crops and the water comes through a watercourse called (Falaj). Which is the main factor that cause these problems on those 2 villages. Then, we went to a third village that does not has this problem called Al- qarya to compare between the water characteristics.

We find out that water characteristics on Al-Sieh & Al-jazeer falajs are similar and the water source for those falajs is Wadi Diqa dam. This water cause those problems on the crops and after doing several interviews With the people and the director of the dam it turned out that the dam gathered in the valleys and deposited in the hall of the dead animals for years and not opening it for a period that ranged for a full year led to stagnation of water and changed its properties, so it was coordinated with the manager to send samples of Al-Sieh and Al-Jazeer Falajs water to the Laboratories of the General Directorate of Regional Municipalities and Water Resources on Muscat for testing .

Our recommendations for those responsible for the dam to take the necessary measures to get rid of stagnant water by open it periodically and it is our duty to do some lectures for the people of the region to protect their crops from being harmed by the water.

❖ **Key terms:**

- **Stagnation of water :the water stops flowing and is considered environmentally dangerous.**
- **The salinity :concentration of dissolved salts in the water.**
- **Electrical conductivity :the ability of the material to conduct electrical current.**

❖ **Research Questions:**

1) **What is the difference in the properties of water on falaj Al-Sieh, Al-qarya and Al-jazeer and what are the causes?**
2) **What are the external factors affecting the water characteristics of the three falajs?**

❖ **Introduction and literature review:**

People of the region are suffering corruption of some of the fruits of their crops after the construction of the dam. So, our aim was to identify the causes of this problem and why it happened after years of building the dam. Therefore, we headed to test the water that feeds those crops though falajs and we compare between the water characteristics to try to solve this problem.

In Oman, Falajs are considered to be an essential source of irrigation plants in ancient times where this unique water system has achieved prosperity of agriculture in Oman therefore, a Royal Decree No: 2007/39 was issued that identified the law "the organization and protection of Falajs" .

The Holy Qur'an talked about the huge water reservoirs that exist under the surface of the earth, which exceed the amount of fresh water in rivers, through the Almighty saying: this phrase includes a reference to the processes of storing water in the earth, and this matter was not known at the time of the descent of the Holy Qur'an.

Higher the water was purer, so Almighty said:
Scientist consider the mountains today as the most important source of fresh water in 21 century.
Based on all of that, we decided to do this research.

❖ **Research Methods:**

First :The research plan:

Following the steps below:

1) Choosing the research problem which has been selected by the students and discussed with the supervisor teacher.
2) Implementing a meeting with the manager of Wadi Diqa dam Mr. Abdullah Al – Foriy , and coordinate with the Laboratories of the General Directorate of Regional Municipalities and Water Resources on Muscat to examine the dam's water.
3) Appling the water protocol using an acidity, conductivity, salinity and temperature device in the school laboratory.
4) Compare the acidity of the water on Al-Sieh, Al-jazeer and Al-qarya falajs and record the amount of change in their characteristics.
5) Make tables and charts on Microsoft Excel to see the extent of the discrepancy between the characteristics.
6) Study the external factors that cause changing the characteristics of falajs water and reach the recommendations necessary for treating the problem or reduced it.
7) Record all water protocol data and study sites on the program site.

All the research students went to the study sites to discover and implement the protocol and take samples from the falajs and to identify the external factors surrounding the three study sites. Coordination and cooperation with the staff of the Marine Science and Fisheries Center to examine the falajs also took place, and we also searched for various references to support our findings

Research timeline schedule:

Month	Time period	Objectives to be implemented
Nov	11/November	Choose a research topic
	11-21 / November	Collect information related to the research
	24/ November	Field visits to the three search sites and Appling water protocol
Dec	December 15th	
January	12-26/ January	Extracting results, writing them down and recommendations
	26-30/ January	Review the final research and production
February	February 26th	Design the research poster
March	10/ March	Send the research to the site

Table (1): Research timeline

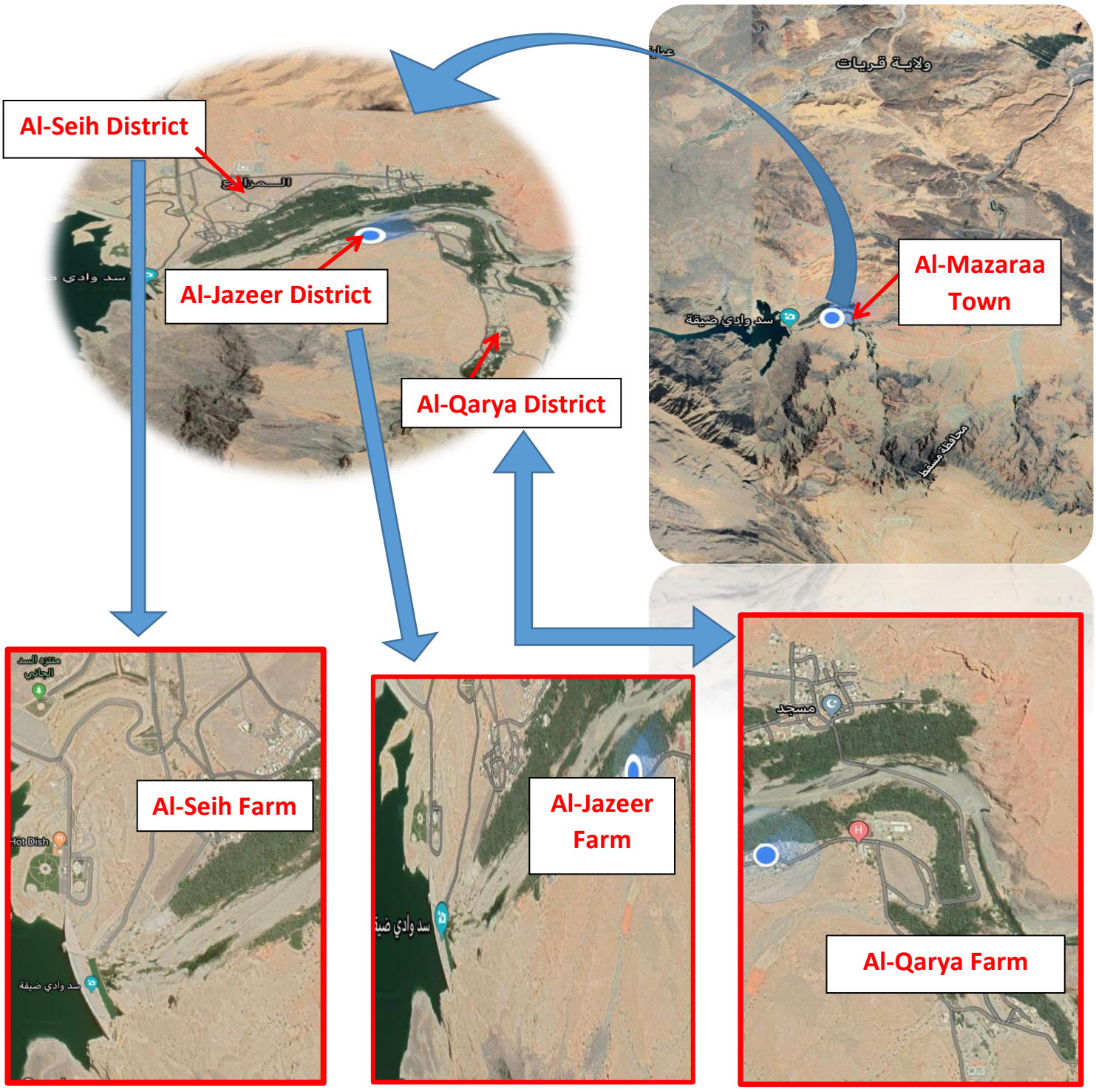
Distribution of work roles to the research team:

The Work	Students performing
Formulating the research problem clearly and defining and equipping the required tools	Naqa and Jumana
Collection and analysis by applying planned protocols inside and outside the school and entering data on the site	Naqa and Jumana
Reaching conclusions through the data collected, including drafting the abstract and writing the research	Naqa and Jumana

Table (2): Distribution of roles among the research team

Second: The study site:

Study site: (Sultanate of Oman - Muscat Governorate - Quriyat State – Al-Mazaraa Town), Al-Seih District, Al-Jazeer District, Al-Qarya District, January. The weather is cool to moderate (20.6). The water protocol was used.



Third: data collection and analysis:

Collect data related to the first and second questions by taking samples from Al-Sieh, Al-Jazeer and Al-Qarya falajs and applying the water protocol to identify the properties of water by taking samples and examining them on its locations and laboratory.

AL -Sieh's Falaj



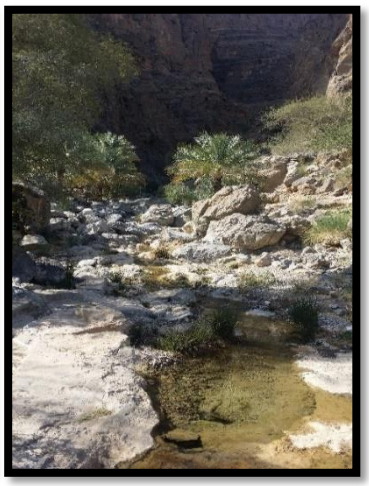



Al-Jazeer's Falaj






Al-Qarya’s Falaj

We visited the Wadi Daiqah Dam to conduct an interview with Mr. Abdullah Al- Furriy , the director of the dam, to inquire about matters related to the dam's water and the reasons for its characteristics differing from Al-Qarya's falaj water, and to address the teacher with the need to coordinate with the General Directorate of Regional Municipalities and Water Resources in Muscat to examine samples from Al-Sieh, Al-Jazeer, and The Dam lake and compare between its characteristics, with the assistance of the Marine Research and Fisheries Research Center, to visit the site, take samples, examine them, and provide us with its components.

Picture of the specialists from the research center in the study areas

❖ Results:

1) Through applying the water protocol to measure its properties in Al-Seih, Al-Jazeera, and Al-Jazeera falajs, the data were analyzed in tables and graphs as follows:

   ➢ Comparing the characteristics of the three study sites in November and December are as follows:

comparison	Average salinity during two months	Average acidity during two months	Average conductivity Within two months	Average temperature in two months
Al-Sieh Falaj	290.5	9.08	621.5	22.8
Al-Jazeer Falaj	284.5	9.31	626	22.45
Al-Qarya Falaj	223.3	6.71	558	24.25

Table (3) a comparison between the characteristics of falajs water

First: The comparison between the salinity of the three falajs water is as follows:

comparison	Salinity in November	Salinity in December
Al-Sieh Falaj	317	264
Al-Jazeer Falaj	315	254
Al-Qarya Falaj	226	220

Table (4) Comparison between the salinity of the falajs water

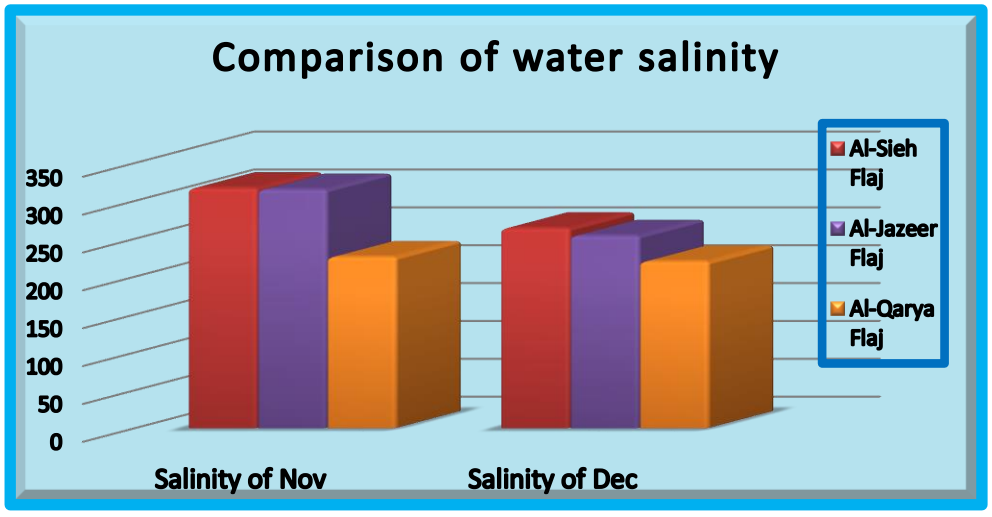


Diagram (4): A comparison of the salinity of the falajs water

Second: The comparison between the conductivity of the three areas falaj water is as follows:

comparison	Conductivity in November	Conductivity in December
Al-Sieh Falaj	627	616
Al-Jazeer Falaj	626	618
Al-Qarya Falaj	558	558

Table (5) comparison between the conductivity of falajs water

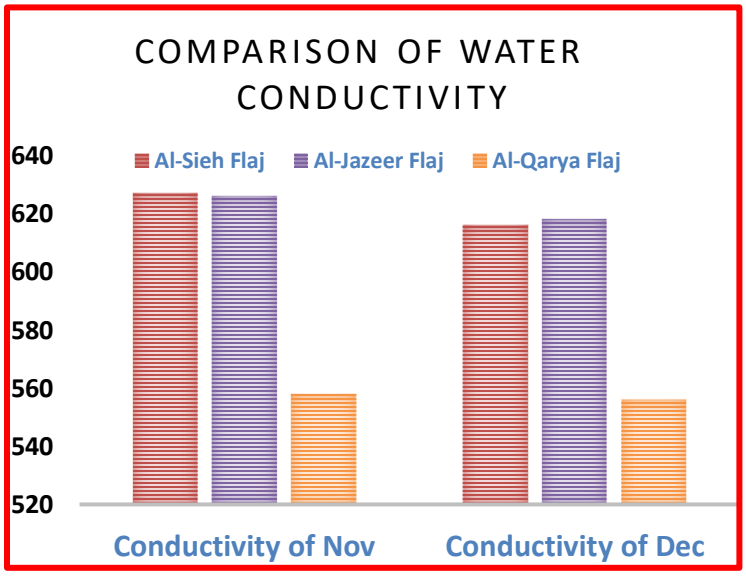


Diagram (5): A comparison of the conductivity of falajs water

Third: The comparison between the acidity of the falajs water of the three regions is as follows:

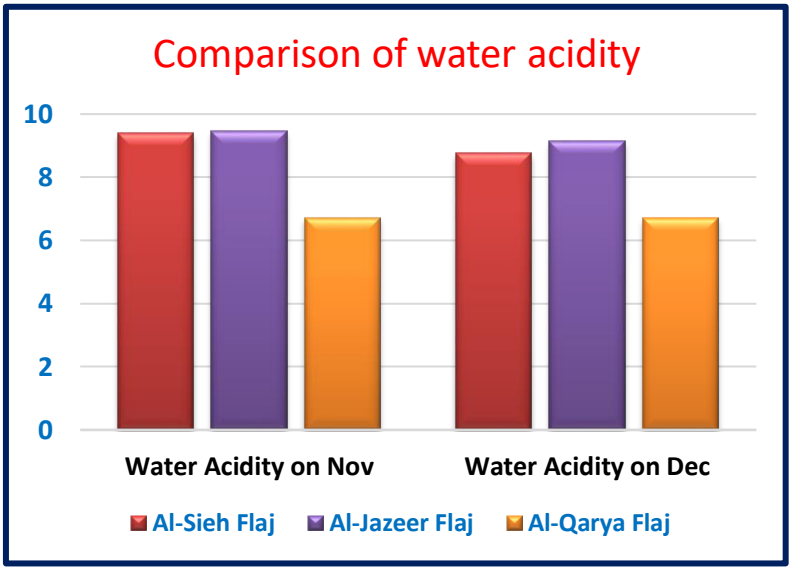


Diagram (6): A comparison of the acidity of falajs water

Comparison	Acidity in Nov	Acidity in Dec
Al-Sieh Falaj	9.4	8.76
Al-Jazeer Falaj	9.46	9.16
Al-Qarya Falaj	6.72	6.70

Table (6) a comparison between the acidity of falajs water

Fourth: The comparison between the temperatures of the three areas falaj water is as follows:

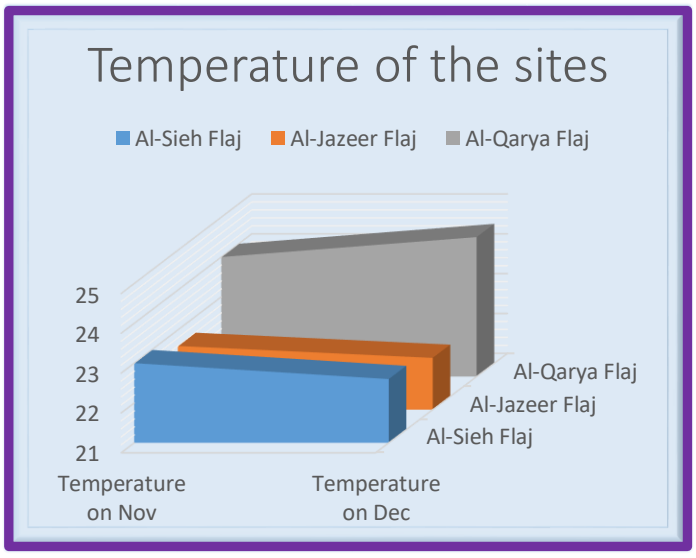


Diagram (7) a comparison between the temperatures of falajs water

Comparison	Temperature in November	Temperature in December
Al-Sieh Falaj	23	22.6
Al-Jazeer Falaj	22.6	22.3
Al-Qarya Falaj	24	24.5

Table (7) a comparison between the falajs water temperatures

2) The comparison between Al-Seih and Al-Jazeer water and the Wadi Daiqah Dam water through the reports of the Marine Research and Fish Resources Center, as follows:

Elements & Component	The maximum percentage of occurrence in water	The characteristics of Al-Jazeera Falaj	The characteristics of Al-Sieh Falaj	The characteristics of the Dam lake
Potassium carbonate	-	3.07mg/l	3.13mg/l	3.14mg/l
Calcium	-	20.83mg/l	20.86mg/l	21.25mg/l
Dissolved solids	1000	407.82mg/l	332.69mg/l	385.23mg/l
Acidity	9.9-6.5	8.69	8.72	8.65
Silicon as SO2		8.92mg/l	9.02mg/l	9.13mg/l
Carbon diodes		361.12mg/l	163.48mg/l	273.28mg/l
Hardness	500	202.86mg/l	202.11mg/l	206.38mg/l
Nitric acid	11.29	1.03mg/l	1.24mg/l	0.98mg/l
Fluoride compound	1.5	0.00mg/l	000mg/l	0.0mg/l
Strontium		0.49mg/l	0.49mg/l	0.51mg/l
Sodium	400	23.89mg/l	42.07mg/l	41.84mg/l
magnesium	150	36.14mg/l	35.99mg/l	36.78mg/l
barium	0.7	0.09mg/l	0.08mg/l	0.09mg/l
Silicon		4.24mg/l	4.29mg/l	4.34mg/l
Alkalinity		296.00mg/l	134.00mg/l00	224mg/l
chloride	600	59.54mg/l	62.67mg/l	60mg/l
Sulfate	400	71.07mg/l	70.82mg/l	73.08mg/l
nitrate	50	4.58mg/l	5.50mg/l	4.34mg/l
conductivity		570.00us/cm	569.00us/cm	574us/cm

Table (8) Data of properties of water samples from research laboratories

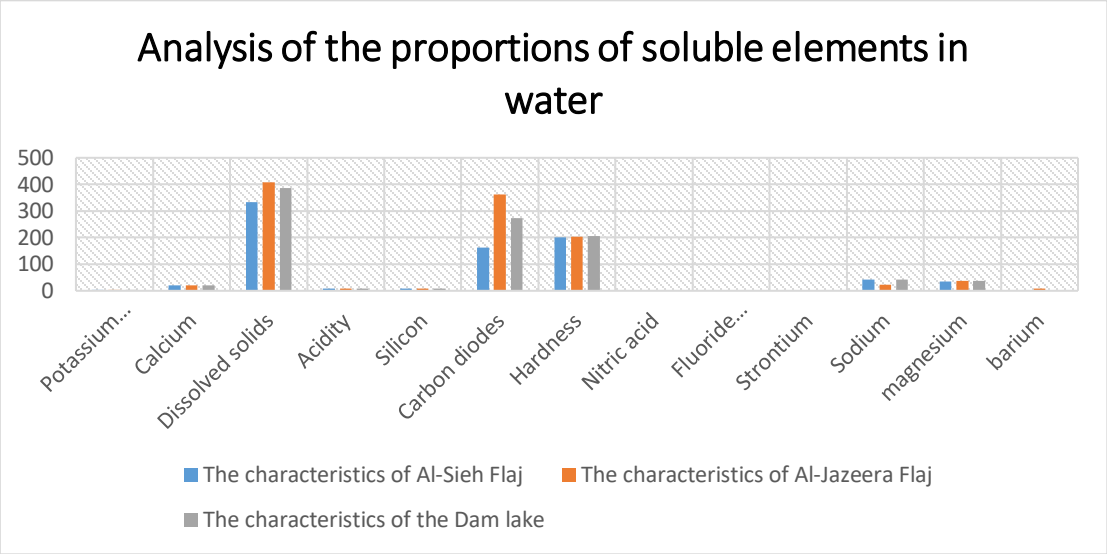
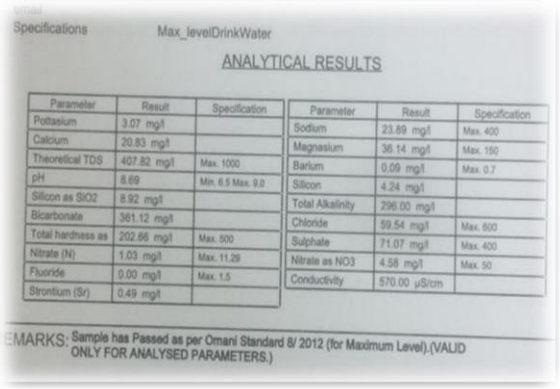


Diagram (8) characteristics of water samples from research laboratories

Attachments for reports of the falajs samples and the Dam Lake:



Specifications Max_levelDrinkWater

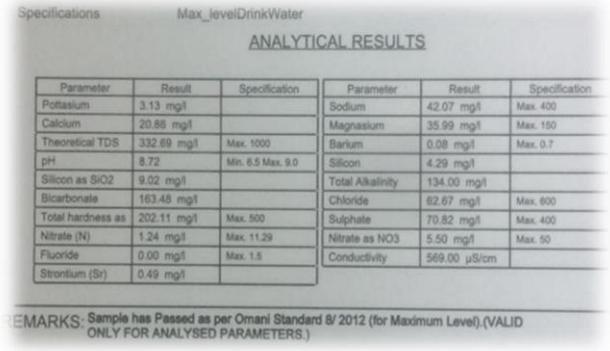
ANALYTICAL RESULTS

Parameter	Result	Specification
Pottasium	3.07 mg/l	
Calcium	20.83 mg/l	
Theoretical TDS	407.82 mg/l	Max. 1000
pH	8.69	Min. 6.5 Max. 9.0
Silicon as SiO2	8.92 mg/l	
Bicarbonate	361.12 mg/l	
Total hardness as	202.66 mg/l	Max. 500
Nitrate (N)	1.03 mg/l	Max. 11.29
Fluoride	0.00 mg/l	Max. 1.5
Strontium (Sr)	0.49 mg/l	

Parameter	Result	Specification
Sodium	23.89 mg/l	Max. 400
Magnasium	36.14 mg/l	Max. 150
Barium	0.09 mg/l	Max. 0.7
Silicon	4.24 mg/l	
Total Alkalinity	296.00 mg/l	
Chloride	59.54 mg/l	Max. 600
Sulphate	71.07 mg/l	Max. 400
Nitrate as NO3	4.58 mg/l	Max. 50
Conductivity	570.00 µS/cm	

EMARKS: Sample has Passed as per Omani Standard 8/ 2012 (for Maximum Level).(VALID ONLY FOR ANALYSED PARAMETERS.)

Appendix (2) Falaj Al-Jazeer Properties Report



Specifications Max_levelDrinkWater

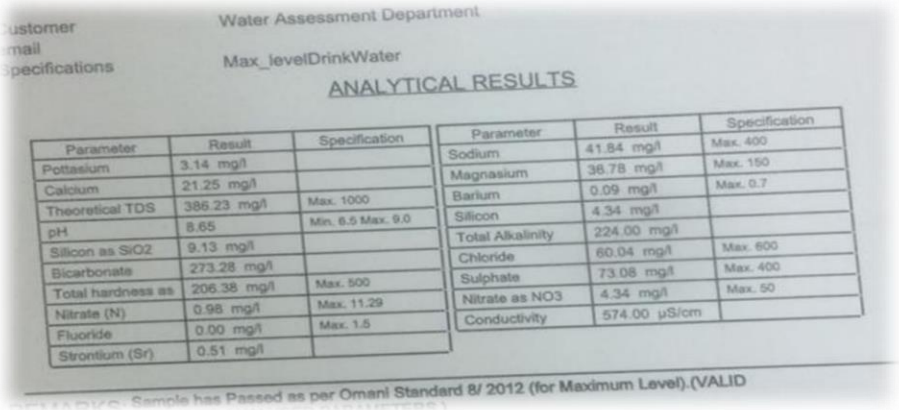
ANALYTICAL RESULTS

Parameter	Result	Specification
Pottasium	3.13 mg/l	
Calcium	20.86 mg/l	
Theoretical TDS	332.69 mg/l	Max. 1000
pH	8.72	Min. 6.5 Max. 9.0
Silicon as SiO2	9.02 mg/l	
Bicarbonate	163.48 mg/l	
Total hardness as	202.11 mg/l	Max. 500
Nitrate (N)	1.24 mg/l	Max. 11.29
Fluoride	0.00 mg/l	Max. 1.5
Strontium (Sr)	0.49 mg/l	

Parameter	Result	Specification
Sodium	42.07 mg/l	Max. 400
Magnasium	35.99 mg/l	Max. 150
Barium	0.08 mg/l	Max. 0.7
Silicon	4.29 mg/l	
Total Alkalinity	134.00 mg/l	
Chloride	62.67 mg/l	Max. 600
Sulphate	70.82 mg/l	Max. 400
Nitrate as NO3	5.50 mg/l	Max. 50
Conductivity	569.00 µS/cm	

EMARKS: Sample has Passed as per Omani Standard 8/ 2012 (for Maximum Level).(VALID ONLY FOR ANALYSED PARAMETERS.)

Appendix (1) Falaj Al-Sieh Properties Report



Water Assessment Department

Max_levelDrinkWater

ANALYTICAL RESULTS

Parameter	Result	Specification
Pottasium	3.14 mg/l	
Calcium	21.25 mg/l	
Theoretical TDS	386.23 mg/l	Max. 1000
pH	8.65	Min. 6.5 Max. 9.0
Silicon as SiO2	9.13 mg/l	
Bicarbonate	273.28 mg/l	
Total hardness as	206.38 mg/l	Max. 500
Nitrate (N)	0.98 mg/l	Max. 11.29
Fluoride	0.00 mg/l	Max. 1.5
Strontium (Sr)	0.51 mg/l	

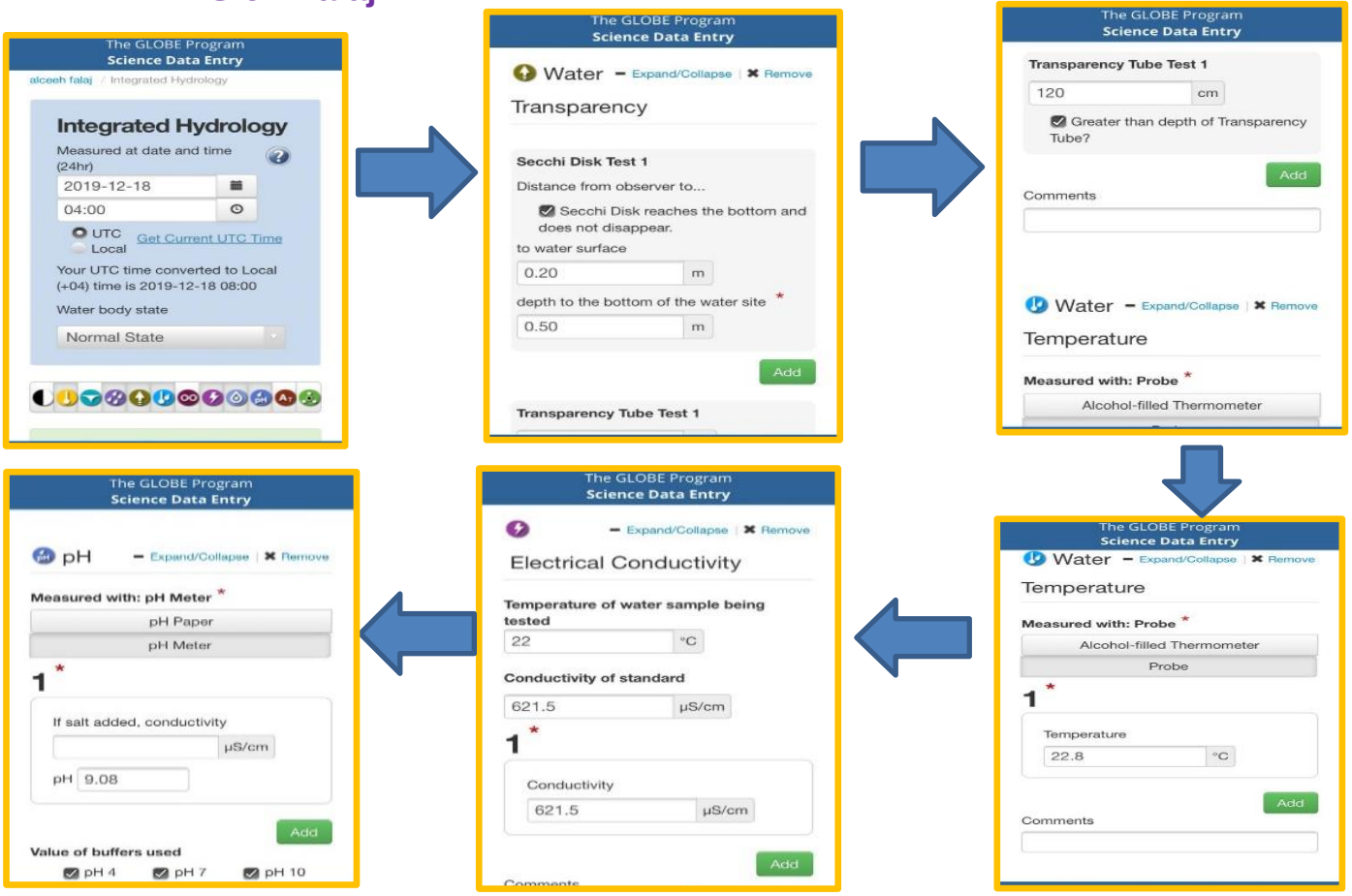
Parameter	Result	Specification
Sodium	41.84 mg/l	Max. 400
Magnasium	36.78 mg/l	Max. 150
Barium	0.09 mg/l	Max. 0.7
Silicon	4.34 mg/l	
Total Alkalinity	224.00 mg/l	
Chloride	60.04 mg/l	Max. 600
Sulphate	73.08 mg/l	Max. 400
Nitrate as NO3	4.34 mg/l	Max. 50
Conductivity	574.00 µS/cm	

Sample has Passed as per Omani Standard 8/ 2012 (for Maximum Level).(VALID

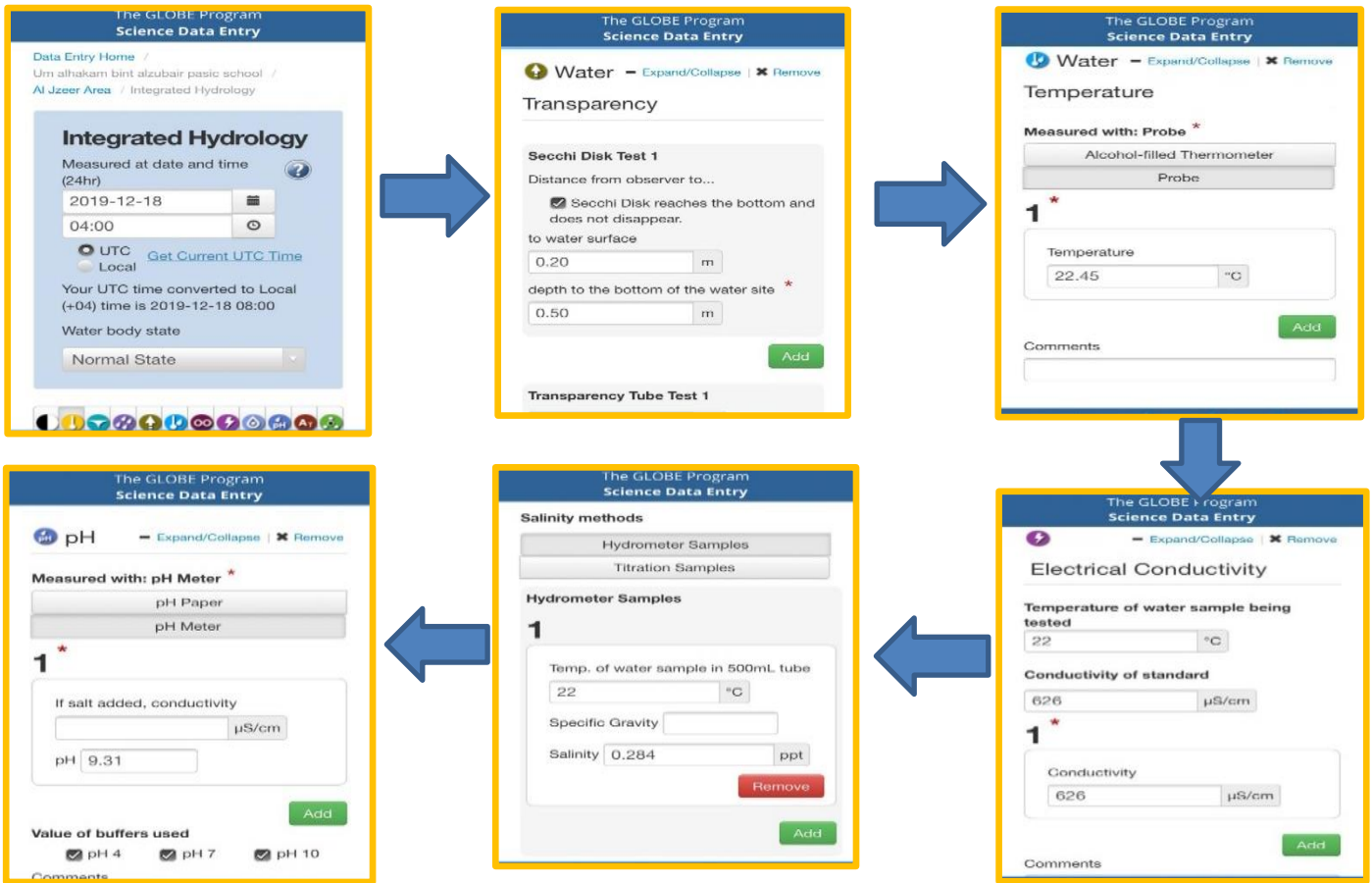
Appendix (3) The Dam's lake Properties Report

Record the data on the website (www.globe.com)

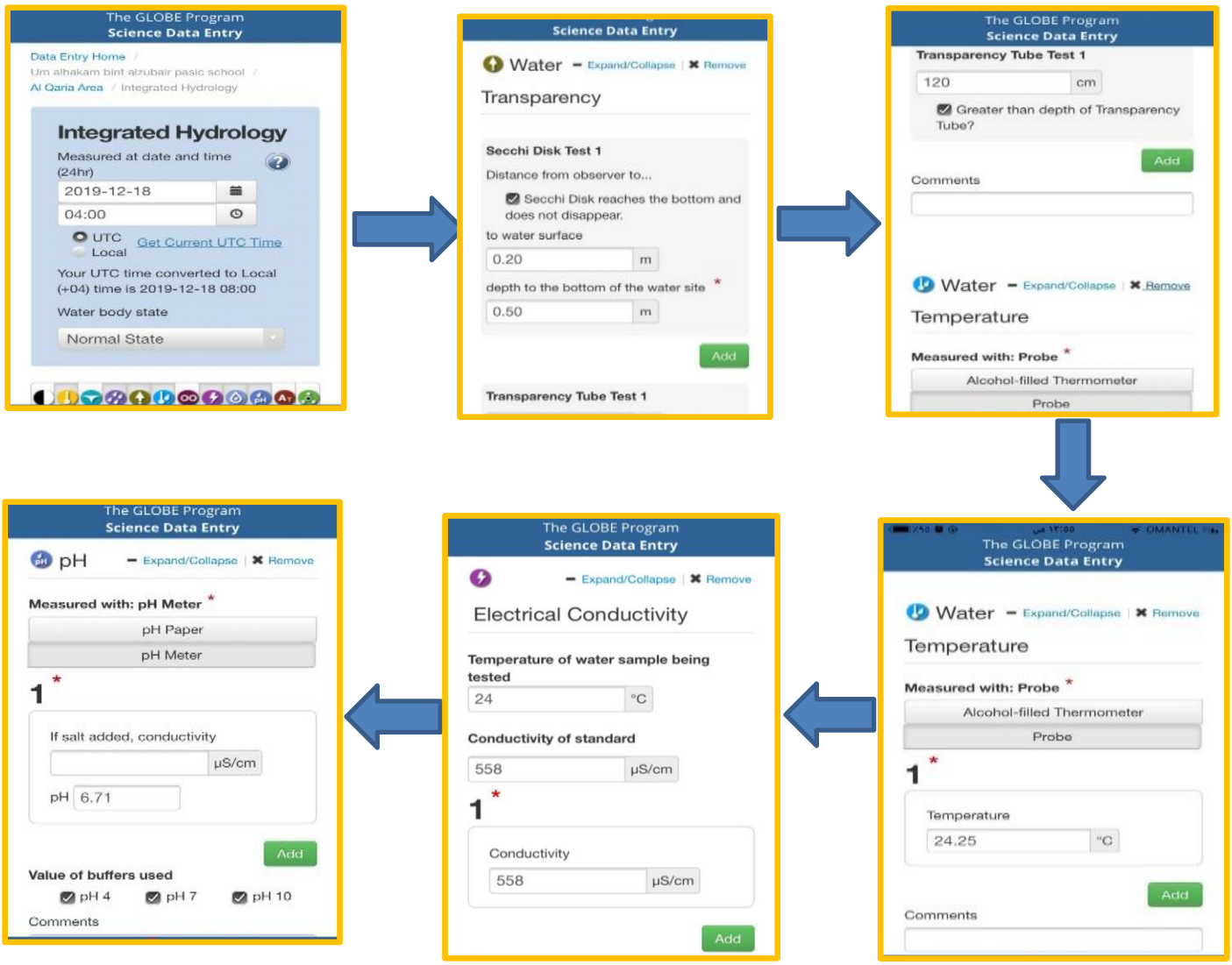
➢ Al-Sieh Falaj:



➢ Al-Jazeer Falaj:



➢ Al-Qarya Falaj:



Interviews:

We made an interview with the father <u>Nasser bin Salim Al-Suti</u>, one of Al-Jazeer region's farmers. And he said:

"Al-Jazeer and Al-Sieh falajs flooded before the construction of the dam. Their source was ongoing valleys that increase when rains fall in multiple areas until reaching the farms area. Therefore, the water is constantly replenished. However, after the construction of the dam, the water has become stagnant for long periods of time and salty that very harmful to the crops."

“The water used to be warm to the crops in the past, and the crops were good. Now, due to the stagnation of the water, the water is very cold, so the crops have started to yield less and some produce rotten fruits.”

We did an interview with the dam director and we discussed how to get rid of salinity and high conductivity of water and finding solutions to stagnation water in and the need to address the competent authorities to solve the problem and they started to open the dam gradually.

❖ **Discuss the results:**

Through the results that we reached from the appendices, tables and previous graphs, it became clear to us that the salinity and conductivity of the water of Al-Seih and Al-Jazeera falajs are high compared to the water of the Al-Qarya falaj. And that the increase of salinity in irrigation water may reduce germination rates and speed, as well as high electrical conductivity. (Anbar University Journal for Banking Sciences - 2013)

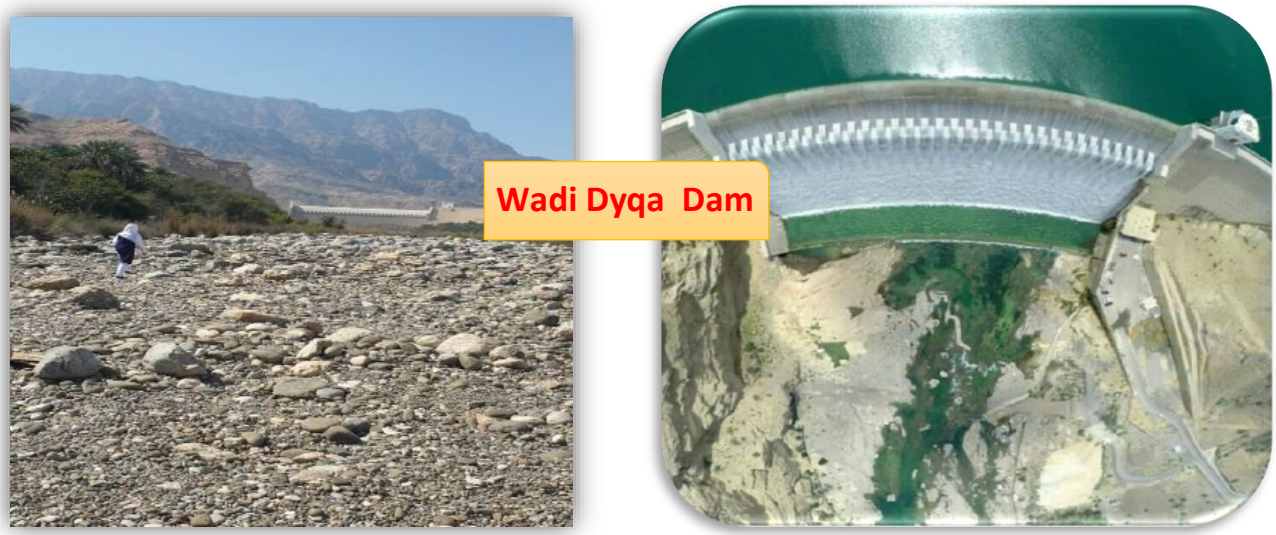
Also, it was found from the results that, the acidity of Al-Seih and Al-Jazeer falajs water has high alkalinity compared to the acidity of the falaj water of Al-Qarya with low alkalinity.

Also, from the comparison between the temperatures of the three regions, it became clear that the recorded temperature of Al-Seih and Al-Jazeer water is mostly low due to the constant stagnation of water because their water Source is the water that comes from the Dam. As for the water of the Al-Qarya falaj, the temperature is higher than that because its’ source is a continuous flow that comes from the highest mountain in the region.

Then we learned about the external factors that could contribute to a difference between the characteristics of the falajs water from a rise in the alkalinity of the water, its salinity, conductivity and low temperature.

And through the interviews, it became clear that after the construction of the dam and the stagnation of water on it caused these differences in the water characteristics.

And the fact that the plant basically needs hot or warm water to grow well and produce high quality crops. And that the reason for the high salinity and acidity of water comes from the constant stagnation of it And the remnants of animals and plants mixed with it were washed away with the valleys running from multiple regions when the rains occurred, which in the end gathered and dissolved in the dam for years which has been confirmed by the reports of the Center for Marine Research and Fisheries Center.



❖ Conclusion:

With the grace of God, we identify the causes of the problem as follows:

External factors, such as the stagnation of the dam's water, are considered the biggest influencing factor in changing the characteristics of the water of Al-Sieh and Al-Jazeera falajs, without Al-Qarya falaj and caused few crops and spoiled some of them. And through interviews with the director of the dam, the people and the results of the research center's experiments to inquire about what was concluded from the impact of the dam's stagnation that led to the increase in salinity, acidity and conductivity of the falajs water and an increase in the percentage of dissolved salts in this water, which

affected its properties, which led to less crop production and the corruption of some of its fruits.

We can apply the research again by watering plants in those towns with the water of the other town and applying a protocol to measure the percentage of dissolved oxygen in the water, which is one of the advanced protocols in the program.

We also advise the people of the region to come up with other ways to adapt with this problem so that their losses in crops are reduced, such as making a dam water heater to bring the water warm and filtering the water.

Likewise, we ask the dam administration to take advantage of the stagnant water for other purposes until it is renewed and does not remain in place due to the risk of the stagnation of water, it may be dangerous if used for drinking because it provides better incubation than running water for many types of bacteria, and other parasites, Which in the future will have a significant impact on humans and the problem will be exacerbated to spread to other countries and the emergence of new diseases.

❖ Thanks and appreciation:

We are pleased to extend a big thanks to everyone who contributed to the completion of this research and they are:

1) **Miss. Nadira Al-Harithiya:**

   The National Coordinator of the Globe Environmental Program in the Sultanate of Oman, which gave valuable information to the protocols of the program

2) **The teaching staff and principal of the school the teacher Aisha Saeed Al Balushi :**

That provided scientific advice and guidance regarding the research.

3) **Mr. Majed Salem Mohammed Al-Busafi:**

The supervisor in charge of the program in Muscat, who did not spare an effort to communicate all that is new of knowledge regarding the research.

4) **The father Nasser bin Salim Al-Suti:**

One of the farmers on the region, we benefit a lot; like the main problems that faces the farmers.

5) **The dam manager, Mr. Said Al-Furiy :**

And who did not hold back with the information that helped us in the research.

6) **The Research and Fisheries Center:**

Marine environment specialists: Mss. Ahlam El-Kharousia and Mss. Aseela Al-Maawali, Engineer: Yahya Al-Wehaibi, and Biologist: Dr. Shamaa' Zaki Aldeen for their cooperation in providing us with scientific information and analysis of the results.

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