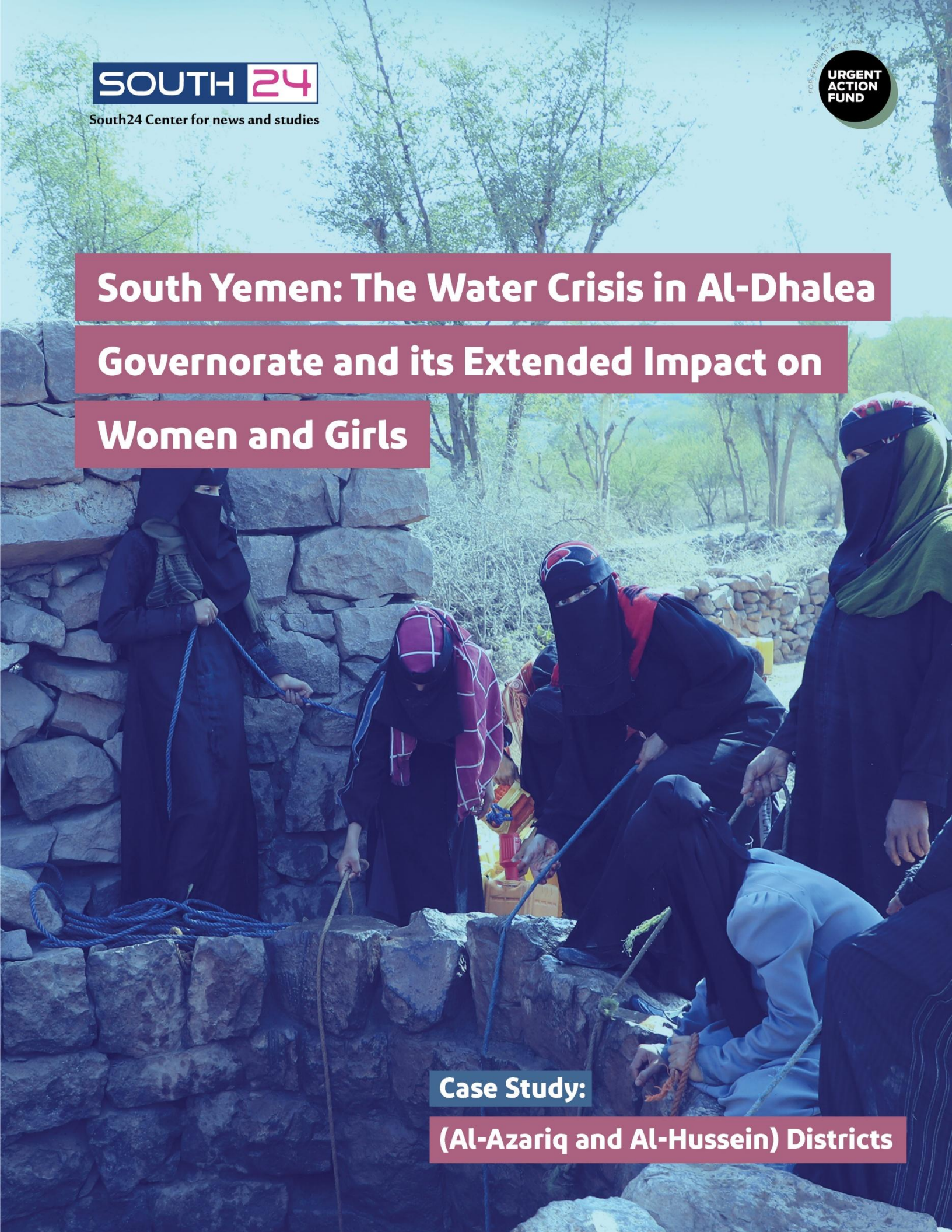


South Yemen: The Water Crisis in Al-Dhalea Governorate and its Extended Impact on Women and Girls



Case Study:

(Al-Azariq and Al-Hussein) Districts

The Water Crisis in Al-Dhalea Governorate and its Extended Impact on Women and Girls

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South24 Center for News and Studies



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Executive Summary

This paper highlights the extreme water crisis in Al-Dhalea, in southwestern Yemen. It focuses on the districts of Al-Azariq and Al-Hussein, due to the dangerous environmental and health conditions prevalent there as a result of the buildup of the crisis, and the irresponsible ways of managing it as well as its impact on the people. The study aims to highlight the basic causes of the water paucity in these two districts, with a special focus on the experiences of women and the challenges faced in accessing water. It also aims to find effective solutions to radically deal with the water crisis, and suggests more practical and sustainable ways to harvest water.

Additionally, the study discusses the status of water resources in the two districts, and the related challenges, with regard to climate change as well as the reasons that have led to worsening of the crisis and its impact on the people. These include the bombing of the Al-Nukhila Dam in Al-Azariq district and the growing dangers behind the indiscriminate drilling of deep underground wells in Al-Hussein district. This has ultimately led to the spread of high levels of fluoride in water that has had a catastrophic impact on people's health. Under these conditions, many people, from both genders, were interviewed for the research to share their experiences and find more realistic solutions for the water crisis in the two districts of Al-Dhalea, the most affected governorate in Yemen.

Methodology

The paper aims to highlight the reality of the extensive water crisis in the two aforementioned districts and its protracted impact on the locals there, especially on women and girls. This is particularly important as there is a lack of quantitative and qualitative studies on the water scarcity issue and its impact on gender-based violence.

The paper is based on some library and field sources. It adopts the descriptive analytical method by relying on quantitative data collected during the field and preparation period. Some references and theoretical narratives related to the water crisis in Yemen were revised, based on news and media coverage as well as reports about the water scarcity in some districts of Al-Dhalea. This is in addition to the accounts of the suffering of women due to the deep disparities between the two genders.

The paper also relied on field data collection tools, represented by interviews and focus sessions through the field team assigned by 'South24 Center', to conduct interviews with 45 women, and separate interviews with 40 men in the two districts. This is in addition to interviewing seven public figures in the city of Al-Dhalea, the capital of the governorate, including officials as well as sheikhs and notables in the districts. Furthermore, interviews were conducted with officials in the Internationally-Recognized Government in Aden besides some experts and academics working in the field and community activists. Most interviews were focused on Al-Dhalea and Aden.

The snowball method (a non-probability sampling method) was used to communicate later with potential interviewees. The male and female participants in the interviews conducted are referred to as sources of information when the context requires this.

Interviewed Categories	Men	Women
Local people (Al-Azariq-Al-Hussein-Al-Dhalea)	40	45
Prominent Tribal Personalities in the two districts	2	-
Officials of Al-Dhalea governorate	7	1
Yemeni government officials in the capital city of Aden	2	-
Security officials	1	-
Specialist experts and academics	1	1
Community activists	2	-
Total number of interviews	55	47

Table (1) Highlights the interviewed categories of people in Aden and the two districts in Al-Dhalea.

Introduction

Water scarcity is an urgent issue that goes beyond geographical and social boundaries and affects the life and the welfare of communities across the world. Yemen, in particular, is facing a serious crisis due to water scarcity, a situation which has been compounded due to the adverse effects of climate change which imposes additional pressure on water resources and territories. This has had a direct impact on people's livelihood and health conditions. The conflict that has wracked Yemen for more than nine years has led to deterioration of the humanitarian situation, worsening of environmental disasters, and the undermining of development. All these challenges have disproportionately affected the lives of women and girls, as they bear the biggest burden of the family's responsibilities.

Watching women and girls venturing out every day to fetch water and bringing it home in large pitchers is probably a common scene in Yemen. However, it has turned into a daily and repeated scene in Al-Dhalea, where women and girls have to trudge kilometers and wait for long hours to bring home water. The bombing of the Al-Nukhila Dam in Al-Azariq district, more than two years ago, has worsened the water crisis for the local people who depended on it for drinking water and agricultural purposes. In addition, the spread of high levels of fluoride in the drinking water in Al-Hussein district poses an unimaginable health catastrophe for the future of the population.

The extreme water crisis in Al-Dhalea, especially in Al-Azariq and Al-Hussein districts, the subject of the study, hasn't only highlighted the blatant failure in managing water resources but has also revealed the drastic disparities between the two genders. The intensification of the crisis has affected women and girls much more. The research paper highlights the serious water crisis in Al-Dhalea's districts and its protracted effects on the local population, with a special focus on the experiences of women and girls and their pivotal role in finding solutions to the crisis.

Part 1 of this paper provides a general background about the water crisis in Yemen, the reasons behind water scarcity, and to what extent other factors increase the suffering. Part 2 provides a comprehensive vision about Al-Dhalea governorate, including location, population, and climate. It also ventures deep into the sources that people rely on to access water, including dams, wells, and water barriers. Part 3 highlights the serious water scarcity in Al-Azariq and Al-Hussein districts. It focuses on the impact of the bombing of the Al-Nukhila Dam on the livelihood of people as well as the heightened suffering of women and girls in dealing with this crisis. Moreover, it discusses the dangerous spread of fluoride and its long-lasting effects on people. Part 4, the final one of this paper, suggests some solutions and environmentally positive friendly practices, some of which Yemen has traditionally relied on for harvesting water.

First: A General Background on the Water Crisis in Yemen

Yemen is suffering from a severe water crisis, due to its location in an arid and semi-arid region of the Middle East. According to the United Nations, 15.3 million Yemenis – more than half of the population – do not have access to sufficient, safe and acceptable water for personal and domestic uses, including drinking, cooking, and sanitation¹.

The scarcity is mostly attributed to the growing population and the misuse of water in the cultivation of some crops such as ‘khat’, a narcotic plant, which consumes about 40%² of the groundwater. The lack of water is considered an important factor behind the instability in Yemen, as around 70 to 80 percent of conflicts in the rural areas are water-related. Across the country, as per estimates by Yemen's Ministry of Interior, conflicts related to water and land kill nearly 4,000 persons annually³.

As Yemen is located south of 25° North latitude, it may become wetter as a result of global warming. However, more rainfall may also lead to more extreme phenomena, with monsoon-like storms occurring off the Gulf of Aden. For example, in 2008, floods hit the eastern side of South Yemen, in the Gulf of Aden, leading to \$1.6 billion in losses, equivalent to 6% of the country's GDP. In a +2 degrees Celsius world, heat waves could hit low-lying coastal areas of Yemen, Djibouti and Egypt. Sea water is seeping into the freshwater coastal aquifers, making the water and soil salty⁴.

The average annual rainfall rate in Yemen ranges between 500 to 800 mm in the highlands, 40 to 100 mm in coastal areas, and 50 mm in desert areas⁵. Unlike other Middle Eastern countries such as Lebanon, Syria, and Egypt, Yemen has no rivers. Therefore, the lack of water in Yemen is far worse than in any other country. According to the UN⁶, the average per capita share of clean water in Yemen is just 198 cubic meters. The water crisis has exacerbated over the past years. The decrease in water resources has pushed Yemeni farmers to increase the depth of wells by about 50 meters since the past 12 years. This has led to decrease in the quantity of water thus collected by two-thirds. This in turn has fueled violent water conflicts among the people.

¹ [Yemen: Warring Parties Deepen Water Crisis | Human Rights Watch \(hrw.org\)](https://www.hrw.org/news/2015/02/10/yemen-water-crisis)

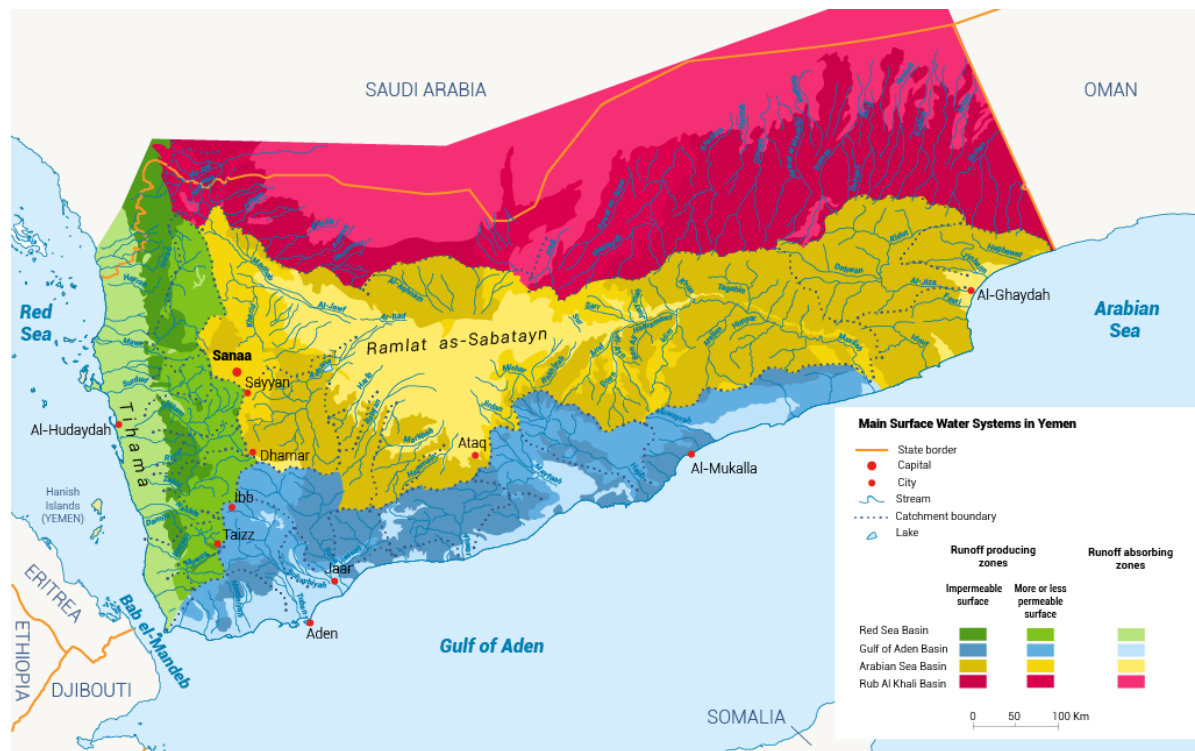
² [Groundwater depletion clouds Yemen's solar revolution \(ceobs.org\)](https://ceobs.org/groundwater-depletion-clouds-yemen-s-solar-revolution/)

³ [Under Pressure: Social Violence Over Land and Water in Yemen \(ethz.ch\)](https://ethz.ch/under-pressure-social-violence-over-land-and-water-in-yemen/)

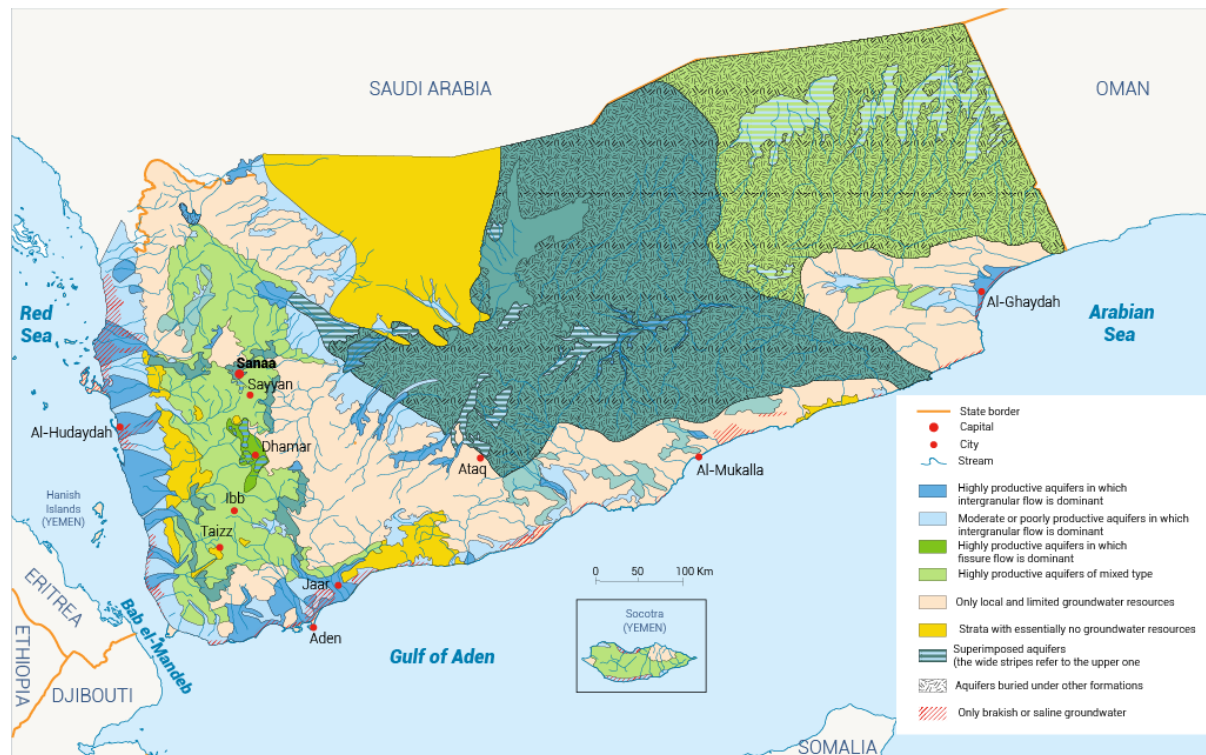
⁴ [Future Impact of Climate Change Visible Now in Yemen \(worldbank.org\)](https://www.worldbank.org/future-impact-of-climate-change-visible-now-in-yemen/)

⁵ The Water Crisis in Yemen: Causes, Consequences and Solutions Global Majority E-Journal, Vol. 1, No. 1 June 2010, pp. 17-30)

⁶ [chapter4.pdf \(un.org\)](#)



Map 1: Major Surface Water Systems in Yemen, Source: @fanak water



Map 2: Yemen's main groundwater basins, Source: @fanak water

The conflict that has wracked Yemen since 2014 between the Internationally-Recognized Government and the Houthis has mainly contributed to the deterioration of livelihood and

humanitarian conditions in Yemen. Hundreds of thousands have lost their livelihoods and are facing the threat of starvation. A report by the United Nations Population Fund⁷ said that Yemen is experiencing the worst humanitarian disaster in the world. The report stresses on the acute lack of water, sanitation and hygiene necessities in Yemen as people badly lack them.

Moreover, the ongoing conflict has caused big damage and destruction to infrastructure, including water infrastructure. This is also a result of the intensive use of landmines, which many times are set off near water resources. According to a report, published by 'Center for Civilians⁸ in Conflict', the Houthis planted hundreds of landmines in 18 of 23 Yemeni governorates during the current war. The landmines were planted in farmlands, along roads, around wells, and inside streams, as well as in schools, airports, hospitals and even houses. In its report in 2022⁹, Human Rights Watch said that "the landmines and unexploded ordnance have killed 9,000 civilians since the beginning of the current conflict".

Going back a little, the drastic change in the policies adopted by the regime of former President Ali Abdullah Saleh, following the 1994 war launched by his army on South Yemen, led to distribution of large tracts of farmland to influential tribal leaders that were subjected to neglect and lack of strategic planning. Saleh focused on enhancing the base of his political support among influential tribal leaders in their areas¹⁰. The goal was to guarantee for himself electoral support from tribal leaders who had strong influence within their areas. In return, these leaders received many privileges and large tracts of state lands which increased their wealth. This enhanced the regime's position.

Most of those who owned these lands used them for the khat trade for domestic consumption, or for growing and exporting fruit crops. For irrigation they relied on deep wells, which are considered the only reliable source of water. Thus, focusing on rain irrigation was neglected. This is despite the fact that rain irrigation is suitable for staple cereal crops that contribute to national food security, mainly maize and, to a lesser extent, wheat, except in Tihama and Wadi Hadramout, where it is grown by thousands of owners of poor¹¹ small holdings.

A- Reasons Behind the Water Scarcity in Yemen

There are several causes that explain the water scarcity in Yemen, including the following points:

1. High Population Growth

Yemen has one of the highest population growth rates in the world, which means an increasing need for water and therefore greater pressure on the existing water resources. Since 1990, Yemen's population has nearly doubled. In 2022, the population in South and

⁷ UNFPA Arabstates | After years of conflict, Yemen remains the world's worst humanitarian crisis, a UNFPA 2021 appeal shows

⁸ CIVIC-Report_Yemen-Climate-Change-and-Protection-of-Civilians_Arabic.pdf (civiliansinconflict.org)

⁹ World Report 2022: Yemen | Human Rights Watch

¹⁰ The Impact of Neoliberal Policies on Yemen's Water Crisis - Helen Lackner (orientxxi.info)

¹¹ Population, total - Yemen, Rep. | Data (worldbank.org)

North exceeded 33 million, according to World Bank figures¹². With the population growing rapidly in cities, coupled with the increasing inflow in the number of refugees arriving from the Horn of Africa, the availability of water has decreased alarmingly, causing a real crisis for the population, especially in densely populated major cities such as Aden and Sanaa.

2. Water Used for Growing Khat

More than half of Yemen's water resources is used for growing khat, a narcotic plant that is chewed by 80% of the population. The leaves of the khat plant, which are chewed, have an effect on the nervous system and give the chewer a mild high. It reduces the feelings of fatigue and exhaustion during the first hours of chewing it. However, this is followed by feelings of depression and worry. Moreover, the cultivation of khat throughout the year needs large quantities of water. This is one of the basic reasons for the water scarcity problem in Yemen. Farmers use underground water for irrigation of their khat crop and repeatedly drill wells in an indiscriminate way to meet the growing demands for khat production¹³. According to the Agricultural Statistics¹⁴, khat growing ranks first in the list of cash crops in Yemen, with the average annual cultivated area reaching 166,557 hectares, out of a total cultivated land of around 1,172,000 hectares¹⁵. Over the past four decades, khat growing areas increased 21 times in 18 of the total 22 governorates in Yemen.

3. Lack of Law Enforcement to Regulate Water Usage

Although the Yemeni government has issued a law that prohibits the indiscriminate drilling of underground wells¹⁶ without taking license, it has failed to enforce it due to the turmoil in the country for the past nine years. As a result, the arbitrary and indiscriminate drilling of underground wells has flourished in several areas. Moreover, the depth of the wells sometimes reaches 1,100 meters to access water, thus also reaching the depths where there is high percentage of fluoride in the water. Many diseases spread due to the high fluoride content that exists in the depth of artesian wells. People in many districts of Al-Dhalea have been afflicted for the same reason. Strictly enforcing the law and implementation of the drilling policy, determined by the government, would reduce the risks of high fluoride on people in areas where illegal drilling of wells is rampant. According to WHO, the safe range of fluoride is at .5-1.5 mg per liter. However, in Yemen it has been found to be at a high of 10-15 mg per liter.¹⁷

4. Prevalent Practices and Poor Water Management

Some farming practices, which largely rely on modern agricultural technologies such as the use of diesel pumps and tubular well drilling technology for irrigation, have contributed to the extraction of groundwater beyond the permissible levels. While this has led to the expansion of cropped areas, it has also contributed to the fast pace of depletion of more

¹² [Population, total - Yemen, Rep. | Data \(worldbank.org\)](https://data.worldbank.org/SH.UV.CD)

¹³ [Khat invades coffee fields in Yemen | News | Al Jazeera Net \(ajnet.me\)](https://www.aljazeera.net/news/2015/11/11/khat-invades-coffee-fields-in-yemen)

¹⁴ [Khat invades coffee fields in Yemen | News | Al Jazeera Net \(ajnet.me\)](https://www.aljazeera.net/news/2015/11/11/khat-invades-coffee-fields-in-yemen)

¹⁵ [Khat cultivation fuels food crisis in Yemen \(scidev.net\)](http://scidev.net/)

¹⁶ [Office of the Attorney General of Yemen \(agoyemen.net\)](http://agoyemen.net/)

¹⁷ [When Water Bends Bones - Medair](http://www.medair.org/)

underground water. Furthermore, the low-interest loans and the cheap diesel as well as the public investment in surface irrigation¹⁸ have drawn several farmers away from the traditional agricultural practices and water management systems. While this has increased surface irrigation, it has led to further depletion of groundwater resources. Yemen has an estimated 100,000 tube wells, of which an increasing number are tapping water from nonrenewable (deep) groundwater resources. Most of the illegal water rigs/wells are found in water critical basins.¹⁹

5. Climate Change

The climate factor has clearly affected water availability in Yemen. According to a report by 'The World Bank's Climate Risk Country Profile on Yemen, 2023, the climate in Yemen will become hotter and drier in the coming years.²⁰ "Yemen is projected to experience spatially and seasonally heterogeneous shifts in extreme heat conditions by midcentury." This will increase possibilities of drought. This is probably attributed to the decline in rainfall rate and its impact on agricultural production in the country. Rising sea levels (due to global warming) have also increased the salinity of aquifers near the coast, leading to deterioration of water supplies in the three major coastal cities in the country – Aden, Al-Mukalla and Hodeidah -- as well as affecting agricultural production in the coastal plains, which have the best soil in the country²¹. The problem of climate change is affecting food and water security in the country. Yemeni academic and environmental expert²² Jacqueline Mansur said: "The unprecedented rise in temperatures has caused drought and has exacerbated the water crisis in the country. This has accordingly led to the decrease of rainfall rate in some areas. Moreover, drought has caused the desertification of many agricultural lands. Because of this, farmers have been unable to benefit from farming which has prompted many of them to sell their farmland and turn them into residential areas."

6. The Decade-long Conflict in Yemen

The ongoing conflict in Yemen between the Internationally-Recognized Government and the Houthis, who launched a coup against the state in 2014, has had an adverse impact on the water crisis and led to a serious humanitarian crisis in many Yemeni areas. Amid the continuing sporadic clashes between the warring parties, the roads connecting a number of cities and rural areas were cut off from each other. The two warring sides also erected many barriers and checkpoints which have hindered ferrying water supplies in many areas. For example, according to 'Human Rights Watch'²³, "The Houthis have weaponized water in Taiz by blocking water in the two basins under their control from flowing into government-controlled Taiz city. Many of the water sources, facilities, and services that Taiz residents previously relied on are inoperable due to war-inflicted damage, salinization issues, or

¹⁸ [Yemen Water Policy - Naama Foundation for Humanitarian Works and Development \(neamafoundation.org\)](https://naamafoundation.org/yemen-water-policy/)

¹⁹ [Water-Availability-Study-in-Yemen.pdf \(undp.org\)](#)

²⁰ [16696-WB_Yemen_Country_Profile-WEB.pdf \(worldbank.org\)](#)

²¹ [Yemen's Environmental Crisis Is the Biggest Risk for Its Future \(tcf.org\)](#)

²² South24 interview with academic and environmental expert Jacqueline Mansour in February 2024.

²³ ['Death is more merciful than this life': Houthi and Yemeni government violations of the right to water in Taiz | HARW](#)

continuous electricity outages due to a lack of fuel that causes water pumps to cease functioning.”

B- The Drivers Behind the Growing Suffering by Water

Due to the deterioration of the economy and the collapse of state institutions as a result of the war, agriculture and the natural environment in Yemen have come under threat. Ministries and recognized-governmental offices which are assigned with managing land and water resources suffer from lack of employees or they aren't functional. The main infrastructure, including irrigation systems, dams, and roads, haven't undergone the necessary maintenance for many years to sustain the seasonal rains. Moreover, cleaning of sewage networks was neglected which has led to the spread of diseases and the pollution of water sources, especially during floods. The lack of effective regulation or governmental oversight has led to water and soil pollution in areas such as Hadramout, where oil is extracted²⁴.

It should be stated that the poor water infrastructure and the lack of safe drinking water have largely contributed to the rise of acute malnutrition in Yemen. Four agencies affiliated with the UN²⁵ (FAO, UNICEF, WFP and WHO) warned that “Nearly 2.3 million children under the age of five in Yemen are projected to suffer from acute malnutrition. Of these, 400,000 are expected to suffer from severe acute malnutrition and could die if they do not receive urgent treatment.”

Moreover, accessing water has become a big source of suffering for many women in Yemen, especially those who have been forced by the conflict to bear the responsibility and venture out to fetch water for their homes. Jacqueline Mansur²⁶ explained that “the suffering of women is impacted by the nature of the geographical areas. The rural women are more affected by water scarcity. They find themselves obliged to cover big distances to bring water from wells or water springs in the valleys. They sometimes even carry water on their heads or backs to the top of mountains. This causes physical damage to them.” She added: “Women who live in cities aren't spared from this suffering either. Water scarcity increases their suffering in carrying out their domestic duties that require much water. This accordingly makes them unable to achieve their tasks or take care of their families properly.” She stressed that “water pollution has caused many diseases among women and their children amid the weak governmental role and its inability to address these problems or reduce them.”

Women, despite bearing the burden of fetching water, are usually kept out from the decision-making process related to water and its different departments. As a result, their needs and special circumstances aren't taken into consideration when preparing water and sanitation programs or in delivering these services. Jacqueline Mansur commented by saying: “The

²⁴ [AGSIW | Conflict and Weak Governance Fuel Yemen's Environmental Crisis](#)

²⁵ [Acute malnutrition threatens half of children under five in Yemen in 2021: UN \(who.int\)](#)

²⁶ South24 interviewed academic and environmentalist Jacqueline Mansur in February 2024.

presence of women in positions related to the decision-making and drawing up of state public policies would help prioritize women's needs at decision tables. Only women can realize the suffering that women in rural areas and cities face due to the water scarcity as well as the health, environmental and psychological damages associated with it.” Mansur believes that the participation of women in these positions would positively impact the water crisis and rationalize its use as well as help in preventing the depletion of water resources. This would also contribute to coping with climate change and reduce its effects in the long run.

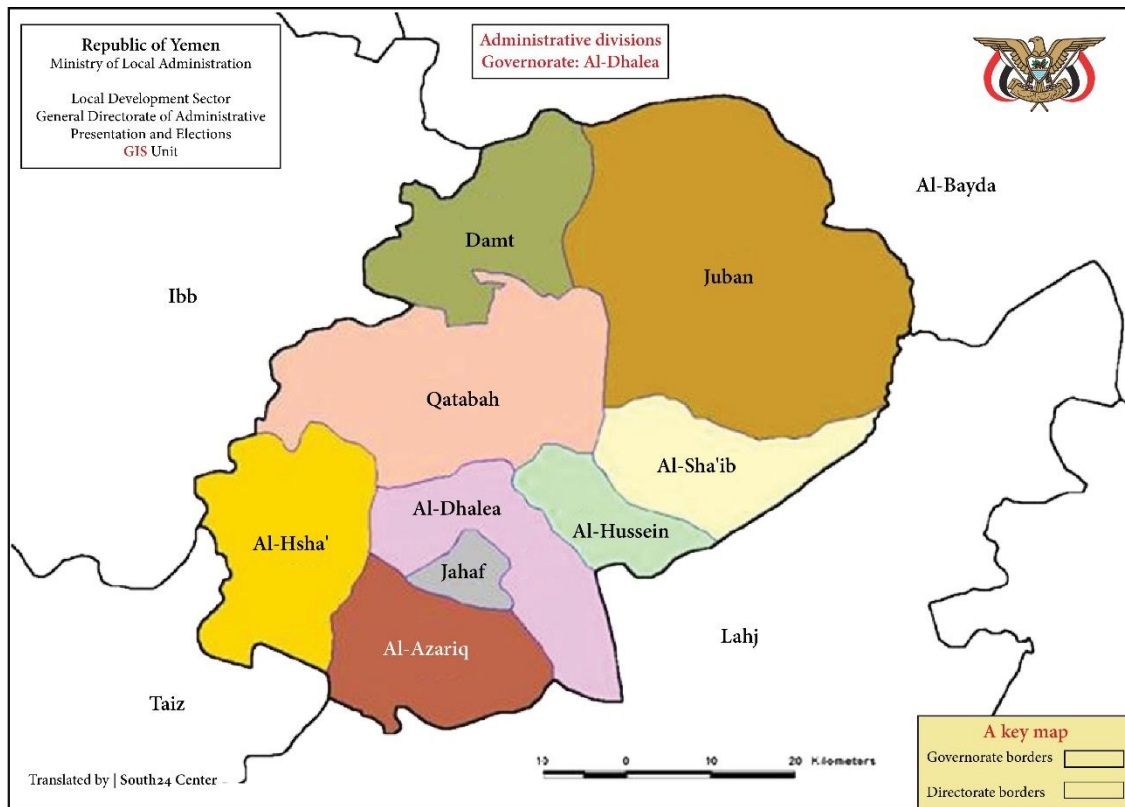
Second: Water Scarcity Haunts Al-Dhalea



Al-Dhalea suffers from dry weather due to the lack of rainfall (File: South24 Center)

1. Al-Dhalea: Location, Population and Climate

Al-Dhalea is one of the Yemeni governorates that was created after declaring the unity between South and North in 1990. It is about 138 km away from the capital, Aden. It is administratively divided into nine districts, including the case study districts of Al-Azariq and Al-Hussein, as well as the city of Al-Dhalea, the center of the governorate. These districts, along with the districts of Jahaf and Al-Shuayb, are considered Southern as they were part of Lahj governorate in the former state of South Yemen before they were joined by four Northern districts and were combined to form one governorate.



Map (3) shows the administrative division of Al-Dhalea following the unity between South and North in May 22, 1990. (Source: The National Information Center – Translated to English by: South24 Center)

According to the general census in 2004, the governorate’s population was 470,564. The population has been growing annually at a rate of 3.55%.²⁷ Keeping this in mind, ‘South24 Center’ has made annual population estimates from 2015 to 2024. This shows that Al-Dhalea’s population in 2024 is approximately 937,772. (See the table)

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Population no.	690,073	714,501	739,794	765,982	793,097	821,172	850,242	880,340	911,504	934,772

Table 2: Estimates for no. of population in Al-Dhalea since 2015 (Source: ‘South24 Center’)

The estimated population of Al-Dhalea is likely to increase further in 2024. The estimated increase in numbers over the past years is 464,208, which is a sizeable figure in comparison with the year 2004.

²⁷ [About Al Dhalea governorate \(yemen-nic.info\)](http://yemen-nic.info)

As regards the population in Al-Azariq and Al-Hussein districts, the estimates, prepared by 'South24 Center', which are based on an annual 3.5%²⁸ growth rate, show that each district has nearly 75,000 people. (See table)

District	Area(km ²)	Population 2004	Population estimate 2024
Al-Azariq	391.00	37,295	75,654
Al-Hussein	198.00	37,118	74,226

Table(3) Estimates for the population numbers of Al-Azariq and Al-Hussein districts between 2004 and 2024.(Source: 'South24 Center')

These population estimates are distributed between males and females but they are slightly in favor of men according to the previous governmental indications.²⁹

The climate condition in Al-Dhalea is dominantly moderate in summer and cold in winter. This is influenced by several factors, including the height of the terrain that varies between 1,311-2,711 meters above sea level. Moreover, this also includes the factor of seasonal wet marine influences due to the movement of southwesterly winds. It is also related to how much the governorate's terrain confronts the incoming winds from the high air pressure area during the spring and summer, mainly located over the Indian Ocean and the humid tropical zone in East Africa.³⁰

Al-Dhalea suffers from dry weather conditions due to rainfall scarcity. Mostly, monsoon rains fall from June to September sporadically. They aren't enough to meet the necessary needs for human and economic use in the governorate. Many people still suffer from the effects of drought and the choking crisis related to scanty water sources, especially those who live in the mountainous areas, where accessing water is a difficult task.

In the context of the climate challenges, Major General Salem Al-Soqotri³¹, Minister of Agriculture and Irrigation, told 'South24 Center' that "the water sector has been largely affected by climate change, especially since Yemen has no rivers and mainly depends on rains, particularly the distribution of rainfall in the agricultural areas". He added that "Al-Dhalea is one of the governorates that faces many challenges due to water scarcity and the mushrooming of illegally drilled wells. This has depleted the underground water."

²⁸ South24 Center also relied on the percentage of the study: The reality of the state of water resources in Al-Dhalea governorate and the natural and human problems suffered by its residents, by researchers: Hussein Muthana Al-Aqil, Muhammad Salem Muhammad Abed. Aden University Journal for Humanities and Social Sciences, 2021.

²⁹ [About Al Dhalea governorate \(yemen-nic.info\)](http://yemen-nic.info)

³⁰ An interview conducted by the Director of the Regional Office of South24 Center, Jacob Al-Sufyani, with the Minister of Agriculture and Irrigation, Major General Salem Al-Soqotri, on March 31, 2024.

³¹ An interview conducted by the Director of the Regional Office of South24 Center, Jacob Al-Sufyani, with the Minister of Agriculture and Irrigation, Major General Salem Al-Soqotri, on March 31, 2024.

2. Wells and Dams in Al-Dhalea

In most of its districts, the locals rely on dams, surface, and underground wells and some small water barriers to tide over drought and provide water for drinking and irrigation. The governorate's people have relied on two ways for drilling wells. The first is the hand-drilled surface wells. This is adopted by some residents to obtain water for drinking and irrigating crops. The second is the deep underground wells, in which people use modern drillers and pumps to extract water. The depths of some of these wells are more than 1,100 m in some districts such as the study case, Al-Hussein. This is dangerous at both the environmental and health levels.

The random drilling of wells without adhering to legal restrictions and at depths beyond the allowed limits has led to many serious problems. These include the growing penetration of the rocky base holding the underground water. This has lowered the water level to extreme depths that can't be reached. This is in addition to the drying up of water in some areas as well as the spread of many diseases due to the increase of fluoride content in the drinking water extracted from deep wells. In this regard, the Head of the Water Department in Al-Dhalea, Omar Abdulaziz³², explained that "the random drilling at great depths has lowered the water level, especially in the wells used for irrigating crops. Moreover, the crisis of global warming and climate change has also led to decrease in the levels of seasonal rainfall in the governorate. This has therefore led to a real water crisis."

'South24 Center' faced difficulty in determining the number of surface and underground wells in the entire governorate. This is a result of the ongoing war and the lack of accurate data due to the arbitrary drilling of wells over the past years. However, we were able to obtain documents, including approximate numbers of underground and surface wells in Al-Azariq and Al-Hussein. We also accessed the number of water barriers and reservoirs in Al-Dhalea in general till 2022. They will be displayed in a subsequent table.

Al-Dhalea is characterized by mountainous terrain and large valleys. According to the Head of the Southern Transitional Council (STC) in the governorate, Abdullah Mahdi Saeed³³, there are two rainwater catchment valleys, Bana and Tebn. There has been no benefit from them as yet. The surplus rainwater heads to the sea after passing Abyan and Lahj governorates. Furthermore, there is no strategic stock of this rainwater as there are no water barriers in the aforementioned valleys and other rainwater catchment areas. First Undersecretary of Al Dhalea governorate, Nabil Qasim Al-Afif³⁴, agrees that the water scarcity issue in the governorate is a thorny one. Over the past five years, the Dhali Aid Project was adopted, supported by some organizations and water reached the city of Al-Dhalea. However, that little water hasn't been enough for even a

³² An interview conducted by the South24 Center descent team with the Director General of the Water Corporation in Al-Dhalea governorate, Omar Abdulaziz, on January 9, 2024.

³³ An interview conducted by the South24 Center Descent Team with the President of the Southern Transitional Council in Al-Dhalea, Abdullah Mahdi Saeed, on January 9, 2024.

³⁴ An interview conducted by the South24 Center Descent Team with the First Undersecretary of Al-Dhalea governorate, Nabil Qasim Al-Afif, on January 9, 2024.

part of the population. He added: “There is no governmental support to contribute in solving the water problem.”

As for the role of the international organizations, Al-Afif added: “They have played a passable role by providing a solar energy system and maintaining some surface wells. They have treated several problems in many areas. However, their role hasn’t covered the demands of the people. Thus, it will be necessary for these organizations to play a bigger role through carrying out sustainable planned projects.” This was confirmed by Ghazi Saleh, General Manager of the Rural Water in the governorate. He said that “the projects carried out by these organizations in the rural areas did not meet the intended purpose. This is because they weren’t carefully planned projects but spontaneous and basic ones. They served as emergency interventions that only covered part of the needs.” He added that “the water demand crisis doesn’t distinguish between urban and rural areas. However, the suffering in the countryside is usually more severe.”

The number of dams, water barriers and reservoirs in Al-Dhalea, according to documents obtained by ‘South24 Center’³⁵, stood at 270 till 2022. These included 151 in the Southern districts, and 119 in the Northern ones. Most of them were funded and implemented through development projects, adopted by governmental bodies; The following table includes the details:

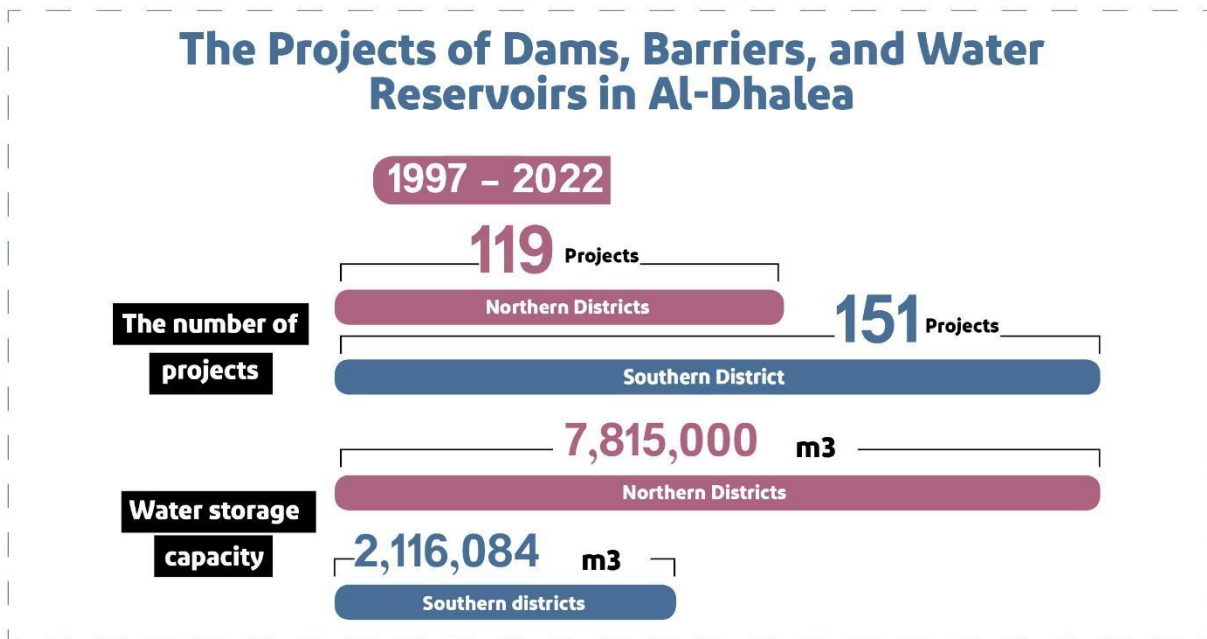
District	Number	Cost	Capacity(m ³)
Al-Dhalea	20	777,663 \$	54,945
Al-Hussein	18	656,588 \$	357,606
Al-Azariq	34	589,441 \$	419,639
Jahaf	37	314,967 \$	336,179
Al-Shuayb	42	1,159,216 \$	20,469
Qatabah	24	137,262 \$	2,033,046
Damt	29	180,993 \$	1,725,294
Al-Husha	35	476,660 \$	975,917
Juban	31	136,145 \$	2,153,497
Total	270	4.428,935 \$	8,076,592

Table (4) shows the number of water barriers and reservoirs as well as the storage capacity from 1997-2022 in Al-Dhalea. Source: The Agriculture and Irrigation Office in Al-Dhalea, (‘South24 Center’)

The aforementioned table shows that despite the bigger number of water barriers and reservoirs being in the Southern districts than the Northern districts, the latter’s water storage capacity is remarkably higher. The storage difference is up to 5,698,916 cubic meters. According to many people, this is attributed to the discrimination regarding the share of development and economic projects among the districts in the governorate. Most projects focused on fields which differ from the Northern districts although there are only four Northern districts against five Southern ones. This is seen as a result of the discriminatory policies, enhanced by the former regime after the

³⁵ Previous source: A study of the reality of the state of water resources in Al-Dhalea.

unity. It has been reflected by giving Northern governorates and districts more attention and privileges than the Southern ones.



A diagram derived from table (4) regarding the shares of dam projects in Al-Dhalea (Source: 'South24 Center')

This has been confirmed by Al-Afif³⁶ who said that “Al-Dhalea hasn’t surrendered to any central policies against it from Sanaa. As a result of the political views of its Southern leaders who opposed the policies of the former regime, Al-Dhalea has been deprived of many strategic governmental projects, including water projects.” He called on the political leadership “to pay attention to the current situation in the governorate to alleviate the daily suffering of the people, especially regarding water”.

In general, the water scarcity has directly affected people in Al-Dhalea at all levels -- livelihood, economic, social, and health. Thus, the locals have lost the meaning of stability. Some have moved from one district to another in search for water, especially as many farms which served as their only source of livelihood have turned into parched fields. Losing livelihood due to drying up of the several water sources, especially for farmers who were displaced from their lands, has exacerbated the factors that already contribute to the conflict.

In this regard, Raed Shaef, journalist and community activist from the governorate’s locals, said: “Some rural areas witness long drought seasons. This forces many people to move and live in the center of the city of Al-Dhalea, which is considered a capital of the governorate. Some of them come from districts such as Jahaf and Al-Azariq. Although the city itself is witness to a water crisis, it is easy to at least buy water from nearby areas, districts, and governorates.” He added: “Those displaced persons are usually able to buy water and live in the city by providing housing rent and

³⁶ Interview conducted by the field landing team of the South24 Center, January 9, 2024.

purchasing daily life requirements. As for those who have higher financial capabilities, they directly move from Al-Dhalea to other nearby governorates such as Lahj and Aden to escape the crises suffered by the governorate, especially the water crisis.”

Al-Dhalea is one of the Yemeni governorates that suffers from water scarcity. According to Water Minister in the Yemeni government, Tawfiq Al-Sharjabi³⁷, the dilemma lies in “the geological and topographic formation in Al-Dhalea which doesn’t allow the refilling of underground water sources or even the surface and near-surface ones. This is in addition to high water consumption related to cultivating khat and for many other agricultural purposes.” He added that “the governmental investment programs in the governorate have been halted since 2014. All the water and sanitation programs are foreign ones which depend on international aid. In 2022 and 2023, we had 46 projects in some districts in Al-Dhalea. However, the situation is still difficult and is complicated more by the assaults on the assets of the department.”

3. The Landmines near Water Sources in Al-Dhalea

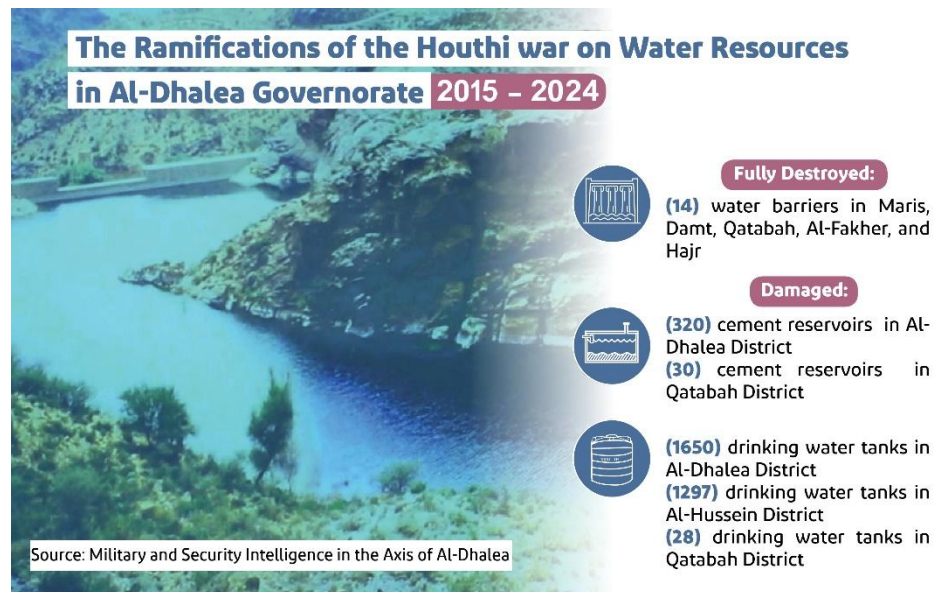
During the war, the Houthis planted hundreds of thousands of landmines in various parts of Yemen, and Al-Dhalea governorate was no exception to its impact on the population and vital resources. The landmines have directly affected agricultural land, livestock and water sources. According to a report published by the Saudi Project for Demining Yemeni Territory (MASAM)³⁸, the Houthis have left minefields in several rural areas, including Qatabah district, north of Al-Dhalea governorate. According to the report, the Saudi project was able to secure 35 "high-impact" mined fields. It explained that these fields were full of mines and explosive devices, and that the team removed more than 1,500 anti-personnel mines, in addition to 400 explosive devices.

Regarding the impact of war on infrastructure and the destruction of underground wells in the conflict and disputed areas in the north of Al-Dhalea fronts, Brigadier General Abdulrahim Al-Tohamy, the Head of Military and Security Intelligence in the Al-Dhalea Axis³⁹, told ‘South24 Center’ that “the Houthis destroyed more than 14 water barriers in the areas of Maris, Damt, Qatabah, Al-Fakher, and Hajar.” He noted that they monitored damages to 350 reservoirs, including 320 in Al-Dhalea and 30 in Qatabah. Brigadier General Al-Tohamy said the number of damaged reservoirs reached 2,930, including 1,650 in Al-Dhalea, 1,297 in Al-Hussein, and 28 in Qatabah in the north.

³⁷ A special interview conducted by the Director of the South24 Center Office, Jacob Al-Sufyani, with the Minister of Water, Tawfiq Al-Sharjabi, on March 19, 2024.

³⁸ [Team 18 Masam clears 35 minefields in Yemen’s Al Dhale and brings the area back to life – Project Masam](#)

³⁹ An interview conducted by South24 correspondent Iyad Al-Hammami, with Brigadier General Abdul Rahim Al-Tohamy, Head of the Military and Security Intelligence Division in the Al-Dhalea Axis, on March 25, 2024.



A diagram that shows the damages caused by the Houthis during the war years against the water sources and reservoirs in Al-Dhalea: 'South24 Center'

Al-Tohamy explained that the destruction of wells as a result of the indiscriminate bombing by Houthis “has largely affected farms and residential areas. This has increased the suffering of people and magnified the tragic displacement and poverty. As a result, many people have lost hope to access pure water which is necessary for life. The Houthis intentionally mined and blew up a number of water pumps in 2020 in Al-Kharaza, west of Qatabah. The heavy torrents in Al-Dhalea have swept dozens of mines and explosive devices, planted by the Houthis in previous times, toward the agricultural areas and farms. This poses a great threat to farmers and citizens for the coming future decades.”

The paths of the torrents and water channels coming from Ibb toward Al-Dhalea are the most important water tributaries to feed the underground storage of Al-Dhalea, according to Al-Tohamy. However, he stressed that “these natural features have now become a big threat as they have turned into confrontational lines, due to the deployment of Houthis on the western bank of these valleys. Now these water channels don’t help people in Al-Dhalea to benefit from rainfalls as before.” Al-Tohamy pointed out that “the direction of rainfall has also changed from Al-Dhalea to Lahj. Moreover, this has made people unable to set up aqueducts or convert the path of torrents toward the farms of Al-Dhalea which was previously getting large quantities of this water.”

Third: Al-Azariq and Al-Hussein are Prime Examples of the Suffering Caused by Water Scarcity



Al-Azariq and Al-Hussein districts during the tour by the field team affiliated with 'South24 Center' (Source: 'South24 Center')

This section discusses the water scarcity affecting two of the most Southern districts - Al-Azariq and Al-Hussein -in Al-Dhalea. It highlights the choking water scarcity crisis suffered by their people and its negative effects on society. This requires a wider understanding about the existing problems. Furthermore, officials in the relevant bodies at the local level, the state institutions in general and interested international organizations need to urgently pay attention to the situation. The suffering of the women and young girls in Al-Azariq, their crushing responsibility to fetch water, the spread of fluoride and its severe effects on the inhabitants of Al-Hussein, and the impact of this on women and children in particular will require a vision and urgent solutions for improving the deteriorating environmental and health conditions. The situation has also directly affected the economic and social life in the two districts and will produce long-term ramifications on the physical and psychological health of the governorate's residents.

1: Al-Azariq District

Al-Azariq is one of Al-Dhalea's districts in South Yemen. It is located to the north of the capital, Aden. It is one of the biggest districts in the governorate, in terms of area and population after the city of Al-Dhalea, the capital of the governorate. The area of the district is 391 km² which includes 55 small villages. The economy of Al-Azariq mainly depends on agriculture, as the district is characterized by its fertile soil and also its livestock⁴⁰.

Al-Azariq has suffered mostly as a result of governmental neglect and the lack of public utility services. The inhabitants are beset by malnutrition, diseases, and epidemics. The livelihood and

⁴⁰ [Al-Azariq district, Al-Dhalea gate to the north \(ayam.news\)](#)

health conditions have increasingly worsened after the eruption of the conflict in Yemen since 2014. However, its people proudly boast that they were the first who resisted the oppression of the former regime and confronted the Houthi aggression on Al-Dhalea governorate.



An aerial drone image showing the gate of Al-Nukhila Dam in Al-Azariq after being damaged as is visible in the photo, Jan. 2024 ('South24 Center')

A. The Bombing of Al-Nukhila Dam

On December 12, 2022, anonymous gunmen bombed the Dam of Al-Nukhila in Al-Azariq. The bombing caused major damage to a large part of the dam. The barrier collapsed and water leaked from it extensively. It is one of the biggest dams in Al-Dhalea governorate. It was built by the Ministry of Agriculture and Irrigation in 1997. The authorities haven't yet said who were behind the bombing despite realizing the wide feelings of resentment among the people at the bombing and its aftereffects.

In the first days after the bombing, some sources⁴¹ said that persons affiliated with "extremist" groups had bombed the dam. This happened a few months after similar offensive operations were executed by these groups against persons affiliated with the security bodies in the governorate⁴². However, it became clear later that the bombing of the dam was carried out by people belonging to the same area due to repeated disputes over water. They were later arrested by security bodies. According to Al-Afif, "the district's local authority was directed to determine

⁴¹ [Extremist gunmen blow up a water dam in al-Dhale \(sa24.co\)](https://south24.co)

⁴² [Al-Qaeda in Yemen Again: Why Now? \(south24.net\)](https://south24.net)

the affected families and villages that have been harmed by water on the path of the dam to find other solutions. These include setting up water transportation channels heading to these areas to feed the wells with water.”



A close-up photo showing the sabotage of the Al-Nukhila Dam in Al-Azariq, January 2024 ('South24 Center')

In general, dams, water barriers, surface wells, and some domestic ponds are considered the main driver of water sources in Al-Azariq. The Al-Nukhila Dam is one of the biggest and most important dams at the level of the governorate, regarding its size and storage capacity, estimated at 22,440 m³ and built at a cost of 34 million Yemeni riyals. People rely on it to irrigate their nearby agricultural lands in Al-Daen, Kerd, and other areas that mainly depend on this dam. The dam also served as a tourist destination for Al-Dhalea's residents, especially during the rainfall season.⁴³

According to a statement released by the Director of the Agriculture and Irrigation Office in Al-Dhalea⁴⁴, the bombing hit the top third of the left side of the dam. This led to heavy leakage of water. Another bombing hit its base and affected the dam's right side. This led to the spillage of a large quantity of water. The Office Director estimated that 80% of the dam is currently damaged.

The table below shows the number of wells, harvest reservoirs and the domestic water ponds, being relied on by people in Al-Azariq and Al-Hussein. Some residents rely on 'ponds' or their individual reservoirs for their houses. These are often created using cement and store between

⁴³ [AL-Nukhila Dam in Dhalea ... a tourist destination frequented by many - YouTube](#)

⁴⁴ A document obtained by South24 Center can be found in the study's final appendices section.

10-12 thousand liters of water. However, the majority of people mainly depend on plastic barrels whose capacity varies between 1,000-3,000 liters.⁴⁵

Number	Al-Azariq	Al-Hussein
Underground and surface wells	70	55-60
Harvest reservoirs	20	3
Domestic ponds (Individual reservoirs for houses)	250	100

Table (5) (Source: 'South24 Center', field information obtained by the landing team)

During some interviews conducted by 'South24 Center'⁴⁶ local residents said that once Al-Nukhila Dam is rebuilt it would help in providing water for the people. However, they linked its repair to some key points, foremost of which is finding solutions to treat the disputes among individuals over the dam water. This is in addition to the fair distribution of its water among people as well as reducing the use of the dam water to irrigate the khat plants which exhaust much of the water at the expense of individuals and the nearby communities. Like other districts of Al-Dhalea, Al-Azariq is famous for its intensive cultivation of khat which is able to sustain the lack of water for a longer time and brings a lot of money for its farmers. This makes many people dispense with cultivating the useful food crops, most of which are ultimately damaged by the lack of water.

Asked whether the specifications of the Al-Nukhila Dam match the required standards, engineering expert Mohammed Naji Hassan explained that the dam was designed by a specialized experienced team. He added that "the engineering, technical, biological, and hydrological standards of the dam are proper. However, any dam can be largely damaged by a bombing at a distance of 500 m. So, imagine what can happen if the body of the dam itself is bombed." Engineer Naji stressed that the "Nukhila Dam has been completely destabilized from top to bottom. Thus, the maintenance process is no longer enough. It should be demolished and rebuilt again due to the massive cracks and shaking. The costs of maintenance are much higher than building it from scratch."

Among the several challenges that residents face, whether due to the lack of dams or wells or scarce rainfall, is a severe shortage of sheep herding areas as most agricultural lands have been exposed to desertification. Sheep rearing is a source of income for many people. The desertification of agricultural land is in addition to the spread of some diseases and epidemics due to the pollution of water in some barriers and surface wells in the areas.

Some locals spoke about the disastrous health situation in Al-Azariq due to the pollution of water in some of its areas. For example, in November 2023, local authorities in Al-Dhalea⁴⁷ warned that

⁴⁵ Raed Shaif, community activist and journalist from the South24 Center Descending Team, in January 2024.

⁴⁶ South24 Center's field team conducted separate interviews with a number of local residents in Al-Azariq district in Al-Dhalea governorate, on January 7, 2024.

⁴⁷ [Health disaster threatens Al-Azariq district in Al-Dhalea governorate \(adengad.net\)](https://adengad.net)

the Houthis intentionally throw garbage, waste and sewage remains in the rainwater streams flowing downwards from Ibb governorate, controlled by them, to Al-Dhalea through Al-Azariq district.

In mid-2022⁴⁸ residents complained about the spread of strange skin diseases, similar to monkeypox or chickenpox⁴⁹. The spread of these diseases was seen in the villages of Thadan and Amor. The latter is a remote area located in the farthest borders of Al-Azariq. It is about 50 km away from Al-Dhalea, the capital of the governorate. People there particularly suffer from the flow of flood waters polluted by the sewage water coming from Ibb. This has become a threat to many residents despite the repeated warnings. This was confirmed by Dr. Mohsen Al-Bahli, Deputy Director of the Public Health Office in Al Dhalea⁵⁰, who said: “The polluted water flowing in from Ibb governorate towards Azraq and Hajar have brought with it more diseases among people, including fever and severe diarrhea.”

Suggesting proposals to address the issue, Nabil Al-Afif said that they have “a strategy for a study project to provide water from ‘Ghayl Torsa’ (highland spring flow) in Al-Azariq. Different areas can benefit from this. However, this requires a very huge budget and supportive bodies that work to implement it. It is a strategic project that can even reach the city of Al-Dhalea”. Al-Afif also proposed the establishment of big water barriers to catch surface water as well as drilling new wells in the basin of ‘Hajar’ to feed the city of Al-Dhalea and the nearby areas. He called for providing solar energy projects to operate surface wells. He believes that the water problem can be dealt with in an emergent way in many areas in the governorate.

Minister Salem Al-Soqotri talked about his ministry’s plan regarding the agricultural areas that need big funding. He stressed on “the importance of creating a different culture for farmers to reduce water waste, cease drilling of random wells, and eliminate flood irrigation”. He believes that “farmers can use better irrigation methods such as drip irrigation. This policy would force khat farmers to resort to irrigation using costly fuel. This would force them gradually to abandon khat cultivation and replace it with other crops such as coffee and other cash crops.”

B. Women and Girls and the Hardships of Accessing Water

Women are largely affected by the water scarcity crisis. They are usually responsible for fetching the water. Sometimes, the distance they have to trudge to obtain water exceeds one kilometer. Women are nearly twice as likely as men to bear the responsibility of fetching water, according to a report released by UNICEF⁵¹. It added that “Women and girls aged 15 and older are primarily responsible for water collection in 7 out of 10 such households, compared with 3 in 10

⁴⁸ [Aldhalea .. the spread of skin disease in Al-Azariq district | Al-Mashhad Net \(almushahid.net\)](#)

⁴⁹ Chickenpox is a disease caused by the varicella-zoster virus. It causes itchy rashes with small blisters filled with fluid. Chickenpox is very easily transmitted to people who have never had the disease before or have not received the chickenpox vaccine. Source: Mayo Clinic.

⁵⁰ An interview conducted by the South24 Center descent team, with the Deputy Director of the Public Health Office in Al-Dhalea governorate, on January 8, 2024.

⁵¹ [Women and girls bear brunt of water and sanitation crisis – new UNICEF-WHO report](#)

households for their male peers. Girls under 15 (7%) are also more likely than boys under 15 (4%) to fetch water. In most cases, women and girls make longer journeys to collect it, losing time in education, work, and leisure, and putting themselves at risk of physical injury and dangers on the way.”

In a pointer to the immense suffering of women in Yemen and Al-Dhalea governorate in particular, the issue of women being the ones to fetch water is seen as natural and common. Women and girls bear the responsibility of walking long distances to get water, due to the remoteness of the water sources from their areas of residence. In Al-Azariq district in particular, women and girls often walk distances of more than 1.5 kilometers. They repeat this four times a day, going back and forth. In addition to spending their entire day collecting water, they are at increased risk of potential waterborne diseases, especially as they are the first to collect and use it in their homes.

In terms of drought caused by water scarcity, academic and environmental expert Jacqueline Mansur said that "women rely upon farming land and raising livestock in rural areas. However, the severe drought in some areas has caused the death of livestock, and some farmers have been forced to sell them because they are unable to provide fodder for them. This has deprived many women of their livelihood and an important food source for their families."

Many people rely on animals, such as donkeys, to transport water to ‘ponds’ or household reservoirs, especially in the poor areas of Al-Azariq district, where some residents cannot obtain water through water tank vehicles (Al-waitat) which are special trucks used for transporting water. Purchasing such water is costly for many families, as each water tanker costs about 100,000 Yemeni riyals, equivalent to 70 dollars⁵². It is too expensive for most people in the region to afford due to the deteriorating economic conditions. Another dilemma they face is that the animals are overloaded with two sacks, and sometimes four, which are equivalent to 20-40 liters. Accordingly, they sometimes faint and even die, due to the heavy load on their back.

⁵² Interviews conducted by the South24 Center Descending Team with 20 women in focus sessions in Al-Azariq district, on January 7, 2024.



A girl from Al-Azariq takes the donkey to the well to load water in two 20-liter plastic sacks. (File: South24 Center)

Some women shared their views on what happened to the Al-Nukhila Dam. They said that "the destruction of the dam hasn't affected daily life in terms of accessing water, as a certain group of people has continued to take over the water resources at the expense of other groups and villages, for a long period of time." Others added that "the wrong use of water, by allocating large quantities to plant the khat shrubs, has led to the depletion of water. People who live in neighboring areas lose out on water due to this, in addition to the fact that the dam is not connected to networks and water supplies that can reach homes and villages to be used."⁵³

According to some residents, people who own farms near the Al-Nukhila Dam have benefited the most from the dam's water, as their farms are supplied with pipes connected directly to the dam for continuous irrigation. This is in addition to benefiting from the dam's water for their daily needs. Residents living at a distance from the dam complained that they do not benefit from the dam's water as they do not have the means to get the water supplied to their homes, unlike those who benefit by living near the dam. This in itself is a cause of constant conflict between community groups.

For women of Al-Azariq, their daily suffering continues -- as it did before, during, and after the dam collapse. Access to water from other sources has become extremely difficult due to the

⁵³ Ibid.

depletion of groundwater wells and the lack of water barriers and dams. Additionally, residents rely more on surface wells in Al-Azariq than underground ones, but these dry up quickly due to the lack of rainfall. Many of the women interviewed believe that rebuilding the dam would be beneficial if it is expanded and completed and connected to water networks extended to homes and villages for the benefit of residents. They also said that building new dams as well as water barriers near each residential block will be of great benefit to the people of the district, and women and girls will not have to fetch water from far away.

A number of men in Al-Azariq agreed that concrete tanks can be built or plastic ones can be provided near houses, which can be connected to networks of pipes extending from the roofs of houses to the inside, especially houses with solid and non-earthen roofs. Houses with earthen roofs can be significantly damaged by water leakage.

Among the most tragic accidents related to the water scarcity crisis in Al-Azariq are the repeated cases of women and girls falling into deep wells during fetching water. In an interview conducted by 'South24 Center', Sufyan Al-Hanashi, a journalist and one of the residents of the region, talked about more than 30 such deaths during the past two years from various villages of the district, as a result of the sudden sliding of some women and girls inside underground wells and ponds⁵⁴. So far, there are no accurate statistics in the district about these fatal falls. However, residents participating in field meetings reported many cases. They include, for example, four young girls who fell at once in a water barrier in the Qard area while trying to collect water. This is in addition to the death of a number of children in separate accidents in the areas of Al-Darb, Al-Haql and Hamada after falling into water ponds. Furthermore, there are cases resulting from stampedes, which usually occur near some reservoirs and water barriers in order to obtain water, according to residents.



South24 Center for News and Studies

⁵⁴ The researcher interviewed Sufyan al-Hanashi, a journalist from Al-Azariq district in Al-Dhalea



A group of women in Al-Azariq in Al-Dhalea gather near a well to fetch water. Source: 'South24 Center', January 7, 2024.

C. Domestic Violence Related to Water

For women and young girls, life can be very stressful. In addition to their daily domestic duties, they bear the onerous burden of fetching water. According to a joint UNICEF/WHO 2022 report⁵⁵, the fact that women and girls are primarily responsible for domestic chores and caring for others – including cleaning, preparing food, and looking after the sick – likely exposes them to diseases and other risks to their health without the protection of handwashing. Additional time spent on domestic chores can also limit girls' chances of completing secondary school and gaining employment.

Many of the women interviewed in Al-Azariq complained about domestic violence as a result of the psychological pressure they are subjected to for their responsibility to bring water for the family and livestock. This is in light of the men's preoccupation in earning their livelihood. These pressures usually result from conflicts between two groups over the access to wells and dams and the refusal by some members to allow a neighboring community to share the water. Such conflicts are reflected on women in the home, in terms of being blamed by the family head if they don't bring enough water sometimes. Women and girls living in rural areas often face more psychological and emotional harm associated with water scarcity than in urban areas. This compounds the pattern of discrimination and violence that already exists against them. A woman

⁵⁵ [Women and girls bear the brunt of the water and sanitation crisis, according to a new UNICEF-WHO report \(who.int\)](#)

in Al-Azariq said: "Women and girls are forced to make difficult and fateful decisions, such as going for early marriage and school dropout, as a result of their preoccupation with having to fetch water several times every day."

Dropping Education for Water

Kawakib, a 12-year-old girl from Al-Masnaa village, Al-Azariq district in Al-Dhalea, found herself compelled to drop school despite her high level of intelligence. This was a result of the tough living conditions due to the drought in the district. She is an example of thousands of girls who have left education. She told 'South24 Center' that she dropped school despite her high level of intelligence and big ambitions, due to the hard living circumstances and having to bring water for her family as a result of the water scarcity. She said: "From dawn to Isha prayers (at night), girls compete to bring water for their families." She has been tasked by her family to bring water. She trudges long distances on foot every day to bring water. She revealed that many of her peers have fallen into wells due to the stampede around water sources. She feels sorrow at the painful reality of the district as a result of the severe drought.

Early Marriage

Um Ali, a young woman from Al-Azariq district in Al-Dhalea governorate, was married off at the age of 13 because of the difficult conditions in her area. She said though she escaped from the task of fetching water, which she had to do day and night before her marriage, her early marriage represented the worst kind of suffering. She became pregnant early and had to take responsibility of rearing her children at a young age, and as a result was deprived of her childhood and education as well. Um Ali suffers from malnutrition. Moreover, her cesarean delivery has weakened her body. Um Ali said: "Early marriage is a tragedy and a crime of which I bear the consequences even today. Regardless of the difficult circumstances, we must think about the consequences and ramifications of marrying off girls early. We must not accept this mistake, which leads to psychological and physical torment of the girls."

A 2003 study found ⁵⁶that nearly 40 percent of the married young women live with their husbands' families in Yemen, compared to 60 percent of married young women who move to live

⁵⁶ [A Gendered Crisis: Understanding the Experiences of Yemen's War - Sana'a Center For Strategic Studies \(sanaacenter.org\)](#)

with their families after marriage. This includes women marrying older men. Families who bring home a new woman or girl through marriage benefit from assigning them with additional household tasks along with being responsible for fetching water.

In terms of health challenges, one female respondent during the focus session with 'South24 Center' said that "in addition to the hardship of fetching water, women suffer from health problems related to personal hygiene due to the lack of clean water. They purify and clean the water using cotton strainers or by boiling the water at high temperature to purify it from dust and impurities and kill the bacteria." Many participants considered this home-based process to be arduous and stressful that consumes a lot of time, not different from the effort they have to put outside their home to bring water.

Regarding the extent to which women and girls are subjected to sexual harassment while fetching water in Al-Azariq, some of them said that they were not assaulted or harassed during the process of fetching and transporting water as they were accompanied by 'mahram'⁵⁷ who accompany a group of them, and sit in a place close to them to ensure their safety from any stranger who may harm them.

It is difficult to mathematically assess in numbers whether there is gender-based violence in the districts of Al-Dhalea. This is due to the lack of comprehensive data amid the absence of specialized and in-depth studies that can be relied on to assess the annual increase. Projects in Al-Dhalea governorate are often limited to awareness-raising activities about the dangers of violence against women along with encouraging them on how to report cases of domestic violence and child marriage, besides their social and other problems. It is important to conduct quantitative and qualitative studies and research that analyze and evaluate gender-based violence issues in the governorate, along with providing solutions and remedies.

2: Al-Hussein District

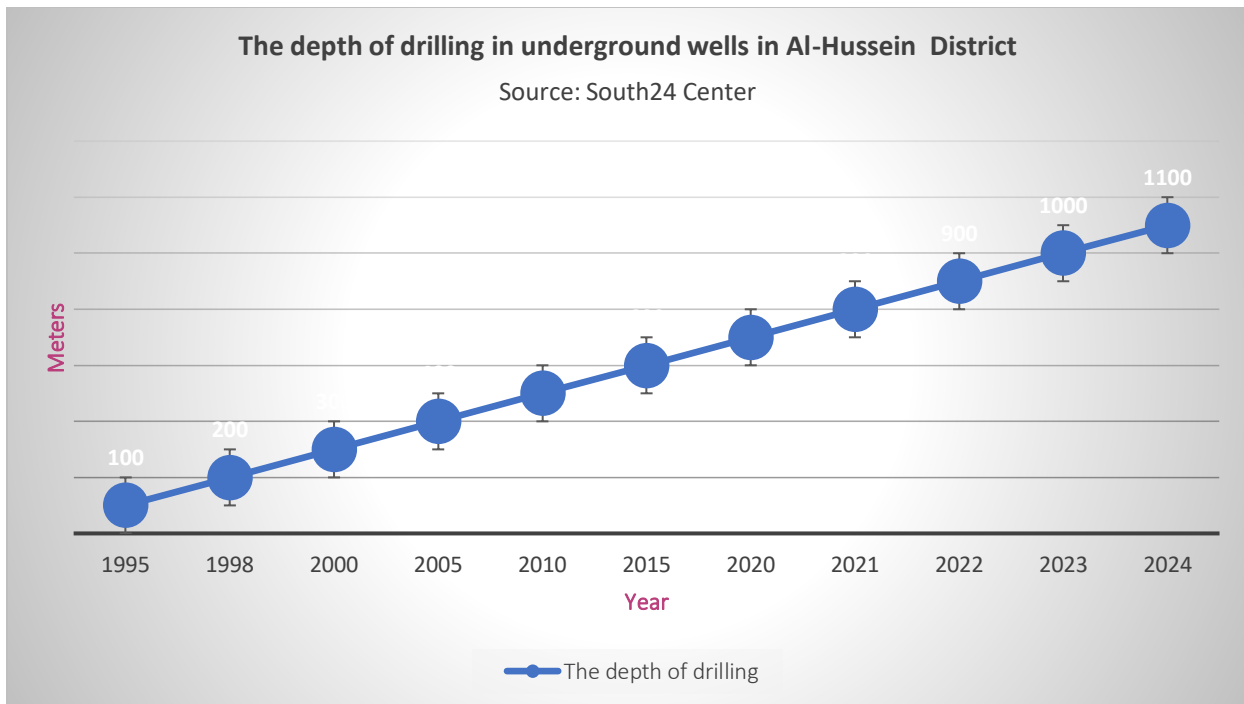
Al-Hussein is one of the southern districts of Al-Dhalea, with an area of 225 km². It includes a number of villages, the most important of which is Al-Hussein. Moreover, 'Jabal Harir' is one of its most important heights. It includes more than 26 villages. Most of the villages there are famous for planting coffee.

Despite this, the district and its villages suffer from bad roads, scarcity of drinking water, poverty, unemployment and stalled development and service projects.

⁵⁷ In Islamic law, mahram is defined as the father, son, brother, uncle, nephew, nephew, uncle and brothers by breastfeeding.

A- The Disastrous Effect of Excess Fluoride on People

In one of its 2022 reports⁵⁸, 'South24 Center' highlighted the danger of high levels of fluoride spreading in the water in Al-Hussein. The scarcity of water and the lack of rainfall in the district in recent years have led residents to deepen the drilling of underground wells to great depths, some of which have reached depths of 1,100 cubic meters, according to some residents. This excessive increase in drilling to great depths results in extraction of water containing high levels of fluoride, and then using it without first purifying it from fluoride as required has caused a health disaster in the district, especially in the village of Marfad in Al-Hussein.



Graphic presentation showing the increased depth of drilling in underground wells in Al-Hussein district in Al-Dhalea governorate (Source: South24 Center)

Fluoride is a natural mineral found in soil, rocks, and water. Consuming too much of it can lead to major health problems, including teeth discoloration and decay, skeletal weakness, neurological problems, hypertension, epileptic seizures, low fertility rates, and more. Water fluoridation is also likely linked to Attention Deficit Hyperactivity Disorder (ADHD), according to a study published in the *Journal of the International Environment*⁵⁹. Doctors in the towns of Marfad, Khubar, Al-Uqla, and Lashoub in the district of Al-Hussein noticed many abnormalities in children, including bone curvature and visible changes in tooth enamel. The high fluoride levels in the water changed the color of their teeth and sometimes led to complete decay.

⁵⁸ [Al-Dhalea and the Fluoride Tragedy: Drinking poison is not an option \(south24.net\)](https://south24.net)

⁵⁹ ["Traumatic" side effects caused by fluoride on public health - RT Arabic](#)

In 2016, the Health Office in Al-Hussein district conducted questionnaires for several population segments in more than one village. This came after the emergence of noticeable health cases that frequently accessed hospitals and suffered from similar symptoms. They also wanted to assess whether the spread of cases was the result of certain viruses or some disease. After several visits and tests conducted of residents, the Director of the Health Office, Mohammed Abdullah Muthana, says that they confirmed that the health issues were directly related to the drinking water, extracted from deep underground wells. On this basis, the Health Office team conducted field surveys to take water samples from those wells for testing.

According to the Director of Health, the normal range of fluoride in water should be around 1-1.5 milligrams per liter of water (mg/L), but in some villages of Al-Hussein, the samples that were examined contained dangerously high levels.

Habeel Jabr	Khobr	Lakmat Lashoub	Mirfad
17 mg/l	13 mg/L	09 mg/L	12 mg/L

Table (6) shows the high levels of fluoride discovered during the field survey of some villages of Al-Hussein district through the Health Bureau.
Source: A meeting conducted by the South24 Center descent team with the Director of the Health Office.

In 2017, the Health Office team conducted field surveys of the number of people affected by tooth decay and osteomalacia (softening of the bones) in the villages of Al-Hussein, as a result of drinking groundwater and its impact on their health. They found that the number of infected people reached 1,020, out of a sample of 1,330 of both genders. These samples included entire families, some of which had more than 10 affected members. The age group between 5-20 years⁶⁰ had the lion's share of these diseases. They included school students who suffered from broken bones in many cases. They said that they suffered fractures after falling down while running or falling from their classroom seats. Undoubtedly, it was a shocking outcome, according to the Health Director, especially as some cases turned into permanent disability.

⁶⁰ The epidemiological surveillance report for the year 2018, showing the number of field surveys for dental caries and rickets in Al-Hussein district, obtained by South24 Center from the Director of the Health Office in the governorate.



Cases of bone curvature in children in Al-Hussein district, as a result of drinking water with high fluoride levels. Source: South24 Center, 8 January 2024.

In 2019, the Health Office team met with a number of organizations working in the field of water and environmental sanitation, to explain to them the catastrophic health situation in Al-Hussein and how it was set to worsen in the following years. However, some organizations began to break their promises of helping to mitigate the situation, according to the Health Office, due to the expected high costs of the proposed desalination projects. The Health Office also wrote to the government authorities and the Social Fund in the capital, Aden. But their pleas were met with negative responses, citing the plea that the water treatment projects were difficult and costly for them to bear in light of the exceptional circumstances that the country was going through.

Consequently, in the second half of 2021, the Public Authority for Rural Water Projects in Al-Dhalea conducted surface and groundwater inspections for several districts in the governorate, including (Qatabah, Al-Hussein, Al-Azariq, Al-Shuayb), as part of the water quality monitoring project with the support of UNICEF and the World Health Organization. The examination showed a frightening rise in fluoride levels in groundwater, determined between 1.56-13.33 mg/L, showing a 60% rise, in 45 samples taken out of a total number of 61 samples. The samples taken from surface water showed levels that varied between 1.62-6 mg/L, a rise of 47%, in 75 samples taken out of a total of 130. Notably, Al-Hussein is recorded as among the most affected districts

due to high percentage of fluoride through tests that were later conducted on people as well as its impact on their health directly⁶¹.



A child in Al-Hussain district showing signs of severe damage to his teeth that have turned black, as a result of the fluoride-saturated drinking water. Source: South24 Center's field team, January 8, 2024.

In interviews conducted by 'South24 Center' with some participants in Al-Husseini, they mentioned that the high percentage of fluoride in drinking water has negatively affected all spheres of life in their villages, due to the increase in diseases, including kidney failure, which in many cases leads to death. Some agricultural land has also been damaged as a result of being irrigated with this water, and livestock have been similarly affected. According to doctors in the district⁶², the increase in the concentration of fluorine in water that residents drink leads to constant pain in the joints and muscles, fatigue, and muscular spasms. This is alongside the aforementioned bone and tooth deformities.

In an interview with 'South24 Center', Minister of Water Tawfiq al-Sharjabi confirmed once again that "the most prominent problem facing Al-Dhalea is the high levels of fluoride in the water,

⁶¹ A document obtained by "South24 Center" from the Director General of Rural Water in Al-Dhalea governorate, showing field surveys of surface and groundwater samples, conducted during 2021.

⁶² [Investigations and dialogues - a health tragedy and serious environmental pollution.. groundwater well water with a high concentration of fluoride leads to the emergence of many diseases \(tahdeeth.net\)](https://www.tahdeeth.net)

which have harmful effects on the women's fertility, bones, teeth, hair, besides many other aspects. When wells are drilled at extended depths, whether public or private, and they do not adhere to the given standards, we pull out the equipment and demolish the wells, because the water extracted from these wells are required to have specific concentrations."



Nour Mansser was born with congenital malformation and permanent disability, in Al-Hussein district, February 2024 (File: by Ayad Al-Hammami, South24 Center)

Fluoride Toxicity is Disabling Children, Crushing their Dreams

Nour Mansser, a child from Al-Hussein district in Al-Dhalea, was born with congenital foot deformity which has prevented her from walking and practicing daily activities like other children of her age. Drinking water with high fluoride levels in the Nour community has seen many women give birth to offspring with similar conditions, including children with disabilities, rickets, or dental deformities. Nour has not surrendered to despair; she has expressed herself with optimism, hope, and a positive spirit, with the help of her family's constant support and follow-up in ensuring she gets the needed treatment.⁶³ People in the villages of Al-Hussein know how dangerous this water is, but the need for water and their helplessness hasn't left

them with many options.

Osteoporosis in Children

Ahmad Al-Sayed, a 13-year-old boy from a village in Al-Hussein district, lives with his six brothers, menfolk and women family members. Because of his tough living conditions and poor food security, his source of drinking water is mostly from artesian wells. The people of the village, where Ahmad's family lives, transport water to their village using water tank vehicles (locally known as waitat) or in the traditional way (transportation on donkeys). Due to the scarcity of water, Ahmed had to drop out of school in order to provide water for his family. However, his suffering from osteoporosis in his feet, due to the high percentage of fluoride in the water his family drinks, makes him hobble with difficulty

⁶³ The interview was conducted with Nour's family by South24 Center's correspondent Ayad Hammami, on March 24, 2024. The reporter asked permission from the family to publish Nour's photo.

during his long walks. Ahmed's parents went for a surgical procedure to treat their son's feet, but it failed. Currently, Ahmed's health condition is very poor due to the family's financial situation, as well as his inability to integrate with other children of his age, as a result of the permanent disability to his feet.

The departure of Médecins Sans Frontières (MSF), which was providing important health services for many years, from Al-Dhalea governorate in November 2018 is an additional problem that has weakened the already dilapidated health sector there. The organization said in a statement that it had closed its humanitarian project in Al-Dhalea after their unit was subjected to violent attacks and security incidents⁶⁴.

The problem of high fluoride in the water of Al-Hussein district isn't the only dilemma. Some residents in villages have resorted to turning abandoned groundwater and surface water wells into sewage tanks. This has led to the polluted sewage water seeping into the ground and mixing with the potable groundwater, thereby transferring the dangerous pollutants, whether organic or chemicals (such as soap and industrial detergents), or some types of harmful bacteria and microbes⁶⁵, to the water which is extracted, eventually leading to the spread of many diseases.

B. Deep Water Crisis in Al-Hussein

The water scarcity crisis in Al-Hussein district is no different from the rest of Al-Dhalea. Al-Hussein and Al-Azariq are among the districts most deprived of water, due to the severe drought coupled with the lack of any minimum emergency water solutions. The dire situation in Al-Hussein is also characterized with the spread of community conflicts over water. Dr. Mohammed Qaed Hassan⁶⁶, a social figure in Al-Hussein, told 'South24 Center' that "the conflict over water is spreading in the district due to the large number of indiscriminate drilling of deep wells. This brings in water with high fluoride levels, leading to the spread of many diseases. Besides, some people get more water than others, which leads to tensions and conflicts. They are trying to resolve these conflicts through dialogue and the equal distribution of water among people."

Salah Mohsen Al-Hariri, a senior official of Al-Hussein district, said⁶⁷, "We witness daily conflicts among citizens because of water scarcity. Some citizens want to get water in order to irrigate their agricultural lands and for their cattle. Others are looking for safe and clean drinking water, amid fear of water contamination. These things lead to a state of permanent conflict that we seek to address." Hariri added that the district "suffers from random drilling, due to the lack of control over the licensing process by the relevant authorities. This leads to confusion and ongoing

⁶⁴ [Al Dhale: governorate of minimum services \(south24.net\)](https://south24.net)

⁶⁵ [Al-Dhalea calls for help \(aljayyam.info\) - Arabic](https://aljayyam.info)

⁶⁶ An interview conducted by South24 Center with Dr. Mohamed Hassan Qaed, a social figure in Al-Hussein district, in person, on January 8, 2024.

⁶⁷ An interview conducted by the South24 Center team, with the Officer of Al-Hussein district in Al-Dhalea, Salah Mohsen Al-Hariri, in person, on January 8, 2024.

disputes, especially on the issue of deep drilling of underground wells, which in turn leads to the spread of birth defects among a large number of children."

One of the biggest challenges facing Al-Hussein district is the government agencies' lack of interest in the situation prevailing there. According to Ghazi Seif, Director of Rural Water in Al-Dhalea, "The poor monitoring of water quality as a result of the lack of a government budget, and the growing price of test detectors have added to the dilemma." In interviews conducted by 'South24 Center' in Al-Hussein, one resident said: "The role of international organizations is limited, almost non-existent, and we are very frustrated as no one is responding to our repeated calls."

During the meeting, some residents suggested that in order to improve the water crisis situation they need to build large dam projects that feed the district in general, as well as build medium water reservoirs and barriers that feed each village or group of nearby villages. This is in addition to building small cement tanks or 'ponds' for each family that does not have the financial capacity. This will help residents collect water in the rainy season and benefit from it during the dry ones.

C. The Impact of Water Scarcity and Pollution on Women and Girls in Al-Hussein

Women and girls in Al-Hussein suffer increasingly from deteriorating health, due to the lack of safe or clean drinking water. This is along with their basic suffering of being responsible for fetching water. Khadija, 35,⁶⁸ one of the teachers interviewed by 'South24 Centre', said: "Women in Al-Hussein face several psychological, physical and emotional challenges, as they bear the full responsibility for providing water to their homes and livestock. This causes them great psychological pressure, especially when they are sick or pregnant while undertaking this task." She added that "the water scarcity crisis has negatively affected the education of girls in Al-Hussein. They study until the early school stages, and then drop out because they are busy fetching water for their families, especially girls from poor families where they cannot provide water alternatives that would prevent the girls from leaving school."

The experiences of women in Al-Hussein regarding the effects of water contamination on people's health indicate that the situation is precarious in the district, especially in the village of Marfad. One of them said: "Most children in the area suffer from bone changes and severe tooth decay due to drinking water with high fluoride concentration," adding that "this is not limited to children, as most members of society of both genders suffer from the same problem. There is no single home in Al-Hussein without that. This is in addition to the fact that many women at marriageable age show tooth deformities, and this is increasingly affecting their psychological status. When we go to the doctors, they advise us to try to change the drinking water to a healthy

⁶⁸ An interview conducted by the South24 Center team in Al-Hussein, with teacher Khadija, on January 8, 2024.

mineral one, which is difficult to obtain on a daily basis, especially since most families are not financially able," she said.

The worsening water situation in Al-Hussein district that has made fetching water the top priority has negatively impacted the lives of many women, even at the social and communication level. This is because visits by family, neighbors and friends have decreased, due to women preoccupied with spending most of their time outside the house looking for water sources during the day. After getting the water, they then spend more time at home cleaning the water of impurities during the evening.

Furthermore, Al-Hussein's women also face significant challenges related to their reproductive health. In addition to being exposed to various diseases due to water pollution, they give birth to children with severe calcium deficiency, as a result of drinking water during pregnancy with a high percentage of fluoride, which consequently affects the health of their children. The lack of water also significantly affects women's personal hygiene. One woman said during the focus⁶⁹ session: "Women are physiologically different from men. They need water more than men for their personal hygiene, in addition to being mothers and caring for their children." She added: "In all the scenarios women will be stressed, either because of the scarcity of water and the hardship in obtaining it, or its being contaminated if available." One study shows⁷⁰ that environmental pollutants, including water, cause hormone disruption in women, leading to blood cysts and impaired ovule production and reproduction, the same problem that reduces fertility in men who drink contaminated water.

It is interesting to note that many families use fetching water to promote early marriage for their daughters.⁷¹ "One of the most negative effects that some families resort to is that some mothers who have no daughters make their sons marry early in order to make it easier to bring water to the house," said one of the participants in the focus session. She added, "Some families push their sons to marry more than one girl to facilitate the task of providing water, especially if the girls are from relative's families. Sometimes the girls are threatened with being returned to their parent's house if they refuse to fetch water." This is one of many examples of gender-based violence, to which women and girls are continuously exposed to in the rural areas of Al-Dhalea governorate.

There are additional forms of violence faced by many women and girls, including violence by partners, child marriage, or sexual harassment during fetching water, that should be considered.⁷² One female interviewee said: "We hear about many cases of harassment while fetching water in Al-Hussein district, but most of these cases are so far of verbal harassment. It is not unlikely that they will develop into something unpleasant if the situation continues as it is. The presence of some water tanks and barriers that have been provided in some well-to-do

⁶⁹ An interview conducted by the South24 Center team with 20 women during a focus session in Al-Hussein district, on January 8, 2024.

⁷⁰ [How does water pollution affect our sexual and reproductive health? \(vdlnews.com\)](https://vdlnews.com)

⁷¹ An interview conducted by South24 Center's field team with 20 women in a focus discussion session in Al-Hussein district, on January 8, 2024.

⁷² *ibid.*

families, have helped to reduce the phenomenon of harassment, as those women no longer have to go out for long hours to fetch water." In fact, many women avoid talking about gender-based violence, especially the phenomenon of harassment, because of the stigma associated with it, especially in many conservative rural communities. This situation is not limited to Al-Dhalea only, but includes Yemeni women in general.

Cases of violence against women and children can increase the rate of morbidity or mortality. Contaminated water supplies and poor sanitation are among the main sources of diseases and its transmission between women and children. Diseases such as cholera, dengue fever, jaundice, acute diarrhea, among others have caused the death of a large number of children in particular. While communicating with the Al-Hussein Health Office,⁷³ 'South24 Center' obtained statistics from 2017 about the number of suspected cases in some villages of Al-Hussein, during November and December as given below:

Type of disease	Cholera	Measles	Diphtheria	Whooping cough	Jaundice	Chicken Pox
Number of cases	156	43	12	4	7	36

Table No. (7) shows the number of medical cases during the months of November and December 2017. Source: Health Office in Al-Hussein for South24 Center

As for the number of cases of tooth decay and rickets, they are as given below:

Month/Year	Number of villages	Number of rickets cases	Number of tooth decay cases
Nov. 2017	5	20	355
Dec. 2017	13	262	94
Total	18	282	449

Table (8) shows the number of cases of rickets and tooth decay, during November and December 2017. Source: Al-Hussein Health Office, 'South24 Center'

The statistics mentioned above, as well as previous statistics in the paper, show that the documentation and careful monitoring in Al-Hussein district stopped in 2017. So far, it is not known to what level the many diseases and deaths and various cases with bone and dental deformities in the district has reached after more than five years without monitoring. The health and environmental situation in Al-Hussein is certainly hazardous, requiring immediate and emergency treatments to save the population, especially women and children, who bear the brunt of fetching water, that is contaminated and handling and drinking it on a daily basis.

⁷³ A graphic report showing the number of cases in the villages of Al-Hussein district for the months of November and December 2017, Source: Al-Hussein Health Office.

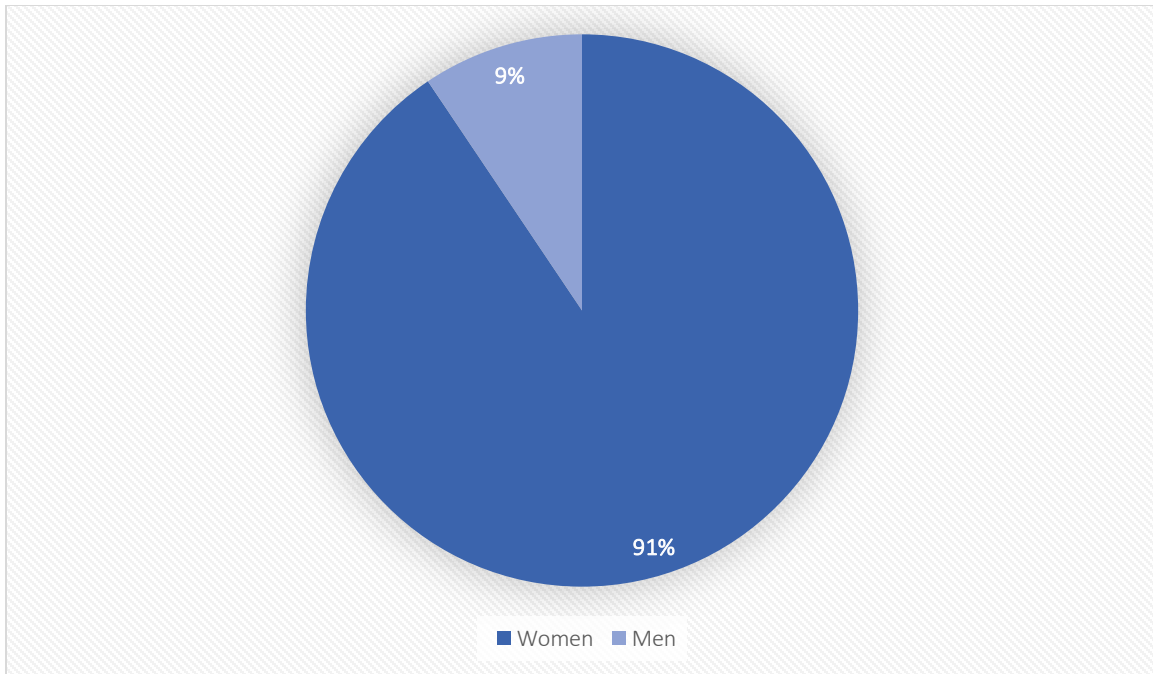
During the interviews, local residents in Al-Hussein tried to propose simple solutions and treatments through some of their observations. A woman said during the focus session⁷⁴, that "some well-off families have made concrete underground tanks in their homes or on the top of their roofs. This provides them with water permanently. We noticed that girls in homes that have water are regular in education and have reached advanced educational levels, as well as being active in community activities. This factor is also witnessed in houses situated near water tanks that have been constructed by some international organizations in partnership with the people." Fatima, one of the women who participated during the focus session, said: "I saw a large number of girls go to school because of the availability of water in their homes or because the tanks are close to them, and I even saw teachers and nurses from these same houses, unlike other houses that do not have water."

Some residents of Al-Hussein also suggested the importance of constructing dams in the villages of the district in order to ensure access to clean water. "This will help improve the health status of the population, solve the problem of desertification of agricultural lands, and feed many livestock," said one of them. Some residents said that drilling of more underground wells without finding solutions to purify the water would worsen the health situation, as relying on surface wells should be enough currently. Ghazi Saleh, Director General of the Rural Water, suggested that "the basic solutions lie in stopping the random drilling of wells and preventing the excessive depletion of water for agricultural purposes." He added that "the construction of reservoirs and water barriers, or the so-called traditional 'caravans', will partially solve the water crisis."

Minister of Agriculture and Irrigation, Major General Salem Al-Soqotri, spoke about a number of projects that the ministry is working on despite the country's fragile economic situation and the insufficient budgets. He pointed out that Al-Dhalea has some of his focus at this stage. The projects include "the completion of two water barriers that are under construction in Al-Hussein and Al-Nashea [Al-Thubah area in Al-Dhalea district]. There are also various projects in animal health and livestock. This is along with projects that support the agricultural sector in general. They include international and regional projects or those that come from the ministry directly."

This study, conducted by 'South24 Center', relied on a segment of the local population in Al-Azariq and Al-Hussein, including (85) persons from both genders. On whether women and girls bear the brunt of fetching water, or do men share the responsibility as well, 90.58% indicated that women and girls bear the greatest responsibility for fetching water; 9.42% said it is a shared burden between men and women, especially since many young males accompany their families while fetching water as 'mahrams' sometimes.

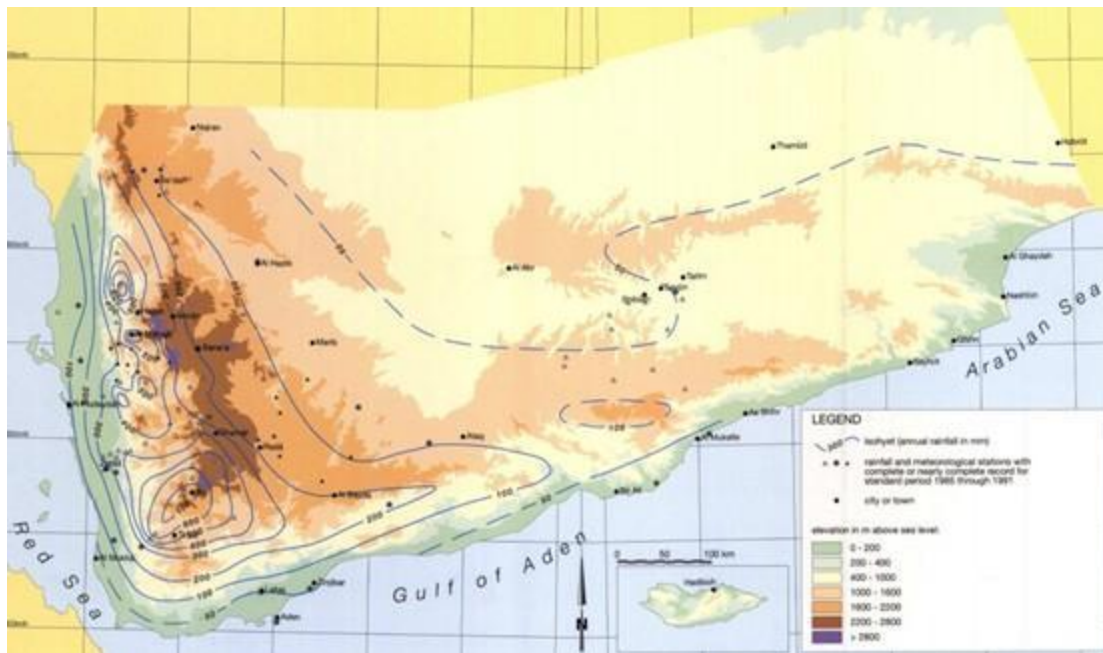
⁷⁴ South24 Center" interviewed 20 women during a focus session in Al-Hussein district, on January 8, 2024.



A graphic that illustrates the responsibility of fetching water: Source: 'South24 Center'

Fourth: Environmentally Friendly Practices of Water Harvesting

Yemen currently lacks effective infrastructure to harvest rainwater and also recharge the groundwater. Water that could be used to refill groundwater or for agriculture production is lost and flows into the sea without it being channeled and benefiting from it. This is despite the fact that storing rainwater correctly would solve many of the aforementioned problems related to water scarcity. The challenges of rainwater harvesting in Yemen are among the factors that sometimes hinder the completion of these projects. They include, for example, lack of data and information, conflict between upstream and downstream users, lack of investment in rainwater harvesting techniques, climate variability, and unequal distribution of rainfall, among others.



Map No. (4) showing the level of rainfall in Yemen, Source: Hydrology of Yemen

However, rainwater harvesting has proved to have a positive impact on the environment by preserving water resources, reducing overexploitation of traditional water sources as well as limiting soil erosion and degradation. This is in addition to social and economic benefits. Rainwater harvesting in Yemen can be very important given that:

- It will solve the problems of water scarcity, especially in the mountainous areas for 77% of the population in Yemen.
- Rural communities rely mainly on agricultural production from terrace farming.
- It will provide effective alternative access to water in large and scattered areas.
- It will help in solving the water issues in areas with difficult topographic conditions.
- It will help in preserving Yemen's heritage, including the traditional structures, ancient irrigation techniques, dams and water reservoirs to collect water.

In this section, we will shed light on some positive conventional techniques that were previously used in water harvesting, and can be applied in many areas of Yemen. This includes the study case districts of Al-Dhalea governorate. This aims to reduce the water scarcity suffered by the population there.

1: Conventional Rainwater Harvesting Techniques

1- Terrace farming

Terrace farming was practiced widely on the mountain slopes in ancient Yemen. This technique has continued today even in the rugged and gentle mountain slopes, and is very effective. Rainwater is allowed to collect in the terraces cut into the sides of mountain slopes, and this soaks into the soil. The terraces are bordered with small walls on the edges that prevents water runoff. These small walls also prevent damage to the terraces from runoff.

2- Open and Closed Tanks and Basins

Cistern construction is a very ancient method and has been used in Yemen for hundreds of years to conserve rainwater. For example, the historic cisterns in Aden are ⁷⁵one of the most important huge watersheds to conserve the annual rainwater in the city. They are used for drinking and irrigating farms. However, with the renewal of water networks and the reliance of the city and other governorates on groundwater wells, coupled with the overexploitation of the drilling layers across them, the importance of cisterns has declined and they have been neglected, despite their effectiveness.

3- Rainwater Harvesting

This method is characterized by its low cost. Moreover, its design is relatively simple. It also consumes less time and needs fewer labor to construct. Furthermore, the water rights are allocated and clear. It is also more appropriate for mountainous areas where groundwater sources are difficult or non-existent, and where central water supply plans prove very expensive, in terms of implementation, operation and maintenance. Rainwater is the only possible way to provide water supply in this form. Therefore, it is considered more sustainable. Additionally, the quality of water is better than other water sources in rural areas. Keeping rooftops clean can be much easier than maintaining hillsides and catchment areas.

⁷⁵ [Aden: Archaeological and historical monuments threatened \(south24.net\)](http://south24.net)

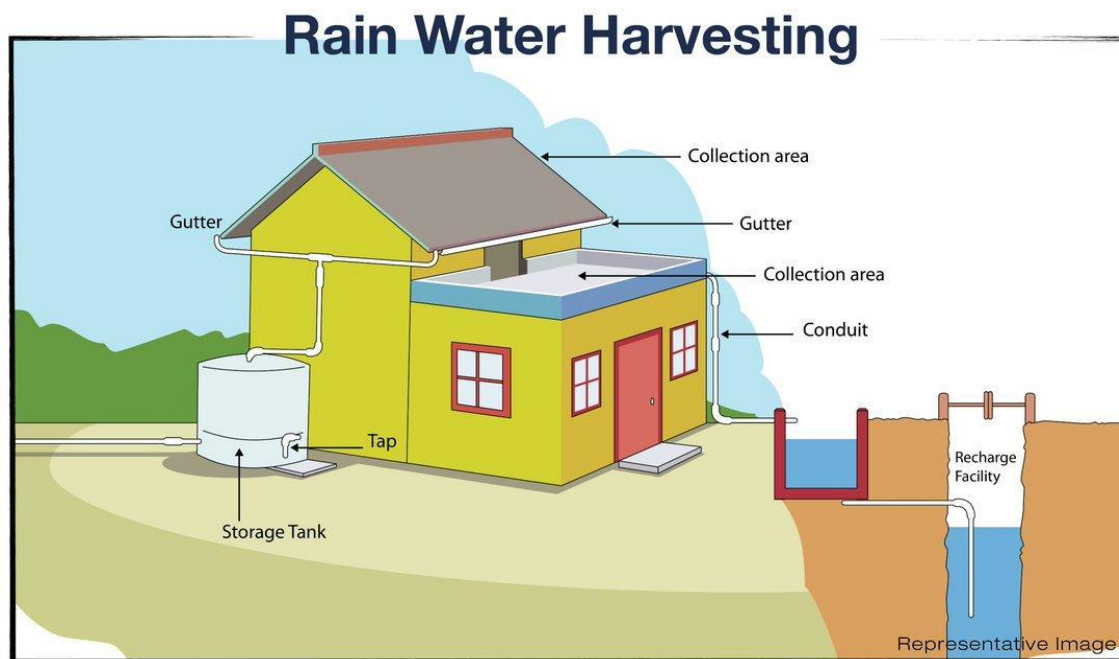


Image showing how water is harvested on the surface, source: procivilengineer.com

The rainwater harvesting system consists mainly of watershed, collection or drainage system (gutter, drain pipe), storage system, and distribution system. The water treatment phase in these systems is usually required to improve water quality and enhance collection efficiency, by removing debris and unwanted contaminants. Treatment can include filtration, sedimentation, ultraviolet sterilization and occasional ⁷⁶ventilation inside the tank. This model can also be applied to the roofs of schools, hospitals, and some facilities to harvest and benefit from rainwater, and not only to homes.

4- Spate Irrigation (aflaj)

This is one of the water conservation methods that Yemenis have mastered for thousands of years. This method helps to cover the agricultural aspect in general as agriculture in Yemen consumes approximately 90% of water.⁷⁷ Spate irrigation is an ancient form of water management that involves diverting rapid floods from torrential rains flowing from the mountain basin, using simple sandy guides, usually constructed of sand, stones and timber on dry valley beds. Flood flows that run for a few hours are directed through short and steep channels to reach an associated basin. The latter is submerged with water to depths of 0.75

⁷⁶ [Technical Brochure: Rainwater Harvesting \(unesco.org\)](https://unesco.org/)

⁷⁷ [Knowledge Repository ::Home \(fao.org\), https://www.fao.org/3/ca0352en/CA0352EN.pdf](https://www.fao.org/3/ca0352en/CA0352EN.pdf)

m or more. Agricultural crops, often grains, are then planted only after the spate irrigation. Crops are grown from one irrigation, or more are grown by using the moisture stored at depths in clay soils, formed from the sediment deposited from the previous spate irrigation.

This type of rainwater harvesting and management is under threat and requires high levels of collaboration between farmers to transform and manage the distribution of flood flows⁷⁸.

2: Fog Harvesting Technique

This method of harvesting the moisture content in fog is unconventional. It is the experience of the fog water collection project in Hajah governorate and Manakhah district in Sanaa. It is an alternative way of providing water for human use. This innovative (experimental) technique is based on the fact that water can be collected from fog when there are proper conditions that help the occurrence of condensation. Fog contains moisture that can provide hundreds of liters of water, most of which is very pure and can be used for drinking.

This water can be collected by using specially manufactured simple rectangular nets, made of nylon material (approximately 1 square meter), supported by poles at both ends directed vertically to the direction of the prevailing wind⁷⁹. Water droplets get collected on the nets from condensation, and trickle down as water, providing up to four liters/day. The water collected falls into a channel that transports the water to reservoirs that hold it.

One of the positives of this technique is that it is environmentally friendly and helps maintain the groundwater level, which is under the threat of depletion and excessive drilling.

⁷⁸ Traditional Water Harvesting Systems and Management in Wadi Hadhramout, Yemen, Mohamed Al-Hebshi and Saleh Ahmed Bin Rabaa, <https://icwrae-psipw.org/papers/2006/Water/14.pdf>

⁷⁹ [Harvesting fog in Manakha – Revolution Net \(althawrah.ye\)](#)



A photo illustrating the fog harvesting technique in a remote village in Morocco. Source: Alarabiya.net

Accordingly, it is possible to depend on broader methods and innovations for solutions related to water harvesting. This is along with making use of traditional experiences at the local level in Yemen, or even introducing new solutions and innovations in the short or sustainable term. These water harvesting solutions have been applied in countries that share Yemen's climatic factors or topographic nature. This would help to urgently address the crisis of water scarcity. But before that, it is important to improve the infrastructure to support different water harvesting systems, especially in rural areas, for better and more sustainable results.

Conclusions

The case study of the two districts in Al-Dhalea governorate (Al-Azariq and Al-Hussein) is an example of the travails of water scarcity that can extend to the rest of the rural areas in Yemen if no emergent and sustainable solutions are found for the people, especially in the most affected areas. It is clear that the water scarcity crisis and its related health and socio-economic problems has reached its zenith. Accordingly, a new cycle of violence may emerge over time over water disputes.

This study is the first quantitative research about the water scarcity crisis and its impact on women and girls in the governorate of Al-Dhalea, in South Yemen, specifically in the districts of Al-Azariq and Al-Hussein. Through qualitative interviews conducted with a number of local residents, women and men, as well as with a number of government officials, experts and specialists in the field of water, both at the level of Al-Dhalea governorate and in the capital, Aden, it is evident that the water crisis is a very distressing one, and has reached high and advanced levels of danger, which poses a threat to the lives of the population and their vital livelihoods.

This paper drew a number of **key findings**, which can be reviewed in the following points:

- Water scarcity in Yemen in general is a crisis whose effects are difficult to predict, especially since the per capita share of clean water in Yemen is decreasing exponentially every year. Accordingly, water availability has fallen by 25%.
- The khat tree, which is cultivated in various regions of Yemen, consumes 40% of the water used in the country. Farmers have drilled and deepened more underground wells indiscriminately to meet the rising demand for khat production. This has caused a health crisis for the population, first, due to the harmful effects of khat, and second, as a result of the consumption of more water for growing khat at the expense of individuals.
- Water scarcity in Al-Dhalea has affected many of its districts with regard to environmental security. Irresponsible uses and methods of extracting water have led to its pollution, causing environmental and health disasters on the population. Women and children have been the most affected, especially in the districts of Al-Azariq and Al-Hussein.
- The bombing of the 'Al-Nukhila Dam' in Al-Azariq district which is one of the most important and largest dams in the governorate, damaged 80% of the structure, exacerbating the water crisis significantly, in light of the high drought rate and lack of rainfall in the area. Residents have relied on the dam as their main source of water for their homes and for irrigating farmland and for livestock.
- The suffering of women and girls in the districts of Al-Azariq and Al-Hussein has reached horrifying levels. This is because they bear the brunt of fetching water for their families. They are most vulnerable to catching diseases through handling and drinking the polluted water and consequently passing the diseases on to their children. Furthermore, they have

been subjected to domestic violence and have lost many opportunities for education, income-generating work, and leading normal lives.

- Although 'South24 Center' addressed the spread of high levels of fluoride in the water extracted from deep underground wells in a previous paper, the current study, including some interviews, data and recent images, shows that the crisis has reached advanced levels of severity. This has been noted through the visible deformities in some of the inhabitants there, including many cases of osteomalacia and tooth decay. This may lead over time to an environmental and health disaster, causing permanent disability or leading to early death of affected individuals in the medium and long terms.
- The continued contamination of drinking water with excessive fluoride in the districts of Al-Dhalea will profoundly affect the reproductive health and fertility of both genders. Accordingly, this will reduce the percentage of births in the governorate.
- The government's failure to allocate a budget to the local authority in Al-Dhalea to fill in the gaps and implement emergency solutions to tackle the water crisis in the mainly affected districts will necessarily exacerbate the catastrophic health and environmental crisis in the governorate.
- According to many residents and officials in Al-Dhalea, the limited interventions by international organizations working in the field of water and environmental sanitation remain inadequate. The majority of the people interviewed argued that wider interventions by international organizations and more effective water treatment solutions would improve the environmental and health situation of the population.
- The proposed solutions and positive environmentally friendly practices, whether conventional or unconventional water harvesting methods, can help address the pressing water crisis, especially since they have been used in many areas of Yemen. However, it will be more useful if the infrastructure is improved to ensure the sustainability of water harvesting.

Recommendations

For the International Community and Donors:

- Part of the financial grants to support research centers and civil society organizations working on the ground in the affected areas should be allocated to conduct more specialized studies and research on the water crisis, especially on gender-based studies. This is due to the lack of accurate data or statistics at the local level.
- The Internationally-Recognized Government should be pressed on the need to involve women in decision-making processes and influential positions, especially in the field of water management. This can help ensure that women's needs and concerns are met, as well as reduce their suffering.

- The international organizations working in the field of water and environment have to mark a wider presence in the affected areas in Al-Dhalea's districts. They should try to change their methods for mitigating the problems and fill the gaps to tackle the water scarcity issue in more sustainable ways. They also need to work in a joint framework with local organizations. This would make the people benefit as much as possible from the outcomes and treatments.

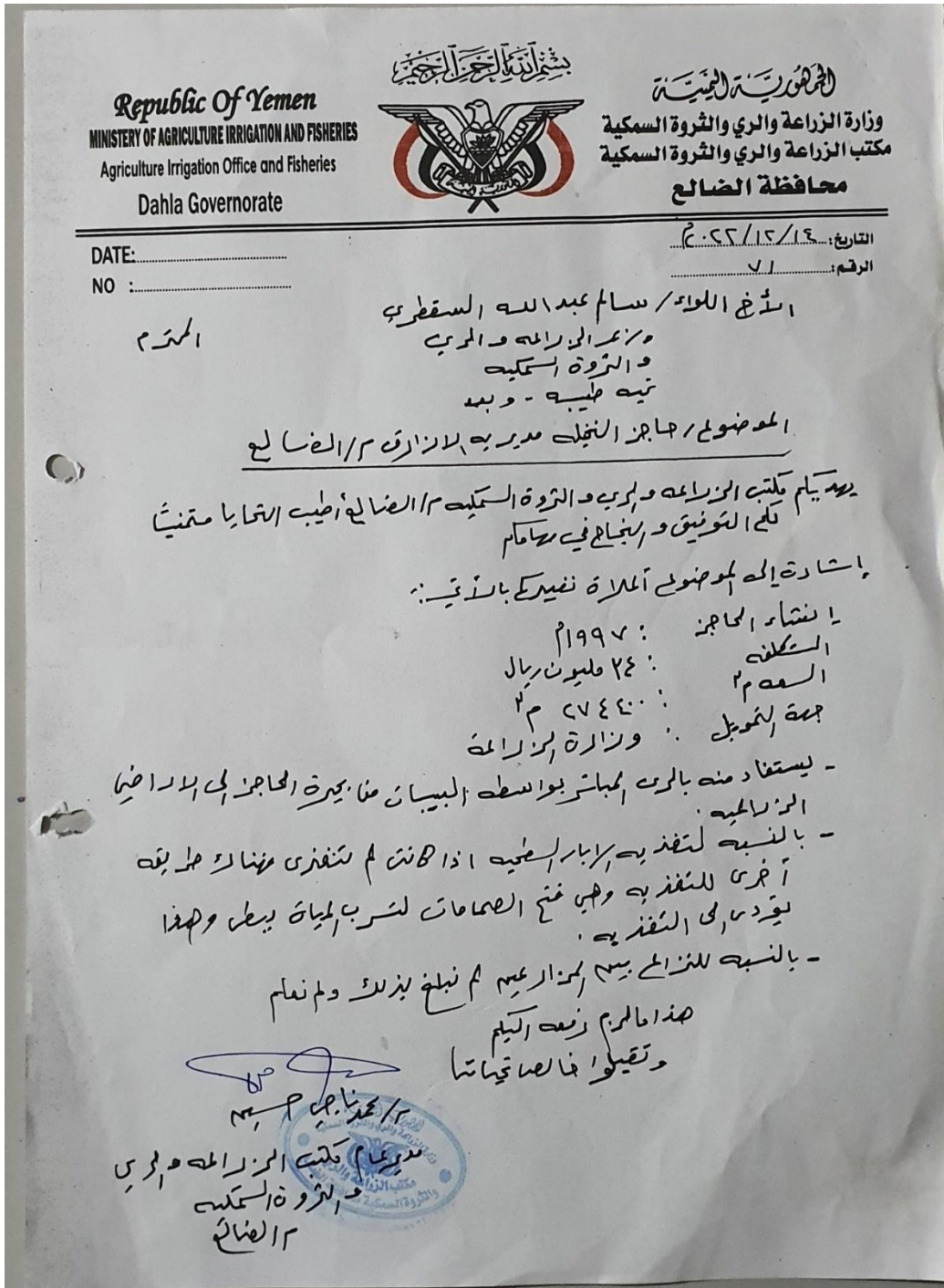
For Local Civil Society Organizations:

- Part of their projects and programs have to be allocated to tackling the water crisis and its negative impacts on the population in the affected districts of Al-Dhalea governorate. This is in addition to raising awareness about the importance of accessing safe water and clean sanitation by all without gender differences or gender-based violence.
- They need to conduct continuous advocacy campaigns on social media to raise awareness of the need to rationalize and conserve water consumption, as it is a scarce resource.

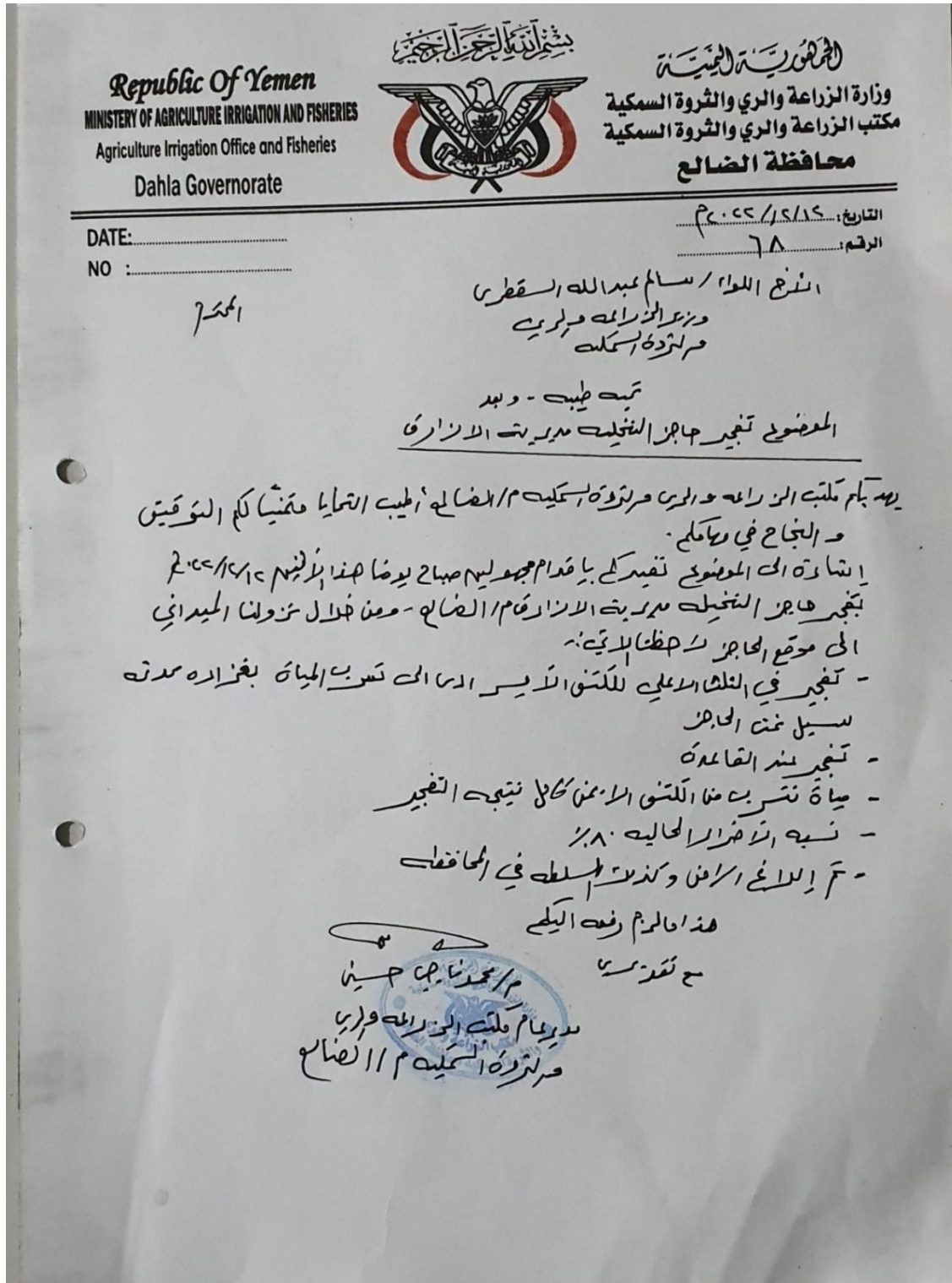
For Official Bodies in the Internationally-Recognized Government:

- There is a need to allocate a budget for the implementation of more sustainable projects to create water resources in the environmentally and health-affected areas, including Al-Dhalea governorate. This is along with conducting comprehensive surveys to detect new sources of water and studying the extent to which they can be utilized. Moreover, the health conditions of those affected by excessive fluoride in these areas should be urgently treated.
- There is a need to enact laws and legislations to preserve water resources and support their maintenance. This is in addition to holding accountable those who cause wastage and contamination of water through the indiscriminate drilling of deep wells, or their monopolization practices by distributing water only to certain groups of society. This is the reason behind the continuous water conflicts among people.
- There is a need to involve women in decision-making positions, including in the various executive water departments. Their empowerment and influence in policies and strategies related to water management will be more useful, especially since women and girls are the most affected by water scarcity and the ramifications of the current mismanagement in dealing with the crisis.

Additional Attachments



Appendix 1: A letter from the Office of the Agriculture and Irrigation in Al-Dhalea governorate to the Minister of Agriculture, Irrigation and Fisheries, Major General Salem Al-Soqtri, explaining to him the specifications of the 'Al-Nukhila Dam' in Al-Azariq District in Al-Dhalea governorate, December,14, 2022.



Appendix 2: A letter from the Office of Agriculture, Irrigation and Fisheries in Al-Dhalea governorate, Delivered to the Minister of Agriculture, Irrigation and Fisheries, Major General Salem Al-Soqotri, explaining the damage caused by the bombing of the 'Al-Nukhila Dam' in Al-Azariq District in Al-Dhalea governorate. December 12, 2022.

المحافظات الخزانة التي تم إنجازها في محافظات الفصاح
وزارة الزراعة والري خلال السنوات ١٩٩٧م - ٢٠١٩م
تحت إشراف وزارة الري والفصاح

١- مديرية: الحسين

رقم	اسم المحاجر/الخزان	القرية	سنة الإنجاز	المساحة م ^٢	التكلفة	جهة التمويل
١	محاجر ستوكان	عدينة	٢٠٠٥م	١٤٠٠٠	١٥,٠٦٥,٨٠٠	وزارة الزراعة
٢	محاجر موهج	موهج	٢٠١١م	٤٧٠٠٠	٥٩,٣٦٧,١٧٨	"
٣	محاجر الذملة	ذملة	٢٠١٤م	٢٥٠٠٠	١٦٠,٠٢٧,١١١	"
الإجمالي						٢٧٤,٤٥٩,٩٨٨
رقم	اسم المحاجر/الخزان	القرية	سنة الإنجاز	المساحة م ^٢	التكلفة	جهة التمويل
٤	خزان حجلة حرس	حجلة	٢٠١٠م	٩٦٠	١٣,٩٨٥,٨٠٠	مشروع إنشغال العاصم
٥	خزان هادي حرس	حرس	٢٠١٠م	١٥٠	٧,٠٢٠,٠٠٠	"
٦	سبلة ربي لبي	عدينة	٢٠١٧م	شبكة	٢٢,٦٩٢	"
٧	خزان المعاريف	المعاريف	٢٠١٨م	٨٠٠	٩٢٠٠٠	"
٨	خزان الفقها رور	الفقهاء	٢٠١٨م	٣٨٤	٨٨٥٠٦	"
٩	خزان ستوكان حرس	عدينة	٢٠١٨م	٣٢٠٠	١٥٩٨١٠	"
١٠	خزان مراهيف حرس	مراهيف	٢٠١٨م	٤٣٢	٦٦٠٠٠	"
١١	خزان السبلة حرس	عدينة	٢٠١٨م	٨٠٠	٦٦٠٥٥	"
١٢	خزان الزبارة حرس	الخزيرة	٢٠١٨م	٧٥٠	٤٣٠٠٠	"
١٣	العقلة خزان	العقلة	٢٠١٩م	٦٥٠	٥٢٤١٥	"
١٤	خزان سبلة الجراد	عدينة	٢٠١٩م	٨٠٠	٦٦٠٥٥	"
الإجمالي						٢١٨,١٥٠,٨٠٠
الإجمالي						٤٩٢,٦١٠,٧٨٨
رقم	اسم المحاجر/الخزان	القرية	سنة الإنجاز	المساحة م ^٢	التكلفة	جهة التمويل
١٥	خزان مرات حرس	مرات	٢٠٠٦م	٤١٠	٩,٢٥٠,٠٠٠	السبلة الحكيمة
١٦	محاجر هبان حرس	هبان	٢٠٠٩م	٢٣,٠٠٠	٢١,٢٧٤,٠٠٠	"
١٧	خزان سبلة الجراد	عدينة	٢٠٠٩م	١٢٠٠	١٦,٠٠٠,٠٠٠	"
١٨	محاجر شامع فله	فله	٢٠١٢م	١٧٠٠	١٦,٨٢٠,٨٢٩	"
الإجمالي						٤٨,٦٨٠,٠٠٠
الإجمالي لعام						٣١٩,٠١٠,٦٢٧
الإجمالي						٨٠٦,٦٥١,٨١٨

Appendix 3: Handwritten table obtained by South24 Centre, from the Office of the Agriculture and Irrigation, showing the number of barriers and reservoirs completed in Al-Hussein district of Al-Dhalea governorate, from 1997 to 2019.

صحة

المحافظات والخزانات التي تم إنجازها في مديريات محافظة الفصاح
وزارة الزراعة والري خلال السنوات ١٩٩٧م - ٢٠١٩م
تحت إشراف المديرية العامة

١- مديرية الفصاح

م	اسم المحاجر/الخزانات	القريب	سنة الإنجاز	السعة م ^٣	التكلفة	جهة التمويل
١	محاجر الثقيلة	الجوس	١٩٩٧	٢٧٠٤٠٠	٤١,٢٩٩,١١٥	وزارة الزراعة
						(١) إجمالاً
٢	خزان متعدد	متعد	٢٠٠٢	٤٠٠	٦,٠٥٦,٠١١	شركة الاستغلال العام
٣	خزان إشرقي	الشرقي	٢٠٠٢	٤٠٠	٦,٠٥٦,٠١١	"
٤	خزان تخسح	سحر	٢٠٠٦	١٢٠٠	١٤,٩٩٦,٠١١	"
٥	خزان ركابين	عند سمارة	٢٠٠٦	١٥٠٠	١٥,٩٦٠,٠١١	"
٦	خزان ما طرا بيجل	ما طرا	٢٠٠٧	٩٦٠	١١,٥٢٧,٠١٦	"
٧	خزان المحور	المحور	٢٠٠٧	٨٥٠	١٢,٩٦٠,٠١٠	"
٨	خزان نجد الجين	النجد	٢٠٠٩	٩٦٠	١٨,٤٤٠,٤٦٤	"
٩	خزان المحور	المحور	٢٠٠٩	٨٥٠	١٢,٠٧٥,٢٢٦	"
١٠	خزان الزيرة	الزيرة	٢٠٠٩	١٢٠٠	١٢,١٦٢,٢١٤	"
١١	محاجر ماننا بيجل	ماننا	٢٠٠٩	١٥٠٠٠	٩,٧٨٥,٨٨٠	"
١٢	خزان العرينة	العرينة	٢٠١٠	٨٥٠	١٨,٠٤٥,٨٤٠	"
١٣	خزان قصابه	قصابه	٢٠١١	٤٥٠	٨,٥١٤,٢٨٠	"
١٤	خزان مليحة	مليحة	٢٠١٤	٧٥٠	١٢,٩١٠,٠٠٠	"
١٥	خزان القفل	القفل	٢٠١٦	٨٥٠	٥,٩٩٩,٧٤٠	"
١٦	خزان وجم سماه	وجم	٢٠١٦	٨٠٠	٥,٩٥١,٤٤٠	"
١٧	خزان قصابه	قصابه	٢٠١٧	٨٥٠	٥,٨٤٨,٠٠٠	"
١٨	محاجر الامسار	هدرة غنينة	٢٠١٧	٤٠٠٠	٣,٩٨٢,٨٤٠	"
١٩	خزان المعزبه	المعزبه	٢٠١٨	٨٥٠	٥,٨٥٠,٩٦٠	"
٢٠	خزان ضاحول	ضاحول	٢٠١٩	٤٥٠	٥,٠٦٧,٦٥٠	"
٢١	خزان المعفاري	المعفاري	٢٠٢٠	٤٥٠	٥,٠٠٠,٠٠٠	"
						(٢) إجمالاً
					٥٢٦٢٠	١٥٩,٤٧٠,٢٠٠
					٥٨٩,٢٤١	

Appendix 4: Handwritten table obtained by 'South24 Center', from the Office of Agriculture and Irrigation, showing the number of barriers and reservoirs completed in Al-Azariq district of Al-Dhalea governorate – (1), from 1997 to 2019.

المديرية: الأزارق

المحافظ: ديرور الخزانة التي يتم إنجازها في مديرية مياه محافظة الفصالح
وزارة الزراعة والري خلال السنوات ١٩٩٧م - ٢٠١٩م
تحت إشراف المديرية والري وم القطاع

رقم	اسم الحاجز/الخزان	القرية	سنة الإنجاز	السعة م ^٣	التكلفة	نوع التمويل
١	حاجز سماقة نوصه	سماقة	٢٠٠٨	٢٠٠٠	٤٦,١٩٥,٦٦٦	القطعة المحلية
٢	حاجز نماش	نماش الحقل	٢٠٠٨	٢٥٠٠٠	١٧,٤٤٠,٨٨٢	"
٣	خزان عد بنه صاره	عد بنه	٢٠٠٩	٤٢٠	٥,٩٥٦,٦٢٠	"
٤	حاجز الشعار	الشعار	٢٠٠٩	٣٥٨٦	٥,٩٨٣,٤٦١	"
٥	خزان صمادة	التالوف	٢٠١٠	٤١٠	٧,١١٥,٧٥٥	"
٦	خزان صمادة	الخزاب	٢٠١٢	٤٥٠	٦,١٠٧,٩٠٠	"
٧	خزان صمادة	عدن ضيبه	٢٠١٢	٨٥٠	٩,٢٦٤,٢٤٥	"
٨	خزان السبعه صماده	السبعه	٢٠١٢	٨٥٠	٨,٦٤٦,٢٠٥	"
٩	حاجز طيقين عد بنه	عد بنه	٢٠١٧	١٧١,٢	٢٥,٨٢٤,٢٧٤	"
١٠	خزان طردف صماده	مردف	٢٠١٤	٤٠٠	٧,١٤٥,٢٩٤	"
				١١٩,٧٧٩,٦٦٢	٧٩,٠٦٩	الإجمالي (١٠)
١	حاجز براط	براط	٢٠٠٢	٨٥٠٠	٤,٢٤٢,٢٤٠	المسيرة الخيرية
٢	خزان حازق	هجرة بكعفا ربي	٢٠٠٢	٧٢٠٠	١,٦٨٠,٠٠٠	"
٣	خزان الحقل	الحقل	٢٠١٠	٧٥٠	٩,٢٥٠,٠٠٠	"
				١٦٥٥٠	١٥,٢٧٢,٢٤٠	الإجمالي (٣)
				٤١٩,٦٢٩	٢٢٥,٧٥٢,٢٦٧	الإجمالي الكلي
					٣٥٨٩,٢٤١	

Appendix 5: Handwritten table obtained by 'South24 Center', from the Office of Agriculture and Irrigation, showing the number of barriers and reservoirs completed in Al-Azariq district of Al-Dhalea governorate –(2), from 1997 to 2019.

وزارة الزراعة والري ومكافحة الجفاف
مكتب الزراعة والري
والتربية السمكية والحيوانية

المواهب والمنجزات المنجزة خلال ١٩٧-٢٠٢٢م

المرتبة	العدد	التكلفة	السهم
١	٣	٣٠٦,٩٥٩,٩٢٤ \$ ٧١٧٦٦٧	٥٤٩٤٥٤
٢	١٨	٣١٩,١٠١,٦٢٧ \$ ٦٥٦٥٨٨	٣٥٧٦٦
٣	٢٤	٦٤٤,٧٨٠,٢٩٨ \$ ١٧٣٢٦٣	٢,٣٣,٠٤٦
٤	٣٤	٢٣٥,٧٥٥,٢٦٧ \$ ٥٨٩٤٤١	٤١٩٦٣٩
٥	٣٧	٦١,٢٤٥,٦٢٤ \$ ٢١٤٩٦٧	٢٢٦١٧٩
٦	٤٢	٤٥٥,١٥,٩٦١ \$ ١٢,١٥٩,٢١٦	٢٠١٤٦٩
٧	٤٩	٨٥٦,٩١٠,٩٠٩ \$ ١١٠٩٩٢	١,٧٤٥,٢٩٤
٨	٣٥	٧٤٤,٩٢٨,١٦٥ \$ ٤٧٦٦٦٠	٩٧٥,٩١٧
٩	٢١	٩٤٦,٧٧٤,٨٨٠ \$ ١٢٦١٤٥	٢,١٥٢,٤٩٧
الأجمالي	٤٧٠	٤٦٥,٥٣٠,٨٤٥,٩٧٢ \$ ٤٠٤,٤٠٩,٩٣٥	٨,٧٥٢,١٠١

Appendix 6: Handwritten table obtained by 'South24 Center', from the Office of Agriculture and Irrigation, showing the number of barriers and reservoirs completed in the districts of Al-Dhalea governorate from 1997 to 2022.



Appendix 7: An X-ray picture obtained by 'South24 Center' from the Office of Agriculture and Irrigation, showing a case of bone curvature of a child in Al-Hussein district in Al-Dhalea governorate, as a result of high fluoride levels (Source, South24 Center's field team)



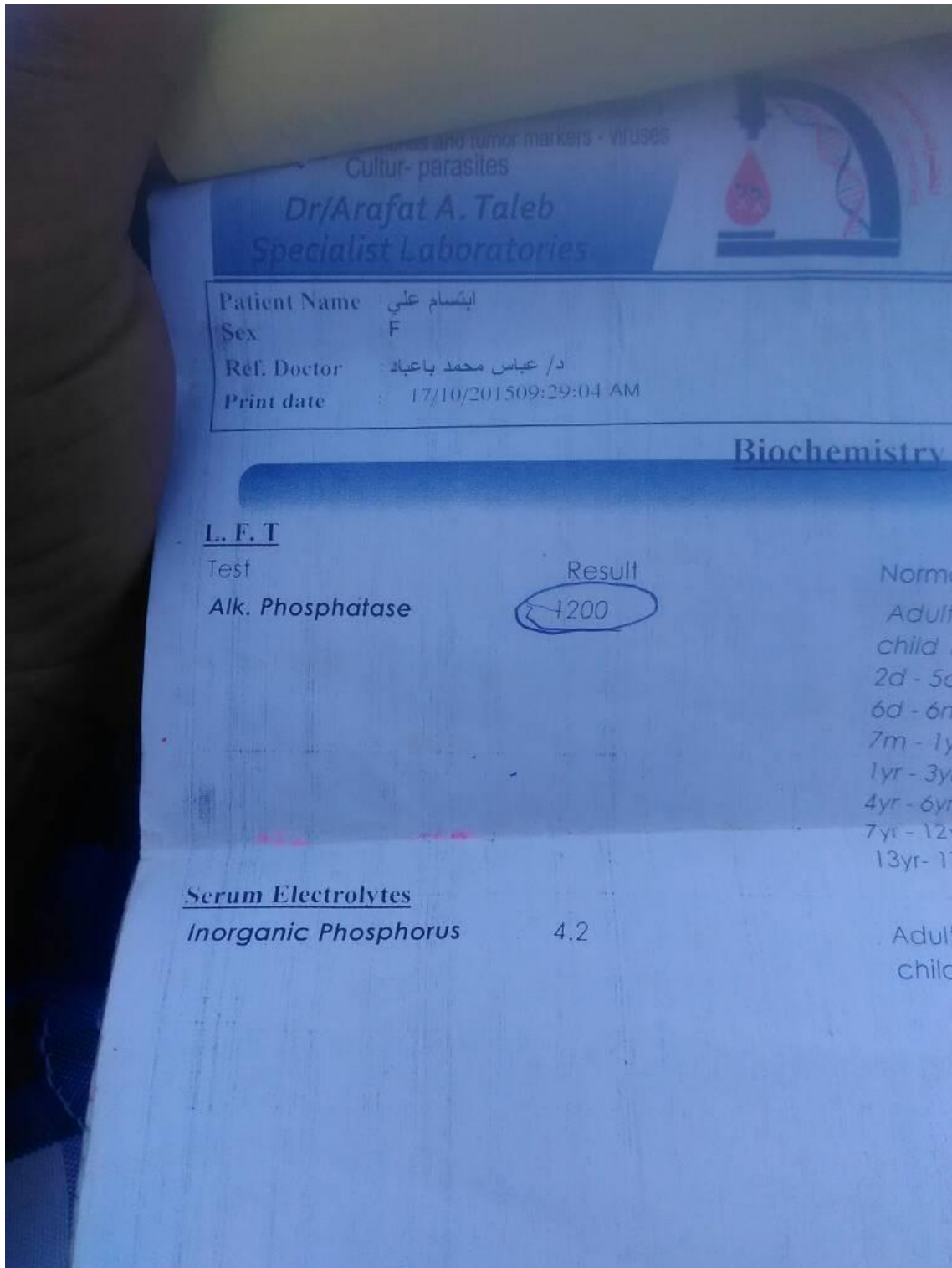
Appendix 8: A picture of a group of children from Al-Hussein district in Al-Dhalea governorate, showing cases of bone curvature in their legs and feet, as a result of drinking water with high fluoride concentration (source, South24 Center's field team)



Appendix 9: A picture of a group of children in Al-Hussein district in Al-Dhalea governorate, showing cases of tooth decay and damage as a result of drinking water with high fluoride concentration (Source, South24 Center's field team)



Appendix 10: A picture of a group of children from Al-Hussein district, showing cases of tooth decay and damage, due to drinking water with high fluoride concentration (Source, 'South24 Center's field team)



Appendix 11: Illustrative image of a medical report showing the high level of highly toxic phosphorus in the body of a patient, as a result of drinking water with high fluoride concentration in Al-Hussein district in Al-Dhalea governorate (Source: South24 Center's field team)



Appendix 12: Director of the South24 Center Regional Office Jacob Al-Sufyani met with the Minister of Agriculture and Irrigation, Major General Salem Al-Soqotri, and the Minister of Water in the Internationally-Recognized Government in Aden, Tawfiq Al-Sharjabi, as part of a series of meetings about the water crisis in Al-Dhalea governorate, March 2024, (South24 Center)

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